**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI, GHANA**

# Assessing the nutritional and health status of people living with HIV/AIDS in the Eastern Region of Ghana

**By**

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**A thesis submitted to the Department of Biochemistry and Biotechnology, College of Science in partial fulfilment of the requirements for the award of Master of Philosophy degree in HUMAN NUTRITION AND DIETETICS**

**JUNE 2019**

## DECLARATION

I, Apungu Francis Kwotua hereby declare that this work is my own effort, it has not been submitted either in part or whole in KNUST or elsewhere and all references have been duly acknowledged.



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## ABSTRACT

Globally about 36.9 million people are living with HIV/AIDS. HIV/AIDS is responsible for more than 940,000 deaths. Most of these deaths are related to malnutrition. Cross-Sectional study design was used to assess the nutritional and health status of people living with HIV/AIDS (18-60) years. Purposive and convenience sampling were used to select four (4) hospitals and two hundred (200) people living with HIV/AIDS in the Eastern Region of Ghana. A structuredquestionnaire was used to collect data of participants and their anthropometrics, food frequency, 24-hour dietary intake, full blood count, and viral load were assessed. The prevalence of underweight and overweight/obesity (using body mass index) were 17% and 37% respectively. Most respondents' had adequate intakes of phosphorus (70.5%), inadequate intakes of

calcium (95%), vitamin E (77.5%), vitamin A (94%), and excess intakes of sodium (93%), selenium (77%), copper (83.5%), and manganese (76%). The respondents' daily intake of fruits, vegetables, legumes, and animal foods were 10.1%, 26.2%, 2.5%, and 7.3% respectively. The study found 20% of respondents on antiretroviral treatment with high/unsuppressed viral load (≥1000cp/mL) and about 87% of respondents with high monocytes (≥10%). The current mean monocytes (15.45±2.23)% was significantly different from the previous mean monocytes (within 6months prior to study)(8.13±6.26)% (p=0.0478). About 38%, 88%, 66% and 69% respectively of respondents had low haemoglobin (Hb <11g/dL), red blood cell (RBC<4.5 x$10^{12}$/µL), haematocrit (Hct <37%), and mean platelet volume (MPV<9.5%). The study found no significant association between nutrient intakes of study subjects and biochemical/haematological parameters. There was also no significant association between anthropometric measures and biochemical/haematological parameters. In conclusion, a significant proportion of people living with HIV/AIDS had high prevalence of underweight and overweight/obesity, inadequate nutrients intakes, and high viral load.

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| | |
|---|---|
| AI | Adequate Intake |
| AIDS | Acquired Immune Deficiency Syndrome |
| AMDR | Acceptable Macronutrient Distribution Range |
| AOR | Adjusted Odds Ratio |
| ART | Anti-Retroviral Therapy |
| BMI | Body Mass Index |
| CD4 | Colony Differentiated type 4 |
| CDC | Centre for Disease Control |
| COR | Crude Odds Ratios |
| FAO | Food and Agriculture Organization |
| FBC | Full blood Count |
| GDHS | Ghana Demographic Health Service |
| GSS | Ghana Statistical Service |
| HAART | Highly Active Anti-Retroviral Therapy |
| Hb | Haemoglobin |
| Hct | Haematocrit |

| | |
|---|---|
| HIV | Human Immunodeficiency Virus |
| JHS | Junior High School |
| MCH | Mean Corpuscular Hemoglobin |
| MCHC | Mean Corpuscular Haemoglobin Concentration |
| MCV | Mean Corpuscular Volume |
| MPV | Mean Platelet Volume |
| MUAC | Mid Upper Arm Circumference |
| NACP | National AIDS Control Programme |
| NACS | Nutrition Assessment, Counseling and Support |
| NSP | Nutrition Support Programme |
| PCT | Plateletcrit |
| PDW | Platelets Distribution Width |
| PLT | Platelets |
| PLWHA | People Living with HIV/AIDS |
| RBC | Red Blood Cell |
| RDA | Recommended Dietary Allowance |
| RDW | Random Distribution Width |
| SDGs | Sustainable Development Goals |
| SHS | Senior High School |
| UNAIDS | United Nations Acquired Immuno-Deficiency Syndrome |
| VL | Viral Load |
| WBC | White Blood Cell |
| WFP | World Food Programme |
| WHO | World Health Organization |
| WHR | Waist-Hip Ratio |

## DEDICATION

This work is dedicated to my loving wife (Joyce Webakurah Kupedimah), daughters (Blessing Awedaga Apungu and Jahdiel Awelana Apungu), and son (Perez Awewoli Apungu).



