LIPIDEMIA STATUS AND ASSOCIATED FACTORS AMONG HIV POSITIVE ADULT MALE ON HAART ATTENDING THE HIV CLINIC AT KERICHO DISTRICT HOSPITAL KERICHO, KENYA

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NOVEMBER, 2014
DECLARATION

This thesis is my original work and has not been presented for a degree or any other award in any other University.

Signature___________________     Date_________________

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DEDICATION

This thesis is dedicated with love, gratitude and respect to my dear wife Winny, son Allan and daughter Chemu for their encouragement and support.
ACKNOWLEDGEMENT

I thank God for his mercies, favour and guidance during the entire process of this work, just as mentioned in Psalm 23 verse 6: surely goodness and mercy shall follow me all the days of my life.

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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AIDS</td>
<td>Acquired Immune Deficiency Syndrome</td>
</tr>
<tr>
<td>Apo B,</td>
<td>Apolipoprotein B</td>
</tr>
<tr>
<td>ART</td>
<td>Anti Retro viral Therapy</td>
</tr>
<tr>
<td>ARV</td>
<td>Antiretrovirals</td>
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<tr>
<td>BMI</td>
<td>Body Mass Index</td>
</tr>
<tr>
<td>CCC</td>
<td>Comprehensive Care Clinic</td>
</tr>
<tr>
<td>CD4</td>
<td>Cluster of Differentiation 4</td>
</tr>
<tr>
<td>CHD</td>
<td>Coronary Heart Disease</td>
</tr>
<tr>
<td>DNA</td>
<td>Deoxyribonucleic Acid</td>
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<tr>
<td>HAART</td>
<td>Highly Active Antiretroviral Treatment</td>
</tr>
<tr>
<td>HBV</td>
<td>Hepatitis B Virus</td>
</tr>
<tr>
<td>HDL</td>
<td>High Density Lipoprotein</td>
</tr>
<tr>
<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
</tr>
<tr>
<td>IDL</td>
<td>Intermediate Density Lipoproteins</td>
</tr>
<tr>
<td>IPAQ</td>
<td>International Physical Activity Questionnaire</td>
</tr>
<tr>
<td>KAIS</td>
<td>Kenya Aids Indicator Survey</td>
</tr>
<tr>
<td>KEMRI</td>
<td>Kenya Medical research Institute</td>
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<tr>
<td>LDL</td>
<td>Low Density Lipoprotein</td>
</tr>
<tr>
<td>LDL-C</td>
<td>Low Density Lipoprotein Cholesterol</td>
</tr>
<tr>
<td>NASCOP</td>
<td>National AIDS and STI control program</td>
</tr>
<tr>
<td>NNRTI</td>
<td>Non Nucleoside Reverse Transcriptase Inhibitors</td>
</tr>
<tr>
<td>NRTI</td>
<td>Nucleoside Reverse Transcriptase Inhibitors</td>
</tr>
<tr>
<td>PI</td>
<td>Protease Inhibitors</td>
</tr>
<tr>
<td>PLHIV</td>
<td>People Living with HIV</td>
</tr>
<tr>
<td>TB</td>
<td>Tubercle Bacillus</td>
</tr>
<tr>
<td>UNAIDS</td>
<td>United Nations Programme on HIV/AIDS</td>
</tr>
<tr>
<td>VDL</td>
<td>Very Low Density Lipoproteins</td>
</tr>
<tr>
<td>VLDL</td>
<td>Very Low Density Lipoproteins</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
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OPERATIONAL DEFINITIONS OF TERMS

The definitions of terms as used in the study are:

**Active**
- Refer to a client who is coming to clinic on the scheduled appointment.

**Associated factors**
- Refer to nutritional status, dietary pattern, HAART and physical activity as used in the study.

**Adult**
- HIV positive male patient 18 years and or above, receiving HAART, attending sessions at the comprehensive care centre and of sound mind.

**CCC**
- HIV clinic at Kericho District Hospital where enrolled HIV positive adult patients receive services also referred to as comprehensive care centre

**HAART**
- The use of antiretroviral treatment rendered to enrolled HIV positive adult male patients with CD4 less than 350 and not on post exposure prophylaxis.

**HIV positive male**
- A male patient who is 18 years and or above, enrolled at Kericho District Hospital HIV clinic and active on treatment.

**Lipidemia**
- Refers to measurement of lipids in blood above the national level limit for HIV positive patient with acceptable levels of less than 5mmoles for total cholesterol and less than 2.5mmoles for low density lipoprotein.

**Nutritional Status**
- Refers to body mass index as categorised per WHO 2003
ABSTRACT

It is unfortunate that while Highly Active Antiretroviral Therapy (HAART) has become the standard of care among HIV positive patients, the medications have been associated with metabolic abnormalities recognized to cause lipidemia. The purpose of this cross sectional analytical study (n=310) was to establish lipidemia status and associated factors among HIV positive adult male patients attending HIV clinic at Kericho District Hospital. Purposive sampling was used to select the study hospital and study subject by gender. Systematic sampling was used to select study samples (n=310) and sub sample for 24 hour recall (n=155). A structured questionnaire was used to collect data on the social, demographic, economic, cultural, 24 hour recall, and anthropometric. Lipid profile assessment was performed on fasting blood sample using standard automated procedures (Cobas Mira Plus-Roche, USA). Physical activity was assessed using a physical activity questionnaire. A measure of central tendency was carried out for demographic, social and economic data. Anthropometric data analysis involved the display of mean and standard deviation of calculated BMI and skin fold measurement. Biochemical analysis was done through measure of central tendency with proportion for LDL, HDL, triglycerides and total cholesterols. 24 hour recall was analyzed for mean nutrient consumption for key nutrients and the 7 day recall was analysed for food frequency. Physical activity data was analyzed for mean and standard deviations. Analysis of variance was used to assess the significance of study parameters between body fat percentage and dietary pattern, lipid profile and HAART classification. Student t test was used to analyse correlations between the body composition values for LDL and the Skin fold measurements (%). The results indicated that the mean age was 43.52 ± 9.17 years and out of which 82.27% were married. Primary Education level attained 40.97% while secondary level was 45.16%. The mean lipid profile level was LDL 2.5 ± 1.05mmol/l, cholesterol 4.49 mmol/L ± 1.28 mmol/l, HDL 1.47± 0.58 mmol/l and triglycerides 1.96 ± 1.32 mmol/l, against the expected level of LDL (1.1.-2.4 mmol/L), HDL (0.9- 1.68 mmol/L ) triglyceride (0.41-2.61 mmol/L ) and total cholesterol ( 2.55-5.7 mmol/L). The prevalence lipidemia was 48.17% with mean difference of 2.5 for PI and non PI based regimen. Normal nutritional status was 70.97%. Mean dietary intake for macronutrients was energy (2049 ± 302), Protein (60 ± 24), cholesterol (249 ± 246), PUFA (5 ± 5), Fat (47 ± 20) and Fibres was (27 ± 16). Mean intake of key micro nutrients was Vitamin A (928±144), Vitamin B1 (1±0.5), Folic acid (336±64), Zinc (11 ± 4), Iron (9 ± 5), Magnesium (537 ± 341) and Vitamin C (50 ± 28). The findings showed that the mean LDL was elevated with proportion of lipidemia at a significant higher level among HIV-positive adult patients on HAART with considerable improvement in the nutritional status. A significant proportion of the respondents had basic education and in stable relationship. Diet diversification remains a significant challenge. Future work should investigate the biological mechanisms and pathways through which micronutrients affects high density lipoprotein (HDL) and low density lipoproteins (LDL).
CHAPTER ONE: INTRODUCTION

1.1 Background Information

As global treatment efforts mature and more people receive life-long treatment for this chronic disease, progressively more patients who are already receiving HAART are switching to new programs for care, either to evaluate alternative programs, or to receive care closer to home. Thus, this group of patients is forming an increasing portion of the clinic population whose outcomes and needs may differ significantly from HAART-naïve patients who have been the focus of the majority of studies citing clinical treatment success in resource-limited settings.

Infection with HIV is associated with subtle changes in lipid metabolism. Slight reductions in high density lipoprotein cholesterol occur early in the course of the infection. This is followed by an increase in the number of small, dense type B low density lipoprotein particles. Later on, as patients begin to develop symptomatic HIV disease, plasma triglyceride levels and Low Density Lipoproteins may rise (Bondiou, 2003). The initiation of antiretroviral therapy also affects lipid metabolism, and protease inhibitors appear to further worsen the patient’s atherogenic profile (Bondiou, 2003). However, Highly Active Antiretroviral Therapy (HAART) leads to lipid changes with increases in both total cholesterol and triglycerides (Riddler et al., 2003).

HAART is indicated in all HIV-positive adults and adolescents with the following: WHO clinical stage 1 or 2 and a CD4 count ≤ 350 cells/mm; WHO clinical stage 3 or 4.
regardless of CD4 count; HIV and TB co-infection regardless of the CD4 count; patients with HIV/HBV co-infection with evidence of active liver disease and cirrhosis or other evidence of chronic liver disease (NASCOP, 2011).

Evidence indicates that lifestyle changes such as diet and physical activity have a major influence on health. While many chronic diseases develop slowly, changes in lifestyle and dietary behaviours transpire with a steady speed. It is possible that people who are already ill may be more likely to be physically inactive and change their diet as a result of prevalence of the diseases (Chiuve, 2006).

Although HIV infection can now be treated effectively with combination of antiretroviral medications, significant toxicities such as hyperlipidemia, as well as the potential for significant drug-nutrient interactions present new challenges for the management of persons infected with HIV. However, the issue is complex, because HAART has improved life expectancy, changed the nutrition profile, and presented new challenges for persons living with HIV infection (Faintuch, 2006).

Hyperlipidemia is a condition with abnormally elevated levels of any or all lipids and or lipoproteins in the blood. High-density lipoproteins (HDL) form a class of lipoproteins, varying somewhat in their size (8-11 nm in diameter) and contents, which carry cholesterol from the body tissues to the liver. Because HDL can remove cholesterol from atheroma within arteries and transport it back to the liver for excretion or re-utilization, they are seen as "good" lipoproteins. HDL is the smallest of the lipoprotein particles.
Low-density lipoproteins (LDL), on the other hand are very-low density lipoprotein (VLDL), and lipoprotein (a) are the 3 major apolipoprotein-B–containing lipoproteins found in blood. Diagnosis of lipidemia is typically based on medical history, physical examination, and blood tests (done after overnight fasting) in order to determine the specific levels of low density lipoprotein cholesterol, high density cholesterol, and triglycerides.

Despite the tremendous benefits of highly active antiretroviral therapy (HAART) use on HIV disease progression and survival, micro and macronutrient malnutrition remain strong independent predictors of mortality among HIV-positive individuals in both high and low resource settings (Hogg et al., 2001). A growing body of evidence suggests that socio-economic determinants may also adversely impact survival among people living with HIV/AIDS (McMahon et al., 2011).

The consequences of HIV infection for societies, health and economies are devastating everywhere, but most especially so in poor, vulnerable and disadvantaged populations such as those already infected with HIV Virus. Research evaluating the role of nutrition in HIV infection focused initially on loss of weight or Lean Body Mass (LBM) and wasting (Forrester et al., 2002). The lean body mass and wasting was found to be associated with increased risk of opportunistic infections and death (Tang, 2002). Even in the era of Highly Active Antiretroviral Therapy (HAART), unintentional weight loss is associated with increased risk of mortality (Tang et al., 2002).
Unfortunately, HAART regimens are associated with the development of chronic metabolic complications, including peripheral lipoatrophy, centripetal fat accumulation and lipidemia (Carpentier et al., 2005). HIV replication alone in human T-cells, without any influence of antiviral drugs or other factors, can stimulate the production of novel cellular enzymes and proteins that enhance fatty acid synthesis, increase the quantity of low density lipoproteins, secrete triglycerides, alter the lipid transport and metabolism, and oxidize lipids (Rasheed et al., 2008).

Debate continues about lipidermia whether deranged status is a direct result of the drugs alone or whether it is primarily from the course of HIV disease or from combination of HIV disease progression plus anti-HIV drug effects. Other factors which have been identified as affecting the development of metabolic complications include age of patient and economic status (Boyle et al., 2002).