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## DEFINITION OF TERMS

**Human Immunodeficiency Virus (HIV)**: is a retrovirus belonging to the family of lentiviruses which spread through sexual contact, mother to child (during pregnancy, birth, or breastfeeding), blood transfusion, and contaminated needles/blades. This virus attacks the immune system if not well treated making the individual susceptible to opportunistic infections.

**Acquired Immunodeficiency Syndrome (AIDS)**: This is the advanced stage of HIV. Acquired refers to the fact that it is infected, immunodeficiency means the body defence system is weakened and syndrome refers to a group or collection of diseases or health challenges.

**Nutritional status**: The state of the body or health of an individual that is influenced by the intake and utilization of nutrients. The nutritional markers used include; body

mass index (BMI), waist-hip ratio (WHR), mid-upper arm circumference (MUAC), visceral fat, muscle mass, and total body fat.

**Health status**: This refers to full blood count (FBC) parameters and viral load (VL).

**Nutrition Support Programme (NSP)**: This include programmes that provide food ration/assistance, therapeutic foods/nutrients/formula and/or nutrition counselling to people living with HIV/AIDS.



# CHAPTER ONE

## 1.0 INTRODUCTION

Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS) is a global health problem, responsible for 940,000 deaths in 2017. According to United Nations Acquired Immuno-Deficiency Syndrome (UNAIDS) report, about 36.9 million people globally were living with HIV/AIDS in 2017, whiles 1.8 million people were newly infected with HIV worldwide (UNAIDS, 2018a). Ghana's 2017 median antenatal care HIV prevalence was 2.1% according to the National HIV/AIDS sentinel survey (GAC/NACP, 2017).

Studies have found a high prevalence of malnutrition among people living with HIV/AIDS (Benzekri *et al*., 2015; Hu *et al*., 2011; Martinez *et al*., 2014; Nnyepi, 2009; Sicotte *et al*., 2015). Demographic health surveys meta-analysis in Sub-Saharan Africa showed the prevalence of malnutrition among people living with HIV/AIDS (PLWHA) as 10.3% (Uthman, 2008). Malnutrition predisposes people living with HIV/AIDS to poor health status and greater risk of mortality (Makubi *et al*., 2015; Paton *et al*., 2006).

The association between HIV/AIDS and malnutrition is well-documented. Studies have found a vicious cycle of HIV/AIDS and malnutrition (Ndakala *et al*., 2017; WHO and FAO, 2002). HIV/AIDS could lead to malnutrition. Malnutrition further weakens the immune system making people living with HIV/AIDS increasingly susceptibility to opportunistic infections (Paton *et al*, 2006). According to the USAIDS report for 2018, tuberculosis (TB) causes about one-third of AIDS-related deaths. TB co-infections predispose people living with HIV/AIDS to greater metabolic stress and risk of malnutrition (UNAIDS, 2018a).

Effective management of HIV/AIDS requires antiretroviral therapy and Nutrition Support Programme (NSP) to help build immunity or resistance to various infectious diseases or complications of diseases. Effective antiretroviral therapy results in low viral load or undetectable (less than 50cp/mL) (UNAIDS, 2018a, 2018b). The USAIDS 90-90-90 fast tract target is for 90% of all people receiving antiretroviral therapy to have viral suppression (UNAIDS, 2014). People living with HIV/AIDS on antiretroviral therapy (ART) require nutritional support or a nutritious diet to help them prevent nutrient deficiencies and maintain proper nutrition and health status (Audain *et al*., 2018).

Although the relationship between malnutrition and HIV/AIDS has been long recognized, there are limited studies on the nutritional and health status of people living with HIV/AIDS in the Eastern Region of Ghana which has a high HIV/AIDS prevalence in Ghana. This study sought to assess the nutritional status, dietary intakes and health status of people living with HIV/AIDS (18-60years) in the Eastern Region.

## 1.1 PROBLEM STATEMENT

Globally, it is estimated that 36.9 million people are living with HIV/AIDS while 940,000 died of AIDS in 2017 (UNAIDS, 2018a). Studies have shown high undernutrition and overnutrition among people living with HIV/AIDS (Benzekri *et al*., 2015; Gedle, *et al*, 2015; Hu *et al*., 2011; Martinez *et al*., 2014; Nnyepi, 2009). PLWHA are more vulnerable to the drivers and determinants of the double burden of malnutrition (WHO, 2016b). Overweight and change in body shape of people living with HIV/AIDS have been associated with antiretroviral drugs, physically inactivity, alcohol consumption, and smoking (Lands, 2013; Obry-Roguet *et al.*, 2018). The high undernutrition among people living with HIV/AIDS has been attributed to chronic diarrhoea, high nutrients requirement, co-infection, reduction in dietary intake,

abnormal protein metabolism, mal-absorption, increased energy expenditure, and abnormal utilization of substrates (Hsu and Pencharz, 2005; Rose *et al*., 2014). People living with HIV/AIDS suffer from food insecurity, hunger, and eating difficulties which increase the prevalence of undernutrition and poor health outcomes (Gedle *et al*., 2015; Martinez *et al*., 2014; Ndakala *et al*., 2017; Weiser *et al*., 2014). Undernutrition predisposes them to a greater risk of mortality. A study showed undernourished people living with HIV/AIDS starting antiretroviral are more likely to die in the first 6 months of ART compared to those with normal body mass index (Paton *et al*., 2006).