1.2 Problem Statement
Highly Active Antiretroviral Therapy had dramatically improved the quality of life and life expectancy of patients with human immunodeficiency virus. However, the prolonged use of HAART leads to severe metabolic events. Both HIV and HAART can cause lipid changes (Kotler, 2003 and Faintuch, 2006). Strong evidence from scientific research implicates a specific class of HIV medication, the protease inhibitors (PI), for the elevation of serum levels of triglyceride and cholesterol in people using the HAART agents (Green et al., 2002; Penzak et al., 2002; Chuck et al., 2000).
Lipidemia has been reported in many documented studies to range from 28% to 80% among HIV positive patients receiving HAART; elevated triglycerides accounted for the majority of cases (40%-80%), followed by elevated total serum cholesterol (10%-50%) (Calza, et al., 2003). While the introduction of HAART has undeniably revolutionized the management of PLHIV, some forms of dyslipidemia have been found to be common and more severe in HAART-experienced patients (Young et al, 2005). However, it remains uncertain whether these complications are related to each other, or they are exclusively associated with protease inhibitor administration (Penzak et al, 2002).

An elevated level of low-density lipoprotein (LDL) is associated with an increased risk of coronary heart disease (CHD). When these lipoproteins cross over the endothelial cell barrier and enter the vessel wall, they can become oxidized, and then are taken up by macrophages. These are subsequently transformed into foam cells. Activated endothelial cells in the blood vessels and foam cells can secrete growth factors that stimulate proliferation and migration of arterial smooth-muscle cells. Ultimately, these processes can result in the formation of an atherosclerotic lesion.

Metabolic derangements associated with the use of HAART calls for clinical concerns about their use. Metabolic disorders like lipidemia (abnormally elevated triglycerides and cholesterol) could lead to heart disease. HIV-1 infection causes a specific pattern of dyslipidemia, resulting from a combination of increased production and decreased clearance of lipoproteins. Molecular mechanisms responsible for the numerous lipid-related disorders in HIV-infected individuals are not well understood.
As the global treatment efforts mature and more people receive life-long treatment for HIV as a chronic disease, progressively more patients who are already receiving HAART are switching to new programs for care, either to evaluate alternative programs, or to receive care closer to home. Clinics must therefore care not only for new patients, but an increasing number who have received HAART previously and are HAART experienced.

Thus, this group of patients is forming an increasing portion of the clinic population whose outcomes and needs may differ significantly from HAART-naïve patients who have been the focus of the majority of studies citing clinical treatment success in resource-limited settings (Ivers and Doucette, 2005). The challenge for many HAART treatment programs, however, has been how to sustain delivery of quality medical care to an ever increasing number and diversity of HIV-infected patients (Wagner et al., 2007). Understanding the impact of HAART on clinical and nutritional outcome will help inform on ways to optimize care.

Women have significantly different lipid, apoprotein, and lipoprotein profiles than men regardless of menopausal status. Presumably these differences are due to the different levels of circulating sex hormones, specifically estrogens and androgens in women versus men. It has been reported that women have higher production rates of apoA-I, the major HDL apoprotein, than do men, and that levels of apoA-I and production rates of apoA-I and Lp A-I can be increased with estrogen administration (Parisi and Oliver, 2011).
In view of the HIV situation in Kenya and the use of HAART in HIV clinics; it was important to study lipidemia status and associated factors among the adult male patients attending the HIV clinic at Kericho District Hospital. The Hospital serves patients from South Rift Valley and neighbouring Nyanza which is affected by increased incidences of HIV with a National burden of 30% (KAIS, 2007).

1.3 Purpose of the study
This study sought to establish lipidemia status and associated factors among HIV positive adult male patients on highly active antiretroviral therapy attending Comprehensive Care Centre in Kericho District Hospital.

1.4 Objectives
To realize the purpose of the study, the specific objectives of this study were to;

1  Determine the demographic and socio-economic characteristic of the HIV positive adult male on Highly Active Antiretroviral Therapy (HAART) attending HIV clinic at Kericho District Hospital.

2  Assess the nutritional status of the HIV adult male on HAART attending HIV clinic at Kericho District Hospital.

3  Establish the dietary intake and food consumption patterns of the HIV positive adult male on HAART attending HIV clinic at Kericho District Hospital.

4  Establish lipidemia status among HIV positive adult male on HAART attending HIV clinic at Kericho District Hospital.
5 Determine factors associated with lipidemia among the HIV adult male on HAART attending HIV clinic at Kericho District Hospital.

1.5 Hypothesis

$H_0$¹: There is no significant difference in the mean LDL levels among the HIV adult male on protease inhibitor and non-protease inhibitor regimen HAART therapy.

1.6 Significance

The study findings has generated new information on lipidemia status and associated factors among the HIV positive male adult patients. The information is useful to health care providers to help them understand the magnitude of lipidemia and therefore design appropriate intervention approaches. The new information is useful to the Ministry of Health and other stakeholders providing health services in informing, designing and evaluating nutrition and HIV related interventions on HAART. The findings are also useful to other researchers wishing to fill research gap. The research participants through the study have had the opportunity to know their lipid profile which is not part of their routine laboratory investigation for patients receiving HAART treatment and be able to acquire nutrition knowledge through nutrition counselling during the assessment session.

1.7 Delimitations of the study

The participation in this study was delimited to HIV positive adult male on HAART, willing and able to provide informed consent. The study was delimited to demographic
characteristic assessment, anthropometric measurement, lipid profile analysis, physical activity evaluation and dietary assessment through 24 hour recall and food frequency questionnaire.

1.8 Limitation of the study
Firstly, due to the physiological differences and the HAART regime, and lifestyle, the results from this study cannot be generalised to HIV positive female, male on care, male on post exposure prophylaxis and children attending HIV clinic and receiving HAART at Kericho. This is because the study subjects were adult male aged 18 years and above on antiretroviral. Secondly, lipidemia is believed to be caused by dietary lifestyle such as high consumption of food rich in cholesterol and low activity levels. It can also be caused by a function of the liver, and now the use of HAART especially protease inhibitors. This study was conducted on only eligible adult male aged 18 or more years and who willingly consented.

1.9 Conceptual Framework.
This model as depicted in Figure (1.1) combines the nutritional status, socioeconomic factors, and dietary intake, physical activity and HAART characteristics to describe lipidemia related factors. The types of HAART can have significant effect on the lipid profile and the nutritional status of the study participants while the socio economic status has influence potential effect on both the nutritional status and the lipid profile. Physical activity level influences both the lipid profile and nutritional status.
The pathogenesis of lipidemia is incompletely understood and appears to be associated with a number of factors. It is not possible to derive a precise incidence rate for lipidemia from these studies (Behren et al., 2005; Carr et al., 1998; Vergis et al., 2001). HIV-infected patients on treatment with Highly Active Antiretroviral Therapy (HAART) have been linked to the development of lipidemia, a clinical condition characterized by elevated levels of plasma lipids (Carr et al., 2000). Nutrition transition involving large increases in the consumption of fat (especially saturated fat) and sugar, marked increases in animal products, and a decline in unrefined cereal and, thus, in fiber intakes (Popkin, 2001a) leads to susceptibility to lipidemia. The heterogeneity in the HIV patterns has been thought to be a product of local, social and economic determinants.
CHAPTER TWO: LITERATURE REVIEW

2.1 Overview of HIV, HAART therapy and Lipidemia

Sub-Saharan Africa remains the region heavily affected by HIV. The most dramatic increases in antiretroviral therapy coverage according to UNAIDS 2011 report on the world AIDS day have occurred in sub-Saharan Africa, with a 20% increase between 2009 and 2010 alone. HIV prevalence among adults aged 15 to 64 years decreased nationally from 7.2%, as measured in KAIS (2007) to 5.6% in 2012. This corresponds to approximately 1,192,000 persons living with HIV infection with 4.4% being men (KAIS, 2012). Fifty-eight percent of HIV-infected persons aged 15-64 years were eligible for Highly Active Antiretroviral Therapy (HAART) treatment for HIV infection based on a CD4+ T-cell count of 350 cells/µl or less or reported history of current tuberculosis treatment. Of those, 63% were currently on HAART (KAIS, 2012).

The past decade has witnessed a revolution in the treatment and long term prognosis for patients with HIV infections. The advent of highly active-antiretroviral therapy (HAART) has made HIV infection a chronic and manageable disease for many patients (Koutkia, 2004; Mocroft, 2003). HAART is the therapy composed of multiple antiretroviral drugs. The HAART include one nucleoside analog (DNA chain terminator), one protease inhibitor and either a second nucleoside analog (“nuke”) or a non-nucleoside reverse transcription inhibitor (NNRTI).

HAART is indicated in all HIV positive adults and adolescence patients with WHO clinical stage 1or 2 and a CD4 counts ≤ 350 cells/mm³, WHO stage 3 or 4 regardless of
CD4 count, HIV and TB co infection regardless of CD4 counts and HIV/HBV co infection with evidence of active liver disease, cirrhosis or the evidence of liver disease. HIV-infected patients on treatment with Highly Active Antiretroviral Therapy (HAART) have been linked to the development of lipidermia, a clinical condition characterized by elevated levels of plasma lipids (Carr et al., 2000.) HAART regimens, especially those including protease inhibitors (PIs), cause lipidemia mostly associated in HIV patients taking long-term HAART.

However, Pre-HAART lipidemia was confirmed in a study, characterized by an initial decrease in serum levels of total cholesterol, High-Density Lipoproteins (HDL), and Low-Density Lipoproteins (LDL), followed by elevations in triglyceride levels during the advanced stages of HIV disease (Penzak and Chuck, 2000). This study desired to establish the lipidermia status among HIV positive adult male receiving HAART at the Comprehensive Care Centre.

2.2 Demographic and socio economic characteristics of the HIV positive adult male

There is now a wealth of compelling evidence from a wide range of settings across the world and at various scales to suggest that location and place shape our health, our exposure to environmental features that impact on our health and our access to those goods and services that either promote health or treat episodes of diseases that we encounter (Gatrell and Rigby, 2004). People and the factors that cause diseases are dispersed, often unevenly, across communities and regions, and the processes that bring
the people and the disease-causing agents into contact are geographically variable too (Cromley and McLafferty, 2002).

The heterogeneity in the HIV patterns has been thought to be a product of local, social and economic determinants. Among the factors are relative gender distribution in the communities, culture, socioeconomic status and religion. Chronic conditions like lipidemia are frequently incorrectly considered to have limited impact on the burden of disease in Sub-Saharan Africa, because of the known high relevance of the infectious diseases like HIV.

For the patients receiving HAART, there are emerging challenges associated with metabolic disorders such as lipidemia and fat redistribution, which are increasingly common and are receiving tremendous attention in the world of research. This study explored the spatial pattern and socio economic characteristics of HIV positive adult male receiving HAART treatment at Kericho District Hospital Comprehensive Care Centre.

2.3 Nutritional status of HIV positive patients on HAART treatment

Individuals living with HIV/AIDS have special nutritional needs irrespective of whether they are on ART or not. Proper nutrition helps to strengthen the immune system, manage opportunistic infections, optimize response to medical treatment, and may contribute to the slowing down of the progression of the disease (Castleman et al., 2004).

Evidence from studies indicates that poor nutrient status in HIV-infected individuals worsens their immune status, rendering them vulnerable to infections and further
deterioration in nutrient status (Anabwani et al., 2005). Malnutrition compromises an individual’s immunity thus increasing susceptibility to infections (including HIV). Infection leads to increased nutrient requirements which if not sufficiently met results in wasting. HIV-associated wasting has been recognized as a predictor of progression to AIDS and is a major contributor to the development of malnutrition in HIV-infected individuals early in the epidemic (Koethe and Heimburger, 2010). Furthermore the increased incidence of opportunistic infections such as diarrhoea causes poor absorption and use of fat-soluble vitamins A and E. This can further compromise nutrition and immune status (Piwoz and Preble, 2000). Nutritional care and support helps people living with HIV to manage HIV-related complications, promotes good responses to medical treatment, and improves the person’s quality of life by maintaining strength, comfort, level of functioning, and human dignity (FANTA, 2004).