According to the 2017 National HIV/AIDS sentinel survey, Ghana's median antenatal care HIV prevalence was 2.1% and the Eastern Region was 2.1% (GAC/NACP, 2017). In Ghana, 16,000 died of AIDS-related deaths (UNAIDS, 2018a). Although there is high HIV/AIDS prevalence and mortality, there are limited studies on the nutritional and health status of people living with HIV/AIDS in the Eastern Region of Ghana.

## 1.2 RESEARCH QUESTIONS

1. What is the prevalence of malnutrition among people living with HIV/AIDS in selected health facilities in the Eastern Region?
2. How is the dietary intake of people living with HIV/AIDS?
3. How is the health status (viral load and full blood count) of people living with HIV/AIDS?

## 1.3 MAIN OBJECTIVE

To assess the nutritional and health status of people living with HIV/AIDS in selected health facilities in the Eastern Region of Ghana.

## 1.4 SPECIFIC OBJECTIVE

1. To determine the prevalence of malnutrition among people living with

HIV/AIDS in selected facilities in the Eastern Region.

2. To assess the dietary intake of people living with HIV/AIDS.
3. To assess the health status (viral load and full blood count) of people living with HIV/AIDS.

## 1.5 JUSTIFICATION

Nutritional and health status assessment is important for people living with HIV/AIDS since they are vulnerable to malnutrition, morbidity, and mortality. To achieve the Sustainable Development Goal three (3) (ensure healthy lives and promote well-being), the health and nutritional status of people living with HIV/AIDS must be considered as a priority. Knowing the nutritional and health status will help health institutions plan activities towards improving their health and nutritional status. This research is not only aimed at contributing to the existing body of knowledge but to make recommendations of action towards improving the nutritional and health status of people living with HIV/AIDS.

# CHAPTER TWO

# 2. 0 LITERATURE REVIEW

## 2.1 OVERVIEW OF HIV/AIDS

Human Immunodeficiency Virus (HIV) is a retrovirus belonging to the family of lentiviruses the etiologic agent of Acquired Immunodeficiency Syndrome (AIDS) (Calles and Evans, 2018). It is transmitted through sexual contact, from an infected mother to baby either during pregnancy, labour, delivery and/or breastfeeding or by exposure to infected blood or contaminated blood products (Kassaye and Levy, 2009). HIV has a long incubation period during which it uses its RNA and the host DNA to make viral DNA (Calles and Evans, 2018). If the infected individual is not on treated the virus eventually destroys all the CD4+ cells causing immunodeficiency and predisposing the individual to opportunistic infections, morbidity, and mortality (Calles and Evans, 2018).

## 2.2 RELATIONSHIP BETWEEN NUTRITIONAL AND HEALTH STATUS AND HIV/AIDS

Malnutrition and HIV infection are intricately linked. The relationship between malnutrition and HIV/AIDS is shown in figure 1. Malnutrition makes an individual highly vulnerable to opportunistic infections and HIV infection eventually contributes to malnutrition (Kielmann, *et al*., 1976). Studies have shown that inadequate dietary intake of people living with HIV/AIDS results in weight reduction, poor immune status, increase disease progression and accelerates susceptibility to sickness and poor appetite (Ndakala *et al*., 2017). The low immunity status resulting from inadequate dietary intake or undernutrition increases the progression from HIV to AIDS, predisposing the individual to opportunistic infection and further perpetuating the vicious cycle of malnutrition and HIV (Ndakala *et al*., 2017; WHO and FAO, 2002) Adequate nutritional status, however, affects innate immune activation. Studies have shown that nutritional

status/body composition (wasting or obesity) produces a complex interactive-response to HIV infection (Koethe *et al*., 2016).

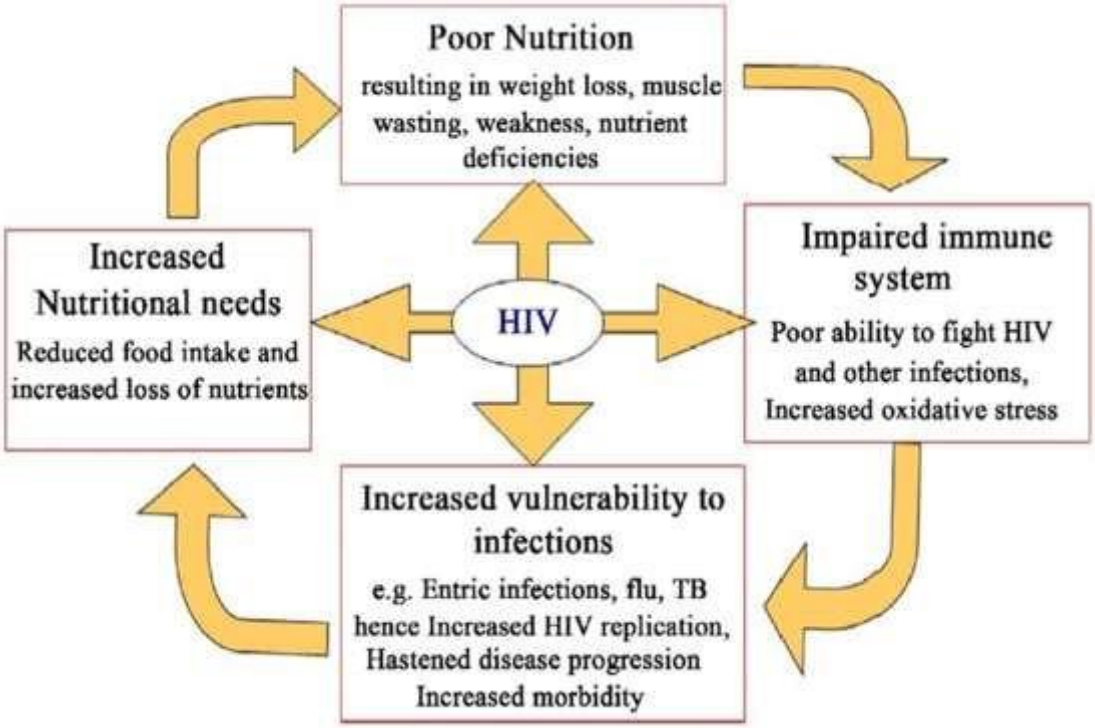


***Figure 2.1: Vicious cycle of HIV infection and malnutrition***

(Ndakala *et al*., 2017)

Malnutrition could result from a reduction in dietary or nutrient intake and other factors such as abnormal protein metabolism, mal-absorption, increased energy expenditure, and abnormal utilization of substrates (Hsu and Pencharz, 2005). HIVassociated malnutrition could also be due to higher macro and micronutrients requirement, co-infection and chronic diarrhoea due to HIV enteropathy (Rose *et al*.,

2014).

**2.3 PREVALENCE OF MALNUTRITION AMONG PEOPLE LIVING WITH HIV/AIDS**

A meta-analysis of demographic health surveys in Sub-Saharan Africa showed the prevalence of HIV-related malnutrition among women was 10.3%. The study showed

that improvement in educational status and wealth index reduces the prevalence rate of HIV-related malnutrition (Uthman, 2008). Sackey *et al.* (2017), reported 47% of overweight/obesity among people living with HIV/AIDS. In Senegal, about 22.9% of PLWHA were undernourished by BMI (<18.5kgm²) and 22.2% by MUAC (≤23cm) (Benzekri *et al*., 2015). However, a study in Kenya showed adult male on ART with the prevalence of underweight and obesity of 14.5% and 2.58% respectively (Bor *et al*., 2016). Interestingly, a study in Botswana showed 28.5% prevalence of undernutrition among PLWHA (20-50years). In this study, it was realized that 47.5% of the PLWHA were at risk of developing malnutrition with subjective global assessment (SGA) score ≥4. Also, about 15.7% of the study subjects had low serum albumin (Nnyepi, 2009).

Studies in Ethiopia reported different prevalence rate of malnutrition of 12.3% and 25.2% (Gedle *et al*., 2015; Hailemariam *et al*., 2013). High malnutrition was observed among people living HIV/AIDS with intestinal parasites and those not adhering to ART. Gedle *et al.* (2015), reported about 2.85 times the likelihood of malnutrition among PLWHA with intestinal parasites as compared to those without intestinal parasites, whiles Berhe *et al*. (2013) reported 8% and 42.5% of malnutrition among patients adhering to ART and not adhering to ART respectively. Moreover, in China, about 37.2% of people living HIV/AIDS were undernourished using BMI (Hu *et al*., 2011).

Martinez *et al*. (2014), reported a high prevalence underweight of 11%, overweight of 31%, and severe food insecurity (65%). Nutritional status of two (2) West African cohorts during the first year of HAART showed a prevalence of undernutrition of 31% and 36% (Sicotte *et al*., 2015). The study observed that low anaemia, BMI, or hypoalbuminemia at time of start or initiation of ART had an impact on the health of the patients as they were persistently undernourished and had increased risk of mortality (Sicotte *et al*., 2015).