Many of the nutritional problems that occurred among HIV infected persons in the era prior to HAART still persist even today. Weight loss remains a prevalent feature of persons with HIV infection, used as one of the indicators for staging the progression of the disease, and the incidence of wasting appears to be unaffected by HAART therapy (Wanke et al., 2000). Decreased lean body mass, in particular, continues to be associated with decreased quality of life among the HIV patients receiving HAART (Wilson et al., 2000). Gastrointestinal problems are frequent in persons infected with HIV and also among those receiving HAART. Diarrhoea is very common, and malabsorption continues to be found in HIV infected persons with or without chronic diarrhoea (Knox et al., 2000). For example, in developing countries more than 90% of HIV-positive individuals get diarrhoea compared with less than half in developed countries (Call, 2000).
According to the 2005-2010 Kenya National HIV/AIDS strategic plan, the Government of Kenya identified good nutrition as a key component of the national response to the HIV/AIDS epidemic, this in keeping with the global recognition that nutrition is essential for the promotion of health and quality of life for HIV infected patients (Ministry of Health, Government of Kenya, 2007). However, effective interventions to achieve this are still deficient due to resource constraints. The study wished to appraise the nutritional status in relation to HIV of the adult HIV positive male patients receiving care and treatment.

### 2.4 Dietary intake and food consumption pattern of the HIV positive adult male on HAART

The Highly Active Antiretroviral Therapy interrupts the replication of HIV and results not only in clinical and immune functions improvement but rapid and significant weight gain, provided that the diet contains adequate energy, protein and micronutrients to enable nutritional recovery (Brown et al., 2008). However, reduced body mass index is still predictive of mortality even with antiretroviral treatment, and highlights the value of appropriate nutritional monitoring and support in addition to antiretroviral medications (Sande et al., 2004). Furthermore, reduced food intake can reduce the efficacy of HAART treatment regimens, as some drugs may not be properly absorbed or can cause significant side effects if not taken with adequate food.

Piwoz and Preble (2000) also noted that HIV infection affects the production of some hormones that are involved in metabolism of macronutrients including fat. Body fat loss
is due to poor dietary intake, in conditions where there is inadequate energy intake; body fat is used as fuel source (Hsu et al., 2005). The dietary changes witnessed in many regions including South Rift Valley of the nutrition transition involve large increases in the consumption of fat (especially saturated fat) and sugar, marked increases in animal products, and a decline in unrefined cereal and, thus, in fiber intakes (Popkin, 2001a). Body fat oxidation increases in HIV-positive patients (Hsu et al., 2005)

However, it is important to appreciate that the association of individual nutrient intakes with disease outcomes can be difficult to detect; that is because nutrients are not consumed in isolation and act synergistically in the body (Kant et al., 2004; Newby et al., 2004). The study therefore enquired about the dietary patterns and its influence on the serum lipid status and body fat percentage through the measurement skin fold.

### 2.5 Lipidemia status in HIV positive patients receiving HAART

Highly Active Antiretroviral Therapy (HAART) associated lipidemia is characterized by elevated serum concentrations of total cholesterol, triglycerides, low density lipoproteins (LDL-C), very low density lipoprotein (VLDL) and apolipoprotein B and low levels of high density lipoproteins profile (Dronda et al., 2004). These lipid changes occur within three months of initiating HAART and plateau after six to nine months (Sherer et al., 2003).

In a large cross-sectional study by Friis-Møller et al., (2003), the prevalence of lipidemia as per the classes of lipoproteins was suggested to be 10 to 27 percent for hypercholesterolemia (>6.2 mmol/L), hypertriglyceridemia (>2.3 mmol/L), and low
HDL-cholesterol (<0.9 mmol/L) depending on the HAART regimen. However, the prevalence of low density lipoprotein has not been highlighted in the study by Friis-Moller et al., (2003).

Protease inhibitors may inhibit several proteins involved in lipid metabolism and adipocyte regulation, including LDL receptor–related protein and cytoplasmic retinoic acid–binding protein-1, which share a high degree of homology with PIs' catalytic site (Brinkman et al., 1999). However, emerging in vitro data suggest a more complicated mechanism, since different protease inhibitors (PIs) have differential effects on these systems (Mooser and Carr, 2001). Exposure to PIs is clearly associated with this entire range of metabolic abnormalities. Fat redistribution and lipidemia are correlated in patients on HAART. Most studies have not found an association between CD4 lymphocyte count or HIV viral load and lipid abnormalities.

The nutritional status of HIV-infected patients such as weight loss and protein depletion, contributes to reduction in the high density lipoprotein-cholesterol or elevation of low density lipoprotein-cholesterol levels (Grunfeld et al., 1992). Several path physiologic models have been proposed to explain the development of lipidemia in HIV-infected patients, involving several studies which postulated the interactions between the virus, antiretroviral therapies, and host factors (Brinkman et al., 1999; Safrin et al., 1999; Lenhard et al., 2001; Mooser and Carr, 2001).
The pathogenesis of hyperlipidemia is incompletely understood and appears to be associated with a number of factors. It is not possible to derive a precise incidence rate for lipidemia from these studies (Behren et al., 2005; Carr et al., 1998; Vergis et al., 2001) since they use different observation period and cut off points for hyperlipidemia and included patients with lipid disorders at baseline. The study by Almeida observed significant increase in total cholesterol, triglycerides and glucose in 110 patients after the treatment with the HAART. The glucose levels were increased due to the HAART in this study.

Nevertheless, the mechanisms that promote lipid alterations in HIV infected patients are still not completely understood, and may be potentiated by genetic and environmental factors as well as by medications (Grinspoon et al., 2005). Kramer (2009) reported dyslipidemia in the HIV patient who makes use of HAART characterized by increased VLDL (the greatest triglyceride transporter) and LDL-cholesterol levels and reduction of the HDL-cholesterol level. The authors also suggest that the factors which would lead the HIV patient to present lipidemia are not totally elucidated yet. It is not clear whether it directly occurs due to the use of HAART or if it is a product of many factors such as: antiretroviral treatment, genetic predisposition, diet and physical exercise or other factors such as the host response to the infection by the HIV. This study sought to establish the status of Lipidemia and associated factors among adult HIV positive male attending Comprehensive Care clinic at Kericho District Hospital.
2.6 Summary of the literature review

Since HIV has become a chronic disease as a result of the efficacious use of HAART, discussion has turned to questions about how to address the metabolic changes associated with the potent use of HAART. Highly active anti retroviral associated lipidemia is characterized by elevated serum concentrations of triglycerides, low density lipoprotein (LDL-c), very low-density lipoprotein (VLDL), and apolipoprotein B (apoB), and low levels of high density lipoprotein (HDL-c), constituting an atherogenic lipid profile.

Nutritional care and support helps people living with HIV to manage HIV-related complications, promotes good responses to medical treatment, and improves the person’s quality of life by maintaining strength, comfort, level of functioning, and human dignity (FANTA, 2004). Having proper nutrition in HIV/AIDS includes consuming diversified or variety of foods that will provide the body with the necessary energy, protein, fats, vitamins and minerals (MOH, 2006). According to the Kenyan national guidelines on nutrition and HIV/AIDS (2006), dietary intake, along with regular exercise, controlling weight, avoiding alcohol intake, smoking and other narcotic drugs make up nutrition related healthy life styles. Dietary diversity, the consumption of an adequate variety of food groups, is an aspect of dietary quality and can be considered an indicator of general nutritional adequacy (Nontobeko et al., 2008). Poor dietary diversity, a component of food insecurity, has been associated with mortality among HAART-naïve individuals in Uganda (Rawat et al., 2012). As the HIV infection becomes a more chronic disease and the management becomes increasingly sophisticated, the ability to ensure HIV-infected persons have access to high quality, nutritious food choices that promote optimal dietary
patterns, rather than just sufficient quantities of food, is significant (Faintuch et al., 2006; Fields-Gardner et al., 2004; Freeland-Graves et al., 2002).

Kramer (2009) reported dyslipidemia in the HIV patient who makes use of HAART characterized by increased VLDL (the greatest triglyceride transporter) and LDL-cholesterol levels and reduction of the HDL-cholesterol level. The author also suggests that the facts which would lead the HIV patient to present lipidemia are not totally elucidated yet. It is not clear whether it directly occurs due to the use of HAART or if it is a product of many factors such as: HAART treatment, genetic predisposition, diet and physical exercise or other factors such as the host response to the infection by the HIV. However, it remains uncertain whether these complications are related to each other, and whether they are exclusively associated with protease inhibitor administration (Penzak et al., 2002). Nevertheless, the mechanisms that promote lipid alterations in HIV/AIDS patients are still not completely understood, and may be potentiated by genetic and environmental factors, as well as by medications (Grinspoon and Carr, 2005).

This study endeavoured to establish Lipidemia status and associated factors among HIV positive adult male patients attending the Comprehensive Care (HAART) clinic at Kericho District Hospital. Throughout the study, literature on studies mostly focussed on clinical trials on lipidemia with very few studies relating nutrition to lipidemia and therefore this presented challenges during the literature review.
CHAPTER THREE: METHODOLOGY

3.1 Research Design

The study design was a cross-sectional analytical. The design desired to examine variables of interest in a sample of subject assayed once and the relationship between them determined. Descriptive study allowed the research to describe the behaviour as it occurred naturally (Mugenda and Mugenda, 1999; Orodho et al., 2004).

3.2 Measurement of variables

Independent variables included factors associated with lipidemia such as socio demographic and socio economic, socio cultural patient characteristics, and physical activity and nutritional status. Dependent variable was lipid profile.

3.3 Study Area

Kericho District Hospital is located at the heart of Kericho County, Western region of Kenya, lying in the highlands of The Great Rift-Valley. The hospital was chosen as the sampling point because it serves patients from many parts of South Rift Valley.

3.4 Target Population

HIV positive males face multiple challenges when deciding whether or not to disclose their serostatus to sex partners. Failure to disclose leads to delayed linkage to care and treatment for comprehensive service. Women unlike male use hormonal contraceptives under family planning that was likely to interfere with lipid profile and therefore studying
male population assisted in controlling confounding factors. Kericho District Hospital has helped accelerate HIV prevention, care and treatment efforts in Kenya for the last eight years. A total of 8000 HIV positive clients had been enrolled at the facility and were active on care and treatment. Out of this, 40% (3200) from the Hospital records were active adult male with 50% (1600) receiving HAART in the last 6 months or more Service (Kericho District Hospital CCC records, 2012).

3.4.1 Exclusion criteria
The study excluded male confirmed HIV positive, Age < 18 years, Mental or physical incapacity leading to inability to provide informed consent, those who have been on HAART in < 6 months, those who did not consent and the male gender on post exposure prophylaxis since their HIV status was indeterminate until the patient completes the regiment and confirmatory HIV test is done.

3.4.2 Inclusion criteria
The study included male confirmed HIV positive, aged ≥18 years, receiving HAART in the last 6 months or more, willing and able to provide informed consent and agreed to a home follow up for 24 hour recall.

3.5 Sampling Techniques
Purposive sampling was used to sample study hospital because of its capacity to run biochemistry test, experience in the provision of highly active antiretroviral therapy and its status as county referral hospital. Purposive sampling was also used to select the male
patients in order to control the confounding factors in the female gender. Systematic sampling was used to select the individual study subjects and a sub sample participants for the 24 hour recall until the desired study sample was realised. Every 5th Sample was selected until the desired sample was achieved for the total study participants. For the 24 hour recall, every 2nd participants was selected from the 310 sample size till the desired sample was achieved.

3.6 Sample size

The required sample size was determined according to Fisher et al. (1998) using the formula

\[ n = \frac{Z^2pq}{d^2} \]

- \( n \) is the desired sample size.
- \( P \) is the estimated prevalence of lipidemia which is set at 50% because from the existing studies, it was difficult to estimate the prevalence.
- \( d \) is the degree of desired precision (in this study it was 0.05).
- \( q = 1-p \) which is the estimated prevalence at 50% less one (1).