## 2.4 DIETARY INTAKES OF PEOPLE LIVING WITH HIV/AIDS

The daily eating patterns, food choices, quantities, and quality of food consumed by people living with HIV/AIDS influence their nutritional and health status. Eating difficulties have been found to accelerate the prevalence of undernutrition. Gedle *et al.* (2015), showed that people living with HIV/AIDS with eating difficulty were 2.69 times more likely to be malnourished as compared to those without eating difficulty.

The dietary intake of people living with HIV/AIDS is influenced by food insecurity. Martinez *et al*. (2014) and Normen *et al*. (2005), reported 65% and 48% of food insecurity among PLWHA respectively. Food insecurity and hunger, accelerate the prevalence of undernutrition and poor health outcomes (Gedle *et al*., 2015; Martinez *et al*., 2014; Ndakala *et al*., 2017; Weiser *et al*., 2014). The absence of adequate food and consumption patterns of less than 3meals per day has been shown to be significantly associated with non-adherence to ART (Berhe, Tegabu, & Alemayehu, 2013). Also, daily food intake of less than 3meals per day and the absence of nutritional support programmes have shown as major determinants of the

undernutrition (Shiferaw *et al*., 2017). A study showed that individuals who benefited from nutrition support programmes in which ready-to-use therapeutic food (RUTF) was supplied were less likely to be malnourished than those without RUTF (AOR =

0.18) (Gedle *et al*., 2015).

The nutritional and health status of people living with HIV/AIDS is greatly influenced by their macronutrient and micronutrient intakes patterns. A study in Botswana showed that the average estimated energy intake of PLWHA was 75% of the median energy requirement set for healthy adults 18 years and older. It was observed that men actual protein intake was lower and fibre intake of 20g/day of both sexes was lower than recommended (Nnyepi, 2009). Low fibre intake predisposes an individual to

cardiovascular diseases. A study showed that high fibre intake is associated with reduced risk of fat disposition (Hendricks *et al*., 2003). Hu *et al*. (2011), reported 59.6% and 54.3% of people living with HIV/AIDS with insufficient total energy intake and insufficient protein intake respectively compared to the average dietary intake of Chinese residents. In this study, 84.6% of the female and 83.8% of the male consumed less than the average calories whiles about 40% of PLWHA took nutritional supplements, 22.3% drank alcohol (>3 times per week), and over 40% consume <100 grams of meat per day (Hu *et al*., 2011). Low energy and protein intake predispose PLWHA to undernutrition. Studies in South Africa, have shown that animal-based pattern is significantly associated with nutrients intake of people living with HIV/AIDS (Annan *et al*., 2015; Vorster *et al*., 2004).

## 2.5 HEALTH STATUS OF PEOPLE LIVING WITH HIV/AIDS

A study in Tanzania found 59% of people living with HIV/AIDS with low Hb (<11 g/dL). The study found about 22% of people living with HIV/AIDS had severe anaemia Hb (<8.5g/dL) and the risk of developing severe anaemia increased by 49% among patients with a BMI of <18.5 kg/m$^2$, by approximately 2-fold among patients with the WHO stage III, and by 3-fold among patients with WHO stage IV illness (Makubi *et al*., 2015). A study in West Africa found low haemoglobin levels associated with BMI < 18.5 kg/m$^2$ (Sicotte *et al*., 2015). A systematic review found the prevalence of anaemia in HIV disease varies considerably, ranging from 1.3% to 95%. This depends on factors such as the stage of HIV disease, age, sex, pregnancy status, injection-drug and definition of anaemia used. In general, the prevalence and severity of anaemia increase as the HIV disease progresses (Belperio & Rhew, 2004). A study found patients initiating zidovudine (ZDV)-containing HAART had a greater risk of developing new anaemia or worsening anaemia than patients initiating nonZDV-containing HAART

(Curkendall *et al*., 2007). A study in Ethiopia found the prevalence of anaemia at baseline of 42.9%. However, after HAART initiation, the prevalence significantly decreased to 20.9% at 6 months ($p<0.001$) and to 14.3% at 12 months ($p=0.001$) (Assefa *et al*., 2015). Anaemia among people living with HIV/AIDS could reduce their physical functioning and quality-of-life, and increase disease progression and mortality (Volberding *et al*., 2004). The health outcome of people living with HIV/AIDS is influenced by factors at the individual level, family, community, institutional and national level. A study found that homeless people with HIV/AIDS were at increased risk of negative health outcomes as compared to those with homes (Kidder *et al*., 2007).

Globally, 47% [35–58%] of people living with HIV are virally suppressed (UNAIDS, 2018a). When a person living with HIV is taking effective antiretroviral therapy, the viral load becomes so low that it is undetectable (less than 50cp/mL) (UNAIDS, 2018a, 2018b). Viral load test results below the threshold of <1000 copies/mL is considered as suppressed viral loads or treatment success according to 2016 WHO Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection (WHO, 2016a). Viral load is recommended as the preferred monitoring approach to diagnose and confirm treatment failure. It is important that routine viral load testing is conducted at 6 and 12 months after ART initiation and every 12 months thereafter (WHO, 2017). A study in Cambodia found 78% of adolescents living with HIV/AIDS (15-17years) with viral suppression (Chhim *et al*., 2018). This study viral load was below the USAIDS 90-90-90 fast tract target of 90% of all people receiving antiretroviral therapy with viral suppression (UNAIDS, 2014).

## 2.6 NUTRIENT REQUIREMENT

### 2.6.1 Macronutrient requirement of PLWHA

Consumption of adequate or balanced diet helps meet nutritional and health needs and survival for all people most especially people living with HIV/AIDS. According to the World Health Organisation, asymptomatic HIV infected adults' energy requirement is increased by 10% while's symptomatic adults requirements of energy is increased by 20% to 30%. This increase helps adult maintain adequate body weight and meet the demands of physical activity. The justification for increasing the requirements energy above healthy people is due to the increase in resting energy expenditure (REE) of PLWHA and energy demand due to infection (Rajabiun, 2001; WHO, 2003b).

According to the WHO technical report on nutrient requirements for PLWHA, there is no sufficient evidence for an increase in protein and fat requirement of people living HIVAIDS. Protein and fat requirements for a healthy adult of 50-80g/day and <35% of total energy needs respectively are also recommended for PLWHA. However, those on ART or having persistent diarrhoea require special assistance to adjust their fat intake (WHO, 2003b).

Nutrition support programmes/food assistance programmes should provide their subject with adequate rations to enable them to meet their daily nutrient requirement. An adequate ration as defined by the World Food Programme/United Nations High Commissioner for Refugees (WFP/UNHCR) is a ration that meets the population's minimum energy, fat, protein, and micronutrient requirements for light physical activity, and as being nutritionally balanced, culturally acceptable, diversified, fit for human consumption, and easily digestible (Koethe *et al*., 2018; WFP/UNHCR, 1997).

### 2.6.2 Micronutrient Requirement of PLWHA

PLWHA are more vulnerable to micronutrient deficiencies such as vitamin A, vitamin $B_{12}$, vitamin D, vitamin C, zinc, selenium, and iron. Vitamin A, vitamin $B_{12}$, zinc, and selenium are associated with increased immune function and their deficiencies could accelerate the risk of HIV progression (Falco and Silveira, 2015; USAID, 2015). The World Health Organisation recommends that HIV-infected adults should consume an adequate or balanced diet that provides micronutrient at recommended dietary allowance (RDA) levels although may not avert their challenges of nutritional deficiencies. Studies are yet to establish the safer upper tolerable limits of micronutrients so as to avoid the adverse effects of nutrient toxicity of micronutrient supplement (Rollins *et al*., 2008; WHO, 2003b).

## 2.7 NUTRITION SUPPORT PROGRAMMES FOR PLWHA

Food insecurity and hunger affect the health and nutritional status of individuals. Food insecurity is more prevalent among PLWHA (Norm n *et al*., 2005; Weiser *et al*., 2014). In sub-Saharan Africa, HIV/AIDS impacts greatly on food security and therefore requires food-based approaches such as community-based care and support, institution-based feeding programs and care for the severely malnourished individual.

These programmes enable individuals, households and communities to maintain proper nutritional and health status. Nutrition support programmes strengthen communities to overcome the HIV/AIDS epidemic (Ivers *et al*., 2009; Rajabiun, 2001). Studies have shown that proactive nutrition interventions of nutrition support programmes such as nutritional counselling, exercise, macronutrient, and micronutrient supplementation improve on the quality of life of PLWHA. A study showed that nutrition support programmes effectively reduce chronic diseases, fat redistribution, obesity, metabolic abnormalities and other health challenges experienced by PLWHA (Botros *et al*., 2013)

Breaking the vicious cycle of HIV/AIDS and malnutrition requires the use of antiretroviral therapy (ART) and Nutrition Support Programme (NSP) which helps build immunity and maintain proper nutritional status (Audain *et al*., 2015). In order to achieve optimal nutrition and health status of PLWHA, this would require not only ART but proactive nutrition support programmes with intervention packages of individualized medical therapy, assurance of nutrition and food security and nutrition education (Fields-Gardner *et al*., 2010).