Based on Fisher et al., equation, the study sample size was calculated as:

\((1.96)^2 \times 0.5 \times 0.5 / (0.05)^2 \) \( n = 384 \). The active patients from the HAART clinic records was 1600 and therefore adjusted sample size was calculated as \( 384/1.24 = (n=310) \). The 24 hour recall sub sample was randomly selected (n= 155) from the calculated sample then followed up to their household to determine household measures for actual consumed food.
3.7 Research Instruments

Structured questionnaire (Appendix B) was used to collect data on social demographic, social economic, social status, 24 hour recall and food frequency. International Physical activity questionnaire (IPAQ) was used to collect data on physical activity. SECA 704 medical Weighing scale, SECA 213 height metre was used to collect information on the nutritional status. La -01128 Lafayette Skin fold calliper was used to assess the body fat percentage. A 5 mls syringe was used to bleed and 4mls purple tube used to collect blood sample for analysis using Cobas Mira Plus-Roche, USA and commercial kit from Randox Laboratories Ltd, UK. A patient medical record was used to collect data the HAART regime.

3.8 Pre-testing of the questionnaire

This involved pre-testing research instrument which was done at Litein hospital, Kericho County. The hospital has similar characteristics to Kericho District Hospital in HIV care and treatment service, social demographic and partner support in HIV activities. The purpose was to check for reliability of the tools, sensitivity and clarity of questions, instructions that could impede the instrument's ability to collect data in an economical and systematic fashion.

3.9 Validity and Reliability

The research tools were then validated by a team of experts including the University supervisors and researchers from Walter Reed Research. The study enumerators were trained on data collection and the need to independently administer the questionnaire and
verify the data twice before entry. Instructions on filling of questionnaires were made clear, simple and concise. Test-retest method of measuring reliability acceptance was conducted within a spurn of one week and the results computed in Pearson’s r for correlation between the two sets with the results demonstrating high correlation (r = 0.8). Biochemical method was validated through internal and external quality control with the blood samples collected analysed at Kericho district Hospital and KEMRI/Walter Reed and both test-retest giving similar results.

3.10 Data collection Techniques

A structured questionnaire (Appendix B) was used to collect data on the social demographic, socioeconomic, socio cultural, 24 hour recall, and anthropometric measurements.

3.10.1: Structured Questionnaire

One 24 hour dietary recall (Appendix B) is a retrospective method of dietary assessment where an individual was interviewed about their food and beverage consumption during the previous day or the preceding 24 hours. In the 24 hour recall the study participant was asked to remember and report all the food and beverages consumed in the preceding day with the results conducted through an interview. The interview was carried out in person in chronological order of consumption. The Multiple Pass Recall (MPR) was used as a staged approach to the dietary recall which followed the pattern of a free and uninterrupted recall of intake, followed by detailed and probing questions about intake (including quantities consumed) and concluding with a review of everything that was previously recalled, allowing addition of any items not remembered point (Nelson, et al., 2008).
Respondents were asked to report everything that they had eaten or drunk in the last 24 hours in an uninterrupted free flowing list.

For each item of food or drink in the questionnaire list, respondents were asked to provide additional detail, including: the time at which the food or drink was consumed, full description of the food or drink, including brand name where available, any foods likely to be eaten in combination e.g. milk in coffee, recipes and other combinations of foods e.g. sandwiches, the quantity consumed and based on household measures.

The food frequency approach asked the study participants to report their usual frequency of consumption of each food from a list of foods eaten in the last seven (7) days. Food frequency data was combined with 24 hour recall to improve the food estimation.

### 3.10.2 Anthropometry Measurement procedures

#### 3.10.2.1 Weight measurement

Weight was measured (Appendix G) for all the study participants using the SECA 704 medical Weighing scale. Calibration occurred at the beginning and end of each examining day. Participants were asked to remove their heavy outer garments and shoes. The participant stands in the centre of the platform; weight distributed evenly to both feet. The weight was recorded to the resolution of the scale (nearest 0.1 kg).
3.10.2.2 Height measurement

Height was measured for all the study participants using the SECA 213 height metre. At the beginning and end of each examination day, the height meter was checked with standardized rods and corrected if the error was greater than 2 mm. Participants were asked to remove their shoes, heavy outer garments, and hair ornaments. The participant was asked to stand with his/her back to the height rule. The back of the head, back, buttocks, calves and heels should be touching the upright, feet together. The top of the external auditory meatus (ear canal) was in line with the inferior margin of the bony orbit (cheek bone). The participant was asked to look straight. Height was recorded to the resolution of the height rule.

3.10.2.3 Skin fold measurement

Prior to measuring the skin fold using La-01128 Lafayette Skin fold calliper, we marked each chest, abdomen and thigh carefully with all marks on the right side of the body. The researcher gently grasped the fold of skin and underlying subcutaneous adipose tissue between left thumb and index finger. The amounts grasped depended upon the thickness of the subcutaneous adipose tissue. The side of the fold was roughly parallel and the grasp was about 2.0 cm above the place the measurement was taken, and gently held with the thumb and forefinger, position the jaws of the calipers perpendicular to the length of the fold and measured the skin fold thickness to the nearest 0.1 mm while the fingers continued to hold the skin fold. The actual measurement from the caliper was read about 3 seconds after the caliper tension was released and recorded to the nearest 0.1mm.
3.10.3 Biochemical assessment of Lipid profile

Lipid profile assessment (Appendix F) was performed on fasting blood sample taken from the vein. The blood sample was collected using 4ml purple tops and sent to Kericho District hospital Laboratory for analysis of lipid profile by a qualified lab technologist. The qualified laboratory technologist collected all the equipments needed for the procedure and placed them within safe and easy to reach table ensuring that all the items were clearly visible. The staff introduced themselves to the patient, and asked the patient to state their full name and checked that the laboratory form for accuracy of the information provided. The staff asked the patient about known allergies or phobia or had ever fainted during the previous injections or blood draws and discussed the test to perform. The lab staff extended the patient’s arm and inspected the antecubital fossa or forearm. The staff located the vein of a good size that is visible, straight and clear.

The lab staff performed hand wash with soap and water and dried with a single-use towel and put on well-fitting, non-sterile gloves. The site was cleaned with a 70% alcohol swab for 30 seconds and allowed to dry completely (30 seconds). Firm but gentle pressure was applied starting from the centre of the venepuncture site and work downward and outwards to cover an area of 2 cm or more. The vein was anchored by holding the patient’s arm and placing a thumb below the venepuncture site. The patient was asked to form a fist so the veins were more prominent. The vein was entered swiftly at a 30 degree angle or less, and the needle introduced along the vein at the easiest angle of entry. Once sufficient blood was collected, the tourniquet was released before withdrawing the needle. The needle was withdrawn gently and gentle pressure applied to the site with a
clean gauze or dry cotton-wool ball. The patient was asked to hold the gauze or cotton wool in place, with the arm extended and elevated.

Triglyceride and cholesterol levels were evaluated using the enzymatic method. 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. All measurements were analyzed in the COBAS MIRA PLUS spectrophometer (Roche Diagnostics) equipped with calibration filters and DIASYS serum control. The result of the test was entered into the questionnaire and lab results sheet pinned to each questionnaire according to the patient’s unique identification code.

3.10.4 Physical Activity
The international physical activity questionnaire categorized the questions into four to obtain global comparable data on health related physical activity. Physical activity was assessed at enrolment using a physical activity recall questionnaire to establish an individual’s level of activity and calculate a physical activity score.

3.11 Data Analysis
Significance was assessed at 95 % confidence level. Results on continuous measurements were presented on Mean ± SD (Min-Max) and results on categorical measurements presented in percentage (%). Nutrition screening in this study began with accurate
measurement of height, weight and then BMI was calculated. Anthropometric data analysis involved display of mean and standard deviation of calculated BMI and skin fold measurement expressed as percentage body fat. Biochemical analysis involved measures of central tendency using the mean and standard deviation and the display of proportion for Low Density Lipoprotein (LDL) and High Density Lipoprotein (HDL) with cut-off points indicated in relation to its effect on health. 24 hour recall was analyzed for mean nutrient consumption for key nutrients and the 7 day recall was analysed for food frequency. Physical activity data was analyzed for mean and standard deviations. Level one data analysis involved descriptive statistics of marital status, education level, highly active antiretrovirals (HAART) and occupation using the measures of central tendency and dispersion using mean, standard deviations and proportion.

Chi-square was used to determine whether lipidemia occurred by chance and multivariate regression analysis has been used to assess the significance among the independent variable and a continuous dependent variable of study parameters between lipid profile and dietary fat %, physical activity, nutritional status and categories of HAART in the study. The Statistical software namely Stata version 11.1 and Nutri-survey software were used to analyse descriptive and inferential statistics and Microsoft word and Excel have been used to generate tables (Rosner et al., 2000; Riffenburg et al., 2005).

3.12 Logistical and Ethical Considerations

Prior to data collection, ethical approval was obtained from the ethical review committee of postgraduate studies, Kenyatta University. The research permit (Appendix J) was
issued by Ministry of Higher Education Science and Technology. Permission was obtained from Kericho District Hospital ethical review committee for the study to proceed. Verbal and written consent (Appendix A) was obtained from the study participants after purpose of the study was explained prior to administering a questionnaire, anthropometric assessment (Appendix G) and blood sample collection for lipid analysis. Participants were informed (Appendix A) that all data obtained from them would be kept confidential using codes instead of their personal identifiers.

The researcher respected each participant as a person capable of making informed decision regarding the participation in the study. The researchers ensured that the participant received full disclosure on the nature and benefit of the study. The researcher ensured equitable selection of participants in the study through simple random sampling technique employed in the selection of subjects.
CHAPTER FOUR: RESULTS

4.1 Introduction
This chapter presents results for the 310 male on HAART attending HIV clinic at Kericho District Hospital Comprehensive Care Centre. The study examined the demographic and social economic characteristics of male patients receiving HAART, their nutritional status and dietary intake and food consumption frequency, the status of lipidemia and determines the factors associated with lipidemia among HIV adult male.

4.2 Demographic and Social Economic Characteristics of the study respondents
Social determinants operate at different causal levels such as socioeconomic context, demographic, vulnerability, religion, marital status and health outcomes and consequences and can be identified and addressed at those levels (WHO, 2010). This study assessed the demographic, marital status, religious affiliation and occupation. The mean age in years of the participants enrolled in this study was 43.52 ± 9.17. The HAART therapy was varied by marital status. The results show that majority of the study participants are in stable relationship that is marriage with a proportion of 82.26%. The result in this study shows that most participants have religious affiliation with majority being protestant as described in Table 4.1.
Table 4.1: Distribution of respondents by demographic, social and economic characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Freq</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>18-24 year</td>
<td>3</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>25-40 year</td>
<td>128</td>
<td>41.29</td>
</tr>
<tr>
<td></td>
<td>&gt;40 years</td>
<td>179</td>
<td>57.74</td>
</tr>
<tr>
<td>Education Level</td>
<td>College</td>
<td>33</td>
<td>10.65</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>3</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>Primary</td>
<td>127</td>
<td>40.97</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>140</td>
<td>45.16</td>
</tr>
<tr>
<td></td>
<td>University</td>
<td>4</td>
<td>1.29</td>
</tr>
<tr>
<td></td>
<td>Vocational</td>
<td>3</td>
<td>0.97</td>
</tr>
<tr>
<td>Marital Status</td>
<td>Married</td>
<td>255</td>
<td>82.26</td>
</tr>
<tr>
<td></td>
<td>Separated</td>
<td>12</td>
<td>3.87</td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>24</td>
<td>7.74</td>
</tr>
<tr>
<td></td>
<td>Widowed</td>
<td>19</td>
<td>6.13</td>
</tr>
<tr>
<td>Religion</td>
<td>Catholic</td>
<td>63</td>
<td>20.32</td>
</tr>
<tr>
<td></td>
<td>Muslim</td>
<td>3</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>Protestant</td>
<td>202</td>
<td>65.16</td>
</tr>
<tr>
<td></td>
<td>SDA</td>
<td>2</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>40</td>
<td>12.9</td>
</tr>
<tr>
<td>Occupation</td>
<td>Business</td>
<td>56</td>
<td>18.06</td>
</tr>
<tr>
<td></td>
<td>Casual Labour</td>
<td>78</td>
<td>25.16</td>
</tr>
<tr>
<td></td>
<td>Farmer</td>
<td>59</td>
<td>19.03</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>1</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>7</td>
<td>2.26</td>
</tr>
<tr>
<td></td>
<td>Salaried</td>
<td>94</td>
<td>30.32</td>
</tr>
<tr>
<td></td>
<td>Unpaid work</td>
<td>15</td>
<td>4.84</td>
</tr>
</tbody>
</table>

Majority of the respondents in the study were adults above 40 years (n=179) engaging in petty business which could be attributed to the low education level. There is a bigger proportion of patients on HAART with primary education (40.97%) and Secondary education level (45.17%) as opposed to university education level (1.29%). The respondents who reported to be earning salary were engaged in the informal employment with minimum returns.
4.3 Nutritional status of the HIV positive adult male receiving HAART

In this study, weight and height was assessed and the body mass index (BMI) described according to WHO (2004) principled cut off points. The results show that 70.92% of the participants have BMI within the normal nutritional status as described by the WHO principal cut off points using the BMI (Table 4.2). Since the introduction of HAART, malnutrition has declined but not disappeared completely. Table 4.2 shows the BMI distribution among the study participants with 11.94% presenting with moderate under nutrition. The proportion of respondents who presented with severe acute malnutrition was 2.58 %. The study also established that there is currently a trend of respondents with obesity with similar proportion as severe acute malnutrition possibly due to nutrient based intervention and the use of multiple micronutrients in the in the HIV clinic. These results demonstrate improvement of the nutritional status among the HAART patients.