### 2.7.1 Influence of NSP on the nutritional and Health status of PLWHA

Malnutrition usually results in poor clinical and treatment outcomes of PLWHA (Sicotte *et al*., 2015). Studies have shown that an increase in weight helps in the survival of the patients especially when starting ART (Koethe, 2010; Paton *et al*., 2006). Undernourished PLWHA who are starting antiretroviral therapy (ART) are highly at risk of dying in the first 6 months of taking antiretroviral drugs compared to those who have a normal body mass index (BMI)(Paton *et al*., 2006).

Several studies have found a positive influence of nutrition support programmes on the nutritional status of PLWHA; a community-based food supplementation evaluation study in Ghana showed that PLWHA had a significant average weight gain

(Mensah *et al*., 2015). Similarly, the food assistance programme in Uganda for PLWHA showed an improvement in weight gain and a resultant reduction in disease progression (Rawat *et al*., 2010). However, the extent of influence of NSP on nutrition and health status depended on the food items/supplements used. A study in Malawi showed that a fortified spread used in supplementary feeding for PLWHA resulted in increased growth of lean body tissues and increase in body mass index as compared to feeding with the corn-soy blend during a randomized controlled trial (Ndekha *et al*., 2009).

Nutrition Support programmes help PLWHA adhere to ART, support in their engagement, and retention into care (Berhe *et al.*, 2013; Cantrell *et al*., 2013; Fawzi *et al*., 2004; Martinez *et al*., 2014). Expansion in the treatment of PLWHA and adherence would result in reducing viral load and sustained decreases in mortality, morbidity, and transmission associated with HIV/AIDS (Montaner *et al*., 2014). Nutrition support programmes are able to improve the quality of life of PLWHA. Multivitamin supplements used in a randomized trial in Tanzania showed a delay in disease progression, and decrease morbidity and mortality of PLWHA (Fawzi *et al*., 2004). Studies have shown remarkable health outcomes due to livelihood interventions. A randomized controlled trial in Kenya where microfinance loans, water pumps, education on financial management and farming practices were provided for PLWHA showed a significant increase in their CD4 count cells and HIV viral suppression (Weiser *et al*., 2015).

### 2.7.2 Nutrition support programmes and physical activity for PLWHA

Nutrition support programmes and physical activity are recommended for PLWHA. Physical activity is a non-pharmacologic intervention which promotes health in a multidimensional way for PLWHA. Nutrition support programmes and physical activity intervention helps PLWHA overcome challenges of malnutrition, obesity, fat distribution, metabolic disorders, and bone diseases. Incorporating daily physical activity in the life of PLWHA would help stimulates their appetite, relieves stress, maintain health status, and prevent long-term effects of cardiovascular diseases (Botros *et al*., 2013; WHO and FAO, 2002).

### 2.7.3 Factors influencing non-compliance to NSP by PLWHA

The factors influencing non-compliance to nutrition support programmes by PLWHA as shown in Figure 2. These factors are similar to the factors influencing nonadherence to ART. They include intrapersonal factors (e.g. knowledge and perceptions), interpersonal factors (e.g. family settings and support), environmental/community and socioeconomic factors (e.g. stigma and income) and healthcare systems (e.g. accessibility and staff attitude) (Mehta *et al*., 1997; Reda and Biadgilign, 2012).