**Table 4.2: Classification of Nutritional status by Body Mass Index (BMI)**

<table>
<thead>
<tr>
<th>Principal cut-off points of BMI kg/m²</th>
<th>Classification of Nutritional Status</th>
<th>Proportion in Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 16</td>
<td>Severe acute malnutrition</td>
<td>2.58</td>
</tr>
<tr>
<td>&gt;16 &amp; &lt; 18.5</td>
<td>Moderate acute malnutrition</td>
<td>11.94</td>
</tr>
<tr>
<td>≥18.5 and ≤ 24.5</td>
<td>Normal Nutritional status by BMI</td>
<td>70.92</td>
</tr>
<tr>
<td>&gt;25.5 and &lt; 30</td>
<td>Overweight</td>
<td>11.94</td>
</tr>
<tr>
<td>≥30</td>
<td>Obese</td>
<td>2.58</td>
</tr>
</tbody>
</table>

* Adapted from WHO, 2004
4.4 Dietary intake

The food consumed was examined through one time 24 hour recall among the HIV positive adults on HAART. Though a single 24 hour recall may not be representative of the adequate dietary intake, results of dietary intake data revealed that mean energy consumption was $1849.52 \pm 301.73$. This study suggests a low energy intake compared to the recommended daily allowance (Table 4.3) for the male HIV positive adults on HAART in consideration of the pathogenesis of HIV and the HAART regimen. Dietary intake revealed that carbohydrates, cholesterol and fibre consumption was below the recommended daily allowance. On average, the consumption of proteins and fats was slightly above the recommended daily allowance.

Table 4.3: Mean Macronutrient composition in 24 hour recall

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Nutrient Consumption in 24 hour recall</th>
<th>Standard deviation ±</th>
<th>Adult Male RDA* FAO/WHO Requirements</th>
<th>% respondents who met RDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kcal)</td>
<td>2049</td>
<td>302</td>
<td>2670</td>
<td>77%</td>
</tr>
<tr>
<td>Carbohydrates (g)</td>
<td>286</td>
<td>98</td>
<td>367</td>
<td>78%</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>60</td>
<td>24</td>
<td>57</td>
<td>104%</td>
</tr>
<tr>
<td>Cholesterol (g)</td>
<td>249</td>
<td>246</td>
<td>300</td>
<td>83%</td>
</tr>
<tr>
<td>Fats (g)</td>
<td>47</td>
<td>20</td>
<td>45</td>
<td>104%</td>
</tr>
<tr>
<td>PUFA (E %)</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>125%</td>
</tr>
<tr>
<td>Fibre (g)</td>
<td>27</td>
<td>16</td>
<td>25-30</td>
<td>90%</td>
</tr>
</tbody>
</table>

Values are mean and ± standard deviation.*RDA reference FAO/WHO 2003 intake for HIV positive on HAART

The intake of vitamin B1, B6 and vitamin C in this study were below the respective average as per the recommended daily allowance as shown in Table 4.4. The average intake of vitamin A and E which are both fat soluble was above the estimated RDA. Magnesium, zinc, iron and phosphorous intake in the study was above the estimated
RDA. Most sources of zinc and iron are the same and therefore nutrient composition shows similar trend in relation to the RDA.

Table 4.4: Mean Micronutrient composition in 24 hour recall

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Nutrient Consumption in 24 hour recall</th>
<th>Standard Deviation ±</th>
<th>*Adult Male RDA FAO/WHO requirements</th>
<th>% respondents who met RDA*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Folic Acid (ug)</td>
<td>336</td>
<td>64</td>
<td>400</td>
<td>84</td>
</tr>
<tr>
<td>Vitamin A (ug)</td>
<td>928</td>
<td>144</td>
<td>600</td>
<td>155</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>50</td>
<td>28</td>
<td>45</td>
<td>86</td>
</tr>
<tr>
<td>Vitamin E (eq. mg)</td>
<td>15</td>
<td>78</td>
<td>10</td>
<td>149</td>
</tr>
<tr>
<td>Vitamin B1 (mg)</td>
<td>1</td>
<td>0.5</td>
<td>1.2</td>
<td>88</td>
</tr>
<tr>
<td>Vitamin B6 (mg)</td>
<td>1</td>
<td>0.3</td>
<td>1.3</td>
<td>76</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>1952</td>
<td>804</td>
<td>2400</td>
<td>81</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>3645</td>
<td>1257</td>
<td>4700</td>
<td>77</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>585</td>
<td>264</td>
<td>1000</td>
<td>59</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>537</td>
<td>341</td>
<td>420</td>
<td>127**</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>9</td>
<td>5</td>
<td>9</td>
<td>100**</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>11</td>
<td>4</td>
<td>9.4</td>
<td>119**</td>
</tr>
<tr>
<td>Phosphorous (mg)</td>
<td>701</td>
<td>215</td>
<td>700</td>
<td>100**</td>
</tr>
</tbody>
</table>

The Values are ± mean and standard deviation.*RDA reference FAO/WHO 2003 intake for HIV positive on HAART. **Nutrients levels above the RDA.

Calcium, potassium and sodium intake according to the study results is below the RDA. The respondents reported boiling and frying as the most common method of cooking food. Vitamin B1 and B6 are heat labile and therefore their raw content samples are easily decreased by cooking. The one day 24 hour recall may not be representative of the food consumption.
Table 4.5: The percentage frequency of food consumption in 7 day food recall

<table>
<thead>
<tr>
<th>Food</th>
<th>% Consumption times per day</th>
<th>% Consumption times in previous 7 days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>1-2</td>
</tr>
<tr>
<td>Vegetables**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cabbage</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>Kales</td>
<td>36</td>
<td>9</td>
</tr>
<tr>
<td>legumes**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beans</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Protein**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td>46</td>
<td>18</td>
</tr>
<tr>
<td>Meat</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Fish</td>
<td>24</td>
<td>4</td>
</tr>
<tr>
<td>cereals**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bread</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Maize meal</td>
<td>9</td>
<td>16</td>
</tr>
</tbody>
</table>

** Key food groups picked for frequency of food consumption in 7 day food recall

The average consumption of cereal products and legumes was higher when estimated by the FFQ as compared to the 24-hour recalls. Foods were classified into the following sources: cereals, animal and animal products, legumes and vegetable. There was variety of foods consumed as shown in Table 4.5. Majority had maize meal (55%) as source of their carbohydrates and only 19% consuming vegetable. A significant proportion of the participants (19%) reported that they did not consume legumes while 17% of the respondents reported that they had not consumed fish in the last 7 days, with 8% not consuming milk and thus implying an inadequate consumption of both animal and plant sources of protein among these respondents.
4.5 Lipidemia status among HIV positive adult male on HAART

The lipid profile was described in terms of lipoproteins to include Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), triglycerides and cholesterols as shown in Table 4.6. The results were presented using mean standard deviation of the lipid profile with reference values indicated to assess individual performance and proportion of deviation from the mean. A mean LDL-C level of 2.5 mmoles/l ± 1.05 was recorded for these respondents, representing 48.71% of the total study population. The results in table 4.6 revealed that triglyceride levels (1.96 ± 1.32) and total cholesterol (4.50 ±1.28) were significantly higher with triglyceride levels representing 45.16 percent of the respondent. The status of lipidemia was described by the proportion of patients with significant elevation of triglyceride and LDL cholesterols compared to the reference values. The observation in the study shows that a higher proportion of the respondents had elevated LDL (48.71%) and triglyceride levels (45.48%). This study suggests altered LDL and triglycerides lipids among the study participants as demonstrated by the mean LDL, triglyceride and cholesterol in Table 4.8. The elevated level of low density lipoproteins and triglycerides is termed as hyperlipidemia.
Table 4.6: Mean and proportion of Lipid profile of adult HIV Positive male on HAART

<table>
<thead>
<tr>
<th>Lipoproteins</th>
<th>Mean profile</th>
<th>Reference Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDL mmol/L</td>
<td>2.5 ± 1.05</td>
<td>1.10 – 2.40</td>
</tr>
<tr>
<td>HDL mmol/L</td>
<td>1.47 ± 0.58</td>
<td>0.90 – 1.68</td>
</tr>
<tr>
<td>Triglycerides (mmol / L)</td>
<td>1.96 ±1.32</td>
<td>0.41 - 2.61</td>
</tr>
<tr>
<td>Cholesterol, Total (mmol / L)</td>
<td>4.50 ±1.28</td>
<td>2.55 - 5.70</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LDL</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>15</td>
<td>4.84</td>
</tr>
<tr>
<td>Normal</td>
<td>144</td>
<td>46.45</td>
</tr>
<tr>
<td>High</td>
<td>151</td>
<td>48.71</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HDL</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>45</td>
<td>14.52</td>
</tr>
<tr>
<td>Normal</td>
<td>178</td>
<td>57.42</td>
</tr>
<tr>
<td>High</td>
<td>87</td>
<td>28.06</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Triglyceride</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>8</td>
<td>2.58</td>
</tr>
<tr>
<td>Normal</td>
<td>161</td>
<td>51.94</td>
</tr>
<tr>
<td>High</td>
<td>141</td>
<td>45.48</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Cholesterol</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>6</td>
<td>1.95</td>
</tr>
<tr>
<td>Normal</td>
<td>164</td>
<td>52.90</td>
</tr>
<tr>
<td>High</td>
<td>140</td>
<td>45.16</td>
</tr>
</tbody>
</table>


Significantly, 14.5% of respondents presented with low levels of HDL- Cholesterol.

HDL-C level is decreased as the disease progresses which is characterized by weakened immune system in HIV positive patients on HAART and thus affecting appetite and ability to eat. HDL-C which is supplied by fat from food therefore reduces as the disease progresses. The DHL carry cholesterol from the peripheral cells to the liver while LDL carries cholesterol in the reverse direction. Due to this function, increased levels of LDL-C augment the risk of cardiovascular diseases while HDL is a vessel protective agent preventing the formation of atherosclerotic changes.
The HAART therapy in this study was grouped into protease containing regimen and non-protease regimen and the mean LDL was analysed for variance using the one way ANOVA as demonstrated in Table 4.7. The results showed that there was no significant statistical difference in the mean LDL level for the HAART. The results suggested that irrespective of the regimen, the mean LDL remains the same in the male HIV adult patients receiving protease and non-protease regimen.

Table 4.7: Mean LDL Analysis of Variance between PI and Non PI using one way ANOVA

<table>
<thead>
<tr>
<th>HAART regimen</th>
<th>Mean</th>
<th>*Reference ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PI (n=20)</td>
<td>2.52 ± 1.07</td>
<td>1.10 – 2.40</td>
</tr>
<tr>
<td>2. Non-PI (n=290)</td>
<td>2.51 ± 1.06</td>
<td>1.10 – 2.40</td>
</tr>
</tbody>
</table>

*Reference values obtained from Kenya Medical Research Institute/Walter Reed Project Clinical Research Centre Laboratory. The definition of HAART for analyses herein was guided by published guidelines and defined as 2 or more nucleoside reverse transcriptase inhibitors (NRTIs) in combination with at least 1 PI or 1 non-nucleoside reverse transcriptase inhibitor (NNRTI)
4.6 Factors Associated with lipidemia among HIV positive adult male on HAART.

4.6.1 Nutritional status and Lipid profile

The body mass index and the skin fold measurements were subjected to multivariate regression analysis to establish if the changes can affect the lipid profile. A significant positive correlation was found between triglyceride levels and body mass index (p=0.03).

The VLDLs are composed predominantly of triglycerides. This explains why VLDL is also elevated when the levels of triglycerides is increased among the HIV-positive. The observation in this study also shows a significant positive correlation between the body fat percentage as assessed through the skin fold measurement of the thigh, abdomen and chest of the respondents with the lipid profile. This demonstrated that as the skin fold measurements increase, the fat percentage increases and so does the triglycerides. In this study, there was no statistical significance in the multivariate regression analysis of BMI, skin fold, LDL and HDL as shown in Table 4.8.

Table 4.8: Multivariate regression analysis of BMI and lipid profile

<table>
<thead>
<tr>
<th>Lipid profile</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>P value (95% CL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDL</td>
<td>0.27</td>
<td>0.21</td>
<td>0.19</td>
</tr>
<tr>
<td>HDL</td>
<td>0.39**</td>
<td>0.30</td>
<td>0.20</td>
</tr>
<tr>
<td>Triglyceride</td>
<td>0.28</td>
<td>0.13</td>
<td>0.03*</td>
</tr>
<tr>
<td>Skin fold</td>
<td>0.27</td>
<td>0.02</td>
<td>0.00*</td>
</tr>
</tbody>
</table>

*P<0.05 = statistically significant relationship with BMI
** refer to negative coefficient suggesting that as BMI increases HLD decrease and vice versa
4.6.2 Body fat percentage and dietary fat intake pattern

The study assessed the dietary fat intake as proportion (%) of the recommended daily allowance and then evaluated the lipid profile group categorized as LDL, HDL, Triglyceride, total cholesterols and the skin fold measurement through multivariate regression analysis. The results showed that at 95% confidence interval, there was no statistical significant relationship between the fat intake and the lipid profile level. The study results suggest that the dietary fat for the HIV positive respondents on HAART did not affect the serum lipid profile and the body fat as shown in Table 4.9.

Table 4.9: Dietary fat and Lipid profile distribution using multivariate regression analysis

<table>
<thead>
<tr>
<th>Lipid Profile *</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>P value (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDL</td>
<td>5.58</td>
<td>5.59</td>
<td>5.59</td>
</tr>
<tr>
<td>HDL</td>
<td>2.87**</td>
<td>8.00</td>
<td>8.00</td>
</tr>
<tr>
<td>Triglyceride</td>
<td>1.39</td>
<td>2.16</td>
<td>2.16</td>
</tr>
<tr>
<td>Total cholesterols</td>
<td>0.20</td>
<td>3.80</td>
<td>3.80</td>
</tr>
</tbody>
</table>


** indicate negative coefficient of HDL which suggest that as Dietary fat increase, the HDL levels reduces.

4.6.3 Physical activity and Lipidemia

The physical activity was analysed and categorized into light, moderate and vigorous and evaluated to determine the statistical relationship with the LDL group. The results presented in Table 4.10 shows that of the participants who reported doing light exercise, 49.33% had elevated LDL cholesterol while those who reported moderate exercise, 47.73% had high LDL cholesterol and of those who performed vigorous exercises, 50.85% had elevated LDL cholesterol. The difference in the proportion is not significant.
Table 4.10: Distribution of physical activity and Lipid profile using Chi-square

<table>
<thead>
<tr>
<th>Lipid profile</th>
<th>Light</th>
<th>Moderate</th>
<th>Vigorous</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>5.33</td>
<td>3.98</td>
<td>6.78</td>
<td>P (0.87)</td>
</tr>
<tr>
<td>Normal</td>
<td>45.33</td>
<td>48.30</td>
<td>42.37</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>49.33</td>
<td>47.73</td>
<td>50.85</td>
<td></td>
</tr>
<tr>
<td>HDL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>4.47</td>
<td>7.37</td>
<td>14.56</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>59.53</td>
<td>49.12</td>
<td>67.49</td>
<td>P (0.63)</td>
</tr>
<tr>
<td>high</td>
<td>36.00</td>
<td>43.51</td>
<td>17.95</td>
<td></td>
</tr>
<tr>
<td>Triglyceride</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>6.45</td>
<td>8.43</td>
<td>5.92</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>55.13</td>
<td>47.46</td>
<td>58.13</td>
<td>P (0.48)</td>
</tr>
<tr>
<td>high</td>
<td>38.42</td>
<td>44.11</td>
<td>35.92</td>
<td></td>
</tr>
<tr>
<td>Total Cholesterol</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>4.65</td>
<td>7.62</td>
<td>9.34</td>
<td>P (0.56)</td>
</tr>
<tr>
<td>Normal</td>
<td>52.53</td>
<td>39.45</td>
<td>57.23</td>
<td></td>
</tr>
<tr>
<td>high</td>
<td>42.82</td>
<td>52.93</td>
<td>33.43</td>
<td></td>
</tr>
</tbody>
</table>

METS* Metabolic Equivalent are used to express the intensity of physical activity. Moderate (3-6 METS). Vigorous > 6 METS. One MET equals the resting metabolic rate, which is approximately 3.5 ml oxygen kg⁻¹ body weight per min⁻¹. METS*Source: Jette M, Sidney K, Blunchen G (1990). Metabolic equivalents (METS) in exercise testing, exercise prescription, and evaluation of functional capacity. Clin Cardiol; 13:555-565

4.6.4 Age, Lipidemia and body fat percentage

The age, lipid profile and fat % were subjected to multivariate regression analysis as shown in Table 4.11. The study observed significant statistical association in body fat percentage which was assessed through the skin fold measurement and the age of the respondent (p=0.00). These results suggested that as the age of respondents increase, subcutaneous adipose tissue deposition raise. This could be due to certain classes of HAART which induces toxicity among the HIV positive HAART experienced patients which then interferes with fat distribution and deposition in the body.
The results did not establish age related statistical significance among the respondent. Although the results did not show statistical significance, there was a trend showing increasing frequency of LDL elevation with the chronological age of the respondent.

Table 4.11: Multivariate regression analysis of respondent’s lipid profile and body fat percentage by age

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>P Value (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDL</td>
<td>0.01**</td>
<td>1.00</td>
<td>0.89</td>
</tr>
<tr>
<td>LDL</td>
<td>0.55</td>
<td>0.68</td>
<td>0.4</td>
</tr>
<tr>
<td>Total Cholesterol</td>
<td>1.10**</td>
<td>0.64</td>
<td>0.09</td>
</tr>
<tr>
<td>Triglyceride</td>
<td>0.79**</td>
<td>0.42</td>
<td>0.06</td>
</tr>
<tr>
<td>Skin fold measurement</td>
<td>0.35**</td>
<td>0.08</td>
<td>0.00*</td>
</tr>
</tbody>
</table>

*p value less than< 0.05
** Negative coefficient value

CHAPTER FIVE: DISCUSSION

The metabolic syndrome that has been described in connection with HIV infection and HAART includes aberrant mobilization and deposition of lipids, lipidemia, elevated circulating concentrations of total cholesterol and triglycerides and disadvantageous shifts in the ratio of high- to low-density lipoprotein cholesterol.

This study sought to establish the Lipidemia status and associated factors among adults on HAART attending HIV clinic at Kericho District Hospital. Currier (2008), Joy (2007) and Friis-Miller (2003) reported similar results in their studies characterized by elevated level of LDL-Cholesterol in HIV positive respondents on HAART. These results agree with the findings of this study which recorded a higher mean LDL-Cholesterol level as compared to the published reference levels. The findings from this cross sectional analytical study suggest that the lipid profiles of HIV-positive adult male respondents on HAART was characterized by elevated mean of both LDL cholesterol and total cholesterol. In terms of the proportion of lipidemia, the results of the present study agree with other scientific studies which documented similar findings in their literature (Currier, 2008; Joy, 2007; Friis-Miller, 2003).

The present study was controlled for the time of use of HAART in the eligibility criteria which sought to only enroll HIV positive adults male who have been on HAART for a period not less than six (6) months. A study conducted by Khiangte (2007) showed that HDL-C level decreased as HIV infection progress among the patients receiving HAART who are either failing treatment.
HIV infection in a population structure strikes the prime aged adults who are most productive (Barnett and Whiteside, 2002) in the society as shown the social demographic characteristics in the present study. The greatest impact of the epidemic is felt at a household level, where socio-economic factors combine with socio-cultural and epidemiological variables to influence prevalence (SSRC et al., 2004). The study through measures of central tendency for the social economic characteristics shows that HIV burden is high among adults on stable relationship such as marriage.

While Kenya outranks most of the African countries on basic education indicators, experts say that the country’s rapidly growing labour force is generally lacking in the skills that will be required for the county to become global competitive (KIPRA, 2009). Majority of the respondents in the study attained secondary school level of education and the form of employment was basically unskilled. As compared to the World Bank survey, primary school completion rate is low with a proportion of 80%, (World Bank, 2010).

With majority of the respondents greater than 40 years, there are suggestions of economic impact, as a result of working adults falling ill or having to stop work to look after the ill or additional expenditure on health care and lot of time spend on the clinic appointments and monitoring of laboratory works (UNAIDS, 2004). Other effects on the household include depletion of household assets (as a result of increased health expenditure and other consumption needs and labour losses), lower productivity of subsistence labour and reduced availability of food.
Esposito et al. (2008) found out similar results to the present study where HIV patients tended to increase in body mass index after initiation of HAART. Use of BMI in body composition is important because it measures a person’s fat content. BMI is widely used to screen for obesity. The study summarized by Salomon et al., (2002) indicated that, despite several advances in the management of HIV infection, including HAART, prophylaxis, treatment of opportunistic infections and psychosocial care, malnutrition remained an important prognostic factor, even in developed countries. Wasting, in particular the loss of lean body mass has been associated with increased mortality, accelerated disease progression, and impairment of physical strength and functional status.

HIV infection can lead to malnutrition (Noble et al, 2008). Various infections, which occur as a result of weakened immune system in HIV infection, can affect appetite and ability to eat. Diarrhoea could lead to malabsorption of fat from the food. In this study, the prevalence of malnutrition in HIV clients receiving chronic care was slightly lower compared to other studies done in India (Sati et al., 2004); Zacharia et al., 2002). The difference may be due to residence, socio culture, economic and or year of study and the duration of the HAART treatment. This study agrees with other studies Tang, (2005) which found that relatively small proportion of weight loss is common among people with HIV who are taking treatment and not trying to lose weight.

The findings in this study highlight the benefits of providing adequate amounts of energy and protein for people living with HIV as demonstrated by Young in 1997. Adequate
intake of micronutrients and macronutrients is essential for the restoration and maintenance of body cell mass and normal function, including immunity. The present study agrees with the findings of cross-sectional study of men with advanced, asymptomatic HIV which demonstrated a positive association between protein intake and body cell mass independent of muscle-building activity (Williams et al., 2003). Adequate energy and protein intakes may be associated with a diet that is high in nutrient density and may not play a specific protective role in the development of fat deposition, because overall good nutrition is associated with better immune response (Kim et al., 2001). The present study agrees with the available data by KAIS (2007), and its estimation of moderate malnutrition at 15% for People living with HIV and estimation of 4% suffering from severe malnutrition.

Energy requirements are elevated with high viral load, fever, opportunistic infection, the need for weight gain and the increased energy cost of breathing in respiratory infections (Xuereb et al., 2004). According to WHO (2003), recommendation for symptomatic HIV positive adults should increase energy intake by 10% and 20-30% during the symptomatic phase over the requirement for healthy HIV positive people of the same age, sex, and physical activity level. These recommendations are also for PLHIV, including those taking HIV-related medications such as HAART (FANTA, 2004).

According to WHO (2003), data are insufficient to support an increase in protein requirements due to HIV infection. HIV-positive persons do not require more protein than the level recommended for healthy HIV negative persons of the same age, sex, and
physical activity level, that is, 12% to 15% of total energy intake. Noakes et al., in 2005 observed that a high-protein diet may increase the percentage of fat loss and total weight loss and thus prevent weight gain and obesity independently of total energy intake. These are factors which the present study concurs with in reference with the observation of mean protein intake and normal body mass index in patients receiving HAART.

The change in paradigm of the nutritional status of individuals living with HIV/AIDS, already achieved in the literature, is corroborated in the present study (Morse et al., 2006 & Crum-Cianflone et al., 2008). Diet composition is a factor also associated with the lipid profile and body composition of individuals living with HIV/AIDS. Diet diversity has however widely been associated with high socioeconomic status. Monthly income can be a strong and significant predictor of diet diversity among HIV patients (Anyango, 2012 & UNDP, 2012). Halton et al., (2008) observed that nutritional quality of the diet does improve with consumption of greater food diversity. Consuming micronutrients (especially Vitamins A, B6 and B12, iron and zinc) is important for building a strong immune system and fighting infections. For example, Vitamin A deficiency is associated with higher maternal-child transmission rates, faster progression from HIV to AIDS, higher infant mortality and child growth failure. The B-group vitamins play important roles in immune regulations, and deficiencies play a role in disease progression. Micronutrients (Vitamins and minerals) are important in the HIV-nutrition relationship due to their critical roles in cellular differentiation, enzymatic processes, immune system reactions, and other body functions (Piwoz and Preble, 2000).
Micronutrients are believed to protect the integrity of the gastrointestinal epithelia irrespective of whether the damage is caused by enteropathogens or by HIV disease. Zinc plays a crucial role in maintaining the integrity of the epithelial cells that line the intestine and preventing diarrhoea in the HIV infected individual (Patel et al., 2010). Using food-frequency questionnaires, Batterham et al., (2003) investigated energy, fat, and saturated fat intake of HIV-infected patients with fat redistribution versus patients without fat redistribution. No relationship was noted between saturated or total fat intake and the metabolic and body composition abnormalities associated with lipodystrophy. However, this study did not assess such dietary factors as intake of polyunsaturated fats and dietary fiber (Chandalia et al., 2000), which are known to modify insulin resistance and lipidemia.

Previously, nutrition intervention focused on management and treatment of wasting among PLHIV but recent study suggested the need to focus on metabolic changes related with the use of HAART (Joy et al., 2007). Diet composition is a factor also associated with the lipid profile and body composition of individuals living with HIV/AIDS (Joy et al., 2007; Hu et al., 2008). The study findings agree with Stewart’s report that daily servings of the same food from each food source may not be enough, but that one should choose variety within food sources because the characteristic nutrients in each group vary greatly for individual foods.

The present study agrees with recent study which has documented a number of metabolic abnormalities including dyslipidemia which can be used as prognostic markers and may predict cardiovascular risk in HIV seropositive individuals (Oh et al., 2007). Smith BA et
al., (2001) reported similar observation made in this study that exercise and physical activity may be positive to HIV patients reducing central and peripheral obesity which is associated with the HAART. Improvement in physical conditioning with physical activity and exercise represents better levels of actual energy for activities including leisure activities.

This study corroborates with Kramer who reported dyslipidemia in the HIV patient who makes use of HAART characterized by increased VLDL (the greatest triglyceride transporter) and LDL-cholesterol levels and reduction of the HDL-cholesterol level. The authors also suggest that the facts which would lead the HIV patient to present dyslipidemia are not totally elucidated yet. It is not clear whether it directly occurs due to the use of HAART or if it is a product of many factors such as: antiretroviral treatment, genetic predisposition, diet and physical exercise or other factors such as the host response to the infection by the HIV. Recent study documented a number of metabolic abnormalities including dyslipidemia which can be used as prognostic markers and may predict cardiovascular risk in HIV seropositive individuals (Nieuwkerk et al., 2005). The study suggests that before initiating HAART, the patients’ hematological and other biochemical parameters are to be evaluated and regularly monitored during the therapy. Study conducted in the past demonstrated the role of HIV infection by itself, irrespective of HAART therapy in the development of metabolic disorders including altered lipid metabolism (Rasheed et al., 2008).
The present study did not show statistical association between lipid profile and antiretroviral containing protease inhibitors and non protease inhibitors contrary to other documented studies (Gallant et al., 2004; Malan et al., 2006) which could be attributed to good care practice and ability to treat opportunistic infection with periodic nutrition assessment and support for patient receiving treatment. The cross-sectional nature of the study could not establish the cause and effect relationships between lipidemia and HAART among HIV positive adult male on antiretroviral treatment. Many social and economic issues around the epidemic are still clouded by uncertainty and described on the basis of assumptions and hypotheses. There is much scope for further investigation, to enrich the breadth and depth of existing work.

Although we have reported relationships between HAART treatment and risk of dyslipidemia, the cross-sectional nature of the present study could not determine a causal relationship between lipidemia and categories of HAART, the protease inhibitors and non protease. In particular, because information on pretreatment lipid levels is unavailable for the majority of patients, we are unable to exclude the possibility that dyslipidemia occurred before exposure to HAART treatment.
CHAPTER SIX: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary
As the ongoing roll-out of antiretroviral treatment programs in resource poor settings is continuing, lipidemia will continue to be major issues for many HAART treated patients for years to come (Mutirima et al., 2007). Even with many advances in the availability and effectiveness of HAART (Highly Active Antiretroviral Therapy), still it is difficult to eradicate abnormalities associated with its long term use.

The purpose of this study, lipidemia status and associated factors among HIV positive adult male patients on highly active antiretroviral therapy attending the HIV clinic at Kericho District Hospital was to assess the magnitude of the problem and establish the associated factors. The study hypothesized that there was no statistically significant relationship between lipidemia and protease containing regimen and non protease regimen of the HAART.

The present study demonstrated that lipid profile of patients receiving HAART treatment are significantly elevated even when greater proportion of the patients have normal nutritional status as defined by the body mass index. Though the respondents reported variety in their dietary intake, the analysis of consumption using 24 hour recall and 7 day food frequency showed that the intake for a number of nutrients remained below the recommended daily intake.
This study agrees with other observational investigations in Europe and North America which demonstrated that HAART is linked with higher HDL and LDL levels (Riddler, 2003; Hill, 2009; Anastos, 2007).

However, these findings are limited by the use of a cross sectional analytical design and therefore the study provides the status of lipidemia only at a point in time not looking at the progress over time on Highly active anti-retroviral therapy. The study also failed to demonstrate the independent association between the protease inhibitor and non-protease inhibitor use and lipidemia on the basis of a cross sectional study on adult males attending Kericho District Hospital Comprehensive Care Centre. The present study was controlled for time of HAART use to take care of those patients newly initiating highly active antiretroviral therapy who may have lipidemia elevation between 3-6 months of HAART initiation.

Despite its exploratory nature, this study presents some insight on the status of lipidemia among the patients receiving HAART and therefore highlights the need to have lipid profile as routine monitoring and intervention. The investigation points out the importance of nutrition intervention among the patients receiving HAART and its significance in the integrated approach of management. It is recommended that nutrition intervention be promoted and supported with enhanced routine lipid profile assessment to identify early and provide appropriate intervention to patients experiencing elevation of LDL, triglyceride and total cholesterol.
6.2 Conclusion

In conclusion, irrespective of the regimen, HAART has resulted in postprandial increase of low density lipoproteins, triglycerides and total cholesterol across the antiretroviral therapy. Lipidemia is common in persons with HIV infection, especially those initiated to antiretroviral therapies. The typical pattern in patients on HAART includes elevated total cholesterol and elevated LDL cholesterol in significant proportion of the respondent. Nutritional status is determinant of biochemical markers of health with the body mass index showing significant relationship with triglyceride level and body fat percentage as assessed though the skin fold measurement. The present study demonstrates the need for evaluating lipid profile as biochemical marker useful in monitoring HIV disease progression and HIV disease management in HAART era. Marital status is a risk factor to HIV infection and subsequent progression of HIV infection.

6.3 Recommendation

6.3.1 Recommendation for policy

The Ministry of Health through NASCOP project should review nutrition guideline with the purpose of incorporating guiding principle for screening and management of lipidemia among HIV patients receiving HAART due to its prevalence and possible long-term cardiovascular risk.

6.3.2 Recommendation for practice

The nutritionist and health workers providing nutrition services to HIV patients need to look beyond BMI when making nutrition diagnosis and planning the intervention for
patients receiving HAART because the study has shown that while BMI may be within the classification for normal nutritional status, the lipid profile may be elevated.

**6.3.3 Suggestions for further Research**

There is much scope for further investigation, to enrich the breadth and depth of existing work. Many social and economic issues around the lipidemia are still clouded by uncertainty and described on the basis of assumptions and hypotheses and therefore need further research to bridge the knowledge gap. There is need for more observational studies seeking to explore and describe pathogenesis of lipidemia among HAART patients in Africa. In order to determine the clinical significance of low density lipoprotein (LDL) and triglyceride changes among HAART patients in Kenya, longer periods of follow-up will be required. Future work should investigate the biological mechanisms and pathways through which micronutrients affects high density lipoprotein (HDL) and low density lipoproteins (LDL).
REFERENCES


Green, C. E., (2002). Can qualitative research produce reliable quantitative findings? Field Methods 13(3), 3-19


Review of the Evidence in Resource-Adequate and Resource-Constrained Settings Clinical Infectious Diseases.


Appendix A: Client’s Consent Form

You are being asked to participate in this research because you are receiving anti-retroviral therapy (ART) at Kericho District Hospital HIV clinic. You were selected by chance from a list of all patients receiving ART at this clinic. This study is conducted by Mr. Wesley Bor, Masters Student of Kenyatta University, and Department of Foods, Nutrition and Dietetics. This study will look at the status of lipidemia among the HIV positive adult male receiving HAART and associated factors with the purpose of looking at ways to improve the treatment by giving recommendations to the program and policy makers. You will have nutritional assessment done, routine blood test and interview on food consumption pattern, frequency and physical activity. The routine blood tests are those tests that will look at the lipid profile. We will take not more than 4ml of blood. The study will review your medical records after the test is over without your name or contacts.

Since the researcher only wants to know the status of lipidemia and associated factors, there are few risks associated with this study. There are risks of having your status revealed to others and therefore the researcher will take appropriate actions to keep your information confidential and to assist you with any discrimination you may face in the study. There is a chance that you may be harmed when the blood is being taken for your laboratory test. These include discomfort, bleeding or bruising where the needle enters the body, light headache or in rare cases fainting.

It is possible you may not receive any benefit from this study. By participating in this study, the researcher will know your nutritional status including the lipid profile and learn
more about your HAART. The information we will learn in this study will help us improve the quality of care for all HIV patients in future.

You will be informed of any side effects associated with the use of HAART and the proper referral done within the HIV clinic for management as per the National ART guidelines as outlined by the Ministry of Health.

I have been informed that I am free to choose to participate in this study. I have been informed that saying “NO” will not have negative consequences.

I (Name)_________________________ (ID Number)__________________ volunteer and without any element of force or coercion agree to participate in the research entitled “LIPIDEMIA STATUS AND ASSOCIATED FACTORS AMONG HIV POSITIVE ADULT MALE PATIENTS ON HIGHLY ACTIVE ANTIRETROVIRAL THERAPY ATTENDING THE HIV CLINIC AT KERICHO DISTRICT HOSPITAL”.

Volunteer’s Name ________________________________ Date ________________

Signature or Mark of Volunteer __________________________ Date ________________

Signature of the person administering consent_______________ Date ____________
Appendix B: Social economic, Demographic and Cultural Questionnaire

“LIPIDEMIA STATUS AND ASSOCIATED FACTORS AMONG HIV POSITIVE ADULT MALE PATIENTS ON HIGHLY ACTIVE ANTIRETROVIRAL THERAPY ATTENDING THE HIV CLINIC AT KERICHO DISTRICT HOSPITAL”.

1. Social Economic, Demographic and Cultural Characteristic Questionnaire

Interview Date…………………………………………………..

Interviewer’s Name…………………………… Code…………………………………………………..

Name of respondent…………………………….Questionnaire number…………………..

Date of Birth (refer to ID card) …………………………………………………………………………..

Division………………………Location……………..Sub-Location…………………..

Starting with the head of the household, which people are living in your household with you, their relationship to the head of the household, sex, marital status, and denomination, level of education, occupation and whether they earn any income?
2. Demographic and Social economic Characteristic

Questionnaire Number ------- Household/Client Number______ Date of the interview: --/--/---- Name of the interviewer ------------
Use pencil marks in the entire questionnaire

SECTION 1: DEMOGRAPHIC AND SOCIO-DEMOGRAPHIC DATA
(Respondent=PLHIV on HAART)

<table>
<thead>
<tr>
<th>1.Code</th>
<th>1.2Relationship to household head</th>
<th>1.3Highest Education level Attained?</th>
<th>1.4Main occupation</th>
<th>1.5Marital status</th>
<th>1.6 Religion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Head</td>
<td>No education</td>
<td>Casual labour</td>
<td>single</td>
<td>Protestant</td>
</tr>
<tr>
<td>1</td>
<td>Spouse to head</td>
<td>Primary</td>
<td>Farmer</td>
<td>married</td>
<td>Catholic</td>
</tr>
<tr>
<td>2</td>
<td>Child to head</td>
<td>Secondary</td>
<td>labour(salaried)</td>
<td>Widowed</td>
<td>Muslim</td>
</tr>
<tr>
<td>3</td>
<td>Parent of the head</td>
<td>Vocational</td>
<td>Business</td>
<td>separated</td>
<td>Other</td>
</tr>
<tr>
<td>4</td>
<td>Other relation</td>
<td>College</td>
<td>Unemployed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Employee to head</td>
<td>University</td>
<td>Housewife</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Friend to head</td>
<td></td>
<td>Domestic help</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td>other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Yrs</td>
<td>Enter code</td>
<td>Enter code</td>
<td>Enter code</td>
<td>Enter code</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Enter code</td>
<td>Enter code</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix C: Food Consumption Frequency (Respondent=PLHIV on HAART)

(Use pencil and tick the appropriate answer)

1. (a) Over the past 7 days, how often did you drink eat vegetable such as kales, cabbages, traditional vegetables?

- [ ] 1 time per day
- [ ] 2-3 times per day
- [ ] 1-2 times per week
- [ ] 3-4 times per week
- [ ] 5-6 times per week

1. (b) Each time you eat vegetables, how much did you usually eat?

- [ ] Less than 3/4 cup (250 mls)
- [ ] 3/4 - 1 ¼ cup (250 mls)
- [ ] More than 1 ¼ mls

2. (a) Over the past 7 days, how often did you eat cereals such as rice, ugali, mashed potatoes and arrow roots?

- [ ] 1 time per day
- [ ] 2-3 times per day
- [ ] 1-2 times per week
- [ ] 5-6 times per week
- [ ] 5-6 times per week

2. (b) Each time you eat cereals such as rice, ugali, mashed potatoes and arrow roots, how much did you usually eat?

- [ ] Less than 3/4 cup (250 mls)
3. (a) Over the past 7 days, how often did you eat food such as meat, poultry and fish?
   - 1 time per day
   - 2-3 times per day
   - 1-2 times per week
   - 5-6 times per week
   - 5-6 times per week

3. (b) Each time you eat meat, poultry or fish, how much do you usually eat?
   - Less than 3/4 cup (250 mls)
   - 3/4 -1 ¼ cup (250 mls)
   - More than 1 ¼ cups (250 mls)

4. (a) In the past 7 days, how often did you eat legumes such as beans (baked beans, kidney, peas lentils and soy beans)
   - 1 time per day
   - 2-3 times per day
   - 1-2 times per week
   - 3-4 times per week
   - 5-6 times per week

4. (b). Each time you eat vegetables, how much do you usually eat?
   - Less than 3/4 cup (250 mls)
   - ½ -1cup (250 mls)
☐ More than 1(250 mls)

5. (a) Over the past 7 days, which fat were usually added to your vegetables, meat, poultry or legumes such food during cooking? (Please mark all that apply)
   - ☐ Margarine (including low fat)
   - ☐ Butter (including low fat)
   - ☐ Corn oil
   - ☐ Solid vegetable fat
   - ☐ Other kinds of oils

5. (b). Now thinking again about all the vegetables and other cooked food you ate in the past 7 days, how often was some sort of fat, sauce or dressing added after cooking or at the table?
   - ☐ 1 time per day
   - ☐ 2-3 times per day
   - ☐ 1-2 times per week
   - ☐ 3-4 times per week
   - ☐ 5-6 times per week

6. (a). If margarine, butter, or bacon fat was added to cooked vegetables after cooking or at the table, how much did you add?
   - ☐ Did not usually add
   - ☐ Less than one tea spoon
   - ☐ 1 to 3 teaspoons
   - ☐ More than 3 tea spoons
Now think about all the meat, poultry, and fish you ate in the past 7 days and how they were prepared.

6. (b) How often was oil, butter, margarine, or other fat used to fry, sauté or marinate any meat, poultry, or fish you ate?

- [ ] 1 time per day
- [ ] 2-3 times per day
- [ ] 1-2 times per week
- [ ] 3-4 times per week
- [ ] 5-6 times per week

The next questions ask about your intake of bread. First we will ask about bread you eat as part of sandwiches only. Then we will ask all other bread you eat.

7. (a) How often did you eat breads or rolls as part of sandwiches (including samosa and hot dog)

- [ ] 1 time per day
- [ ] 2-3 times per day
- [ ] 1-2 times per week
- [ ] 5-6 times per week
- [ ] times per week

7. (b) Each time you ate breads or rolls as part of your sandwiches how many did you usually eat?

- [ ] 1 slice or ½ roll
- [ ] 2 slices or 1 roll
- [ ] More that 2 slices
8. (a) Over the past 7 days, how often did you drink fresh milk, sour milk, mala or yoghurt?

☐ 1 time per day
☐ 2-3 times per day
☐ 1-2 times per week
☐ 3-4 times per week
☐ 5-6 times per week
☐ Never

8. (b) Each time you drink fresh milk, sour milk, mala or yoghurt, how much do you drink?

☐ Less than ½ a cup (250 mls)
☐ ½ to 1 cup
☐ More than 1 cup

9. (a) How often do you add sugar or honey to your tea, coffee or porridge?

☐ 1-3 cups per day
☐ 2-4 cups per week
☐ 5-6 cups per week
☐ 1 cup per day
☐ 2-4 cups per day
☐ Never

9. (b) Each time sugar or honey was added to foods you ate, how much was usually added?

☐ Less than 1 tea spoon  ☐ 1 to 3 teaspoons More ☐ than 3 teaspoons
Appendix D: 24- Hour Recall Questionnaires (Respondent=PLHIV on HAART)

(Tick the day of the week, which you are recalling)

☐ Monday  ☐ Tuesday  ☐ Wednesday ☐ Thursday ☐ Friday  ☐ Saturday

☐ Sunday

Yesterday from the time you woke up to the time you went to sleep, remember the foods and drink you consumed then tell me. Pose for a minute then continue

<table>
<thead>
<tr>
<th>Remembered foods</th>
<th>Forgotten foods. Did you consume any cakes, sodas, sweets, fruits, chewing gum, energy drinks including soda, any snacks, etc</th>
</tr>
</thead>
</table>

Now transfer the foods above to the following table

<table>
<thead>
<tr>
<th>Time of day</th>
<th>Food items consumed</th>
<th>Detailed description of the item as well as preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ingredients, method of preparation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e.g. whole/brown bread, with or without spread (b/band or margarine), size of slices-thin, medium, large tea with sugar and milk, fruit salad-specify fruits, sugar spoons-leveled or heaped, cooking fat or oil, boiled or fried rice, ugali (unga ya kusiaga or packet, meat pieces-use matchbox sizes etc</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Amounts in HHD measures Cans, spoons (tea, table serving spoons), bowls, plates, etc</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weight (metric)</td>
</tr>
<tr>
<td>breakfast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid morning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>snack</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Afternoon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>snack</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supper/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dinner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evening</td>
<td></td>
<td></td>
</tr>
<tr>
<td>snack</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix E: Describe your eating patterns in the last 3 months

(Respondent=PLHIV on HAART)

<table>
<thead>
<tr>
<th></th>
<th>Always</th>
<th>Sometimes</th>
<th>Only on weekend</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>lunch</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>supper</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Snacks</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Appendix F: Biochemical Assessment

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Value</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LDL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triglyceride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cholesterol</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix G: Weight and Height measurement

Height and Weight will be taken for all participants in the study. All measurements will be taken thrice and weight rounded off to the nearest 0.1kg and Height, to the nearest 0.5 cm and BMI

<table>
<thead>
<tr>
<th>measurement</th>
<th>1st</th>
<th>2nd</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kgs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI (Weight(Kgs) /Height(M²)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix H: Skin fold measurement for men

<table>
<thead>
<tr>
<th>Variables</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdominal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thigh</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Fat %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix I: International Physical Activity questionnaire (IPA Questionnaire)

I am going to ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself being a physically active person. Think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for creation, exercise or sport.

1. During the last 7 days, on how many days did you do vigorous physical activities?
   
   Days per week (VDAY: Range 0-7, 8, 9): Don’t know/ Not sure: Refused
   
   (Interviewer clarification: Think only about those physical activities that you do for at least 10 minutes). *If the respondent answers Zero, refuse or does not know, skip to Question 3*

2. How much time did you usually spend doing vigorous physical

   ..................................................Hours per day  (VDHRS: Range: 0-16)

   ..................................................Minutes per day (VDMIN: Range: 0-960, 998, 999)

   998. Don’t know/ Not sure

   999. Refused

Now think about activities which take moderate physical effort that you did in the last 7 days. Moderate physical activities make you breathe somewhat harder than normal and may include carrying light loads, bicycling at regular pace for at least 10 minutes.

3. During the last 7 days, on how many days did you do moderate physical activities

   ............... Days per week (MDAY: Range; 0-7, 8, 9 ;)

   8. Don’t know/ Not sure

   9. Refused
If the answer is Zero, refuses or does not know then skip to Question 5.

4. How much time did you usually spend doing moderate physical activities on one of those days?

...............Hours per day (VDHRS: Range: 0-16)

...............Minutes per day (VDMIN: Range: 0-960, 998, 999)

998. Don’t know/ Not sure

999. Refused

Now think about the time you spent walking in the last 7 days. This include at work and at home, walking to travel from place to place including recreation, sport, exercise or leisure. Think only for walking that you do for at least 10 minutes at a time

5. During the last 7 days, on how many days did you walk for at least 10 minutes.................

...............Days per week (WDAY: Range: 0-7, 8, 9)

Don’t know/ Not sure

Refused

6. How much time did you usually spend walking?

...............Hours per day (VDHRS: Range: 0-16)

...............Minutes per day (VDMIN:Range: 0-960, 998, 999)

998. Don’t know/ Not sure

999. Refused

Now think about the time you spent sitting on week days during the last 7 days. Include the time spend at work, at home, while doing course work and leisure time. This may
include time spent sitting at a desk, visiting friends, and reading or lying down to watch television.

7. During the last 7 days, how much time did you usually spend sitting on a week day?

..............................................Hours per day  (VDHRS: Range: 0-16

..............................................Minutes per day (VDMIN: Range: 0-960, 998, 999)

998. Don’t know/ Not sure

999. Refuse
Appendix J: KU graduate school clearance and research permit.