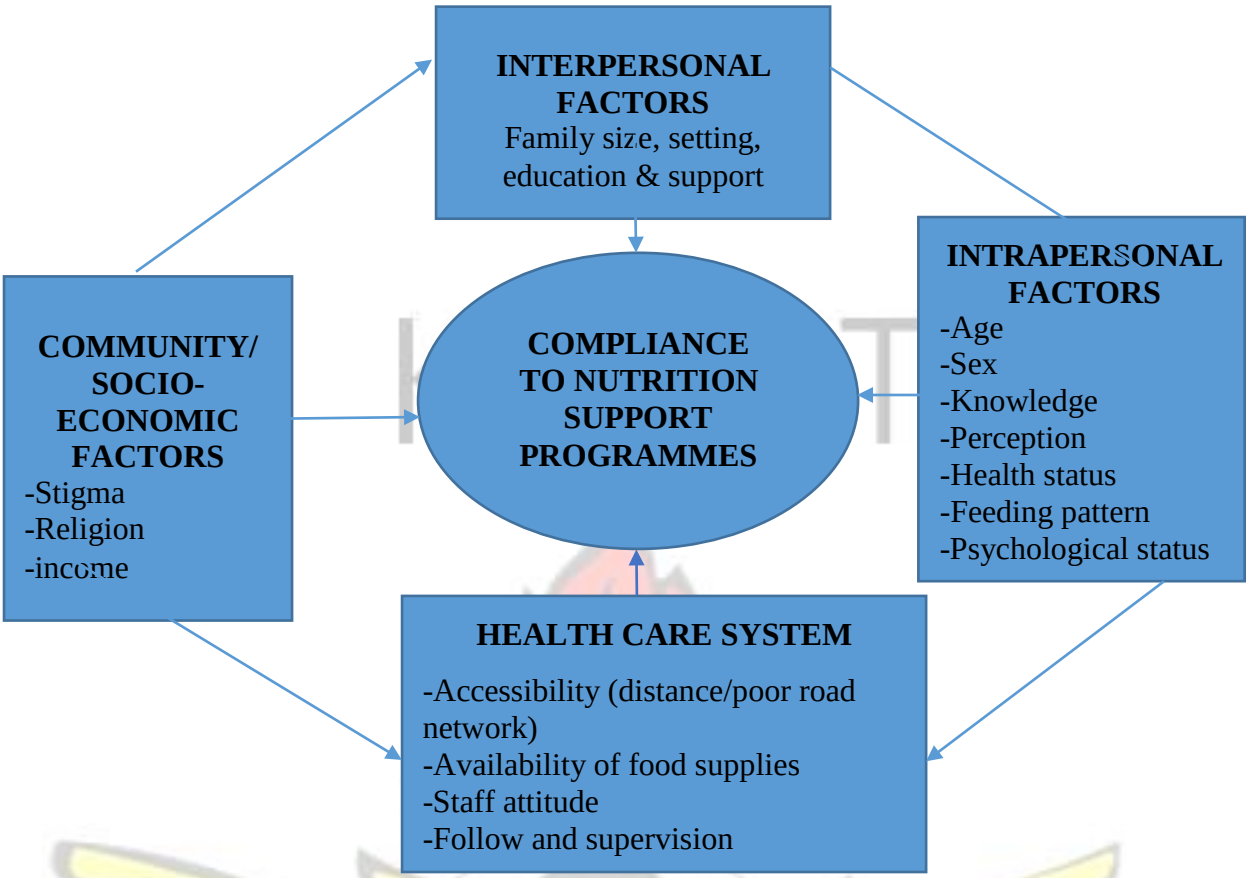


***Figure 2.2: Factors influencing compliance with nutrition support programmes***

Adopted from challenges of adherence to ART (Reda & Biadgilign, 2012).

## 2.8 SYSTEMATIC REVIEW ON INFLUENCE OF NUTRITION SUPPORT PROGRAMMES ON THE NUTRITIONAL AND HEALTH STATUS OF PLWHA

Malnutrition is very prevalent among people living with HIV/AIDS (Benzekri *et al*., 2015; Hu *et al*., 2011; Martinez *et al*., 2014; Nnyepi, 2009; Sicotte *et al*., 2015). The association between HIV/AIDS and malnutrition is well-documented (Ndakala *et al*., 2017; Paton *et al*., 2006). The vicious cycle of malnutrition and HIV/AIDS could be broken with nutrition support programme and antiretroviral therapy. This review examines the influence of nutrition support programmes on the nutritional and health status of people living with HIV/AIDS.

### 2.8.1 Data sources and search strategy

A search was conducted on PubMed and Google scholar electronic databases. The search was from August 2018 to February 2019. Keywords used to retrieve the data were; ―Nutrition support programme‖, ―nutritional status‖, ―health status‖, and ―HIV/AIDS‖.



### 2.8.2 Eligibility criteria

**Inclusion Criteria**

- The study included nutrition support programmes for adults, children, pregnant women and lactating women with HIV infection.
- The study included review publications.
- Studies published within 2009-2019 were considered.

**Exclusion Criteria**

- Studies were excluded if the non-food intervention were used.
- A study was excluded if the full-text was not available.
- Articles that were included in review publications which are included in this review were excluded.

### 2.8.3 Study Selection

Study selection of articles employed the guidelines of the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement (Moher *et al*., 2009). Searched results from the electronic database were merged and their duplicates were excluded. The articles titles and abstracts were screened and those that did not meet the inclusion criteria were excluded. Full texts of the eligible articles were retrieved to identify the studies to be included in the review.

### 2.8.4 Data Extraction

A standardized template and research design algorithm of the Academy of Nutrition and Dietetics was used for the extraction of data inclusion into the study. Data included primary author's name, country, year of publication, study design, setting, sample size and characteristics, recruitment method, outcomes, data collection method, results and conclusion (Academy of Nutrition and Dietetics, 2016). Out of the 9,854 retrieved publications, ten studies met the inclusion criteria for this present review (Figure 2.3). Five studies were review publications, whiles the other five were research articles. The characteristics of the ten studies are summarised in Table 2.1.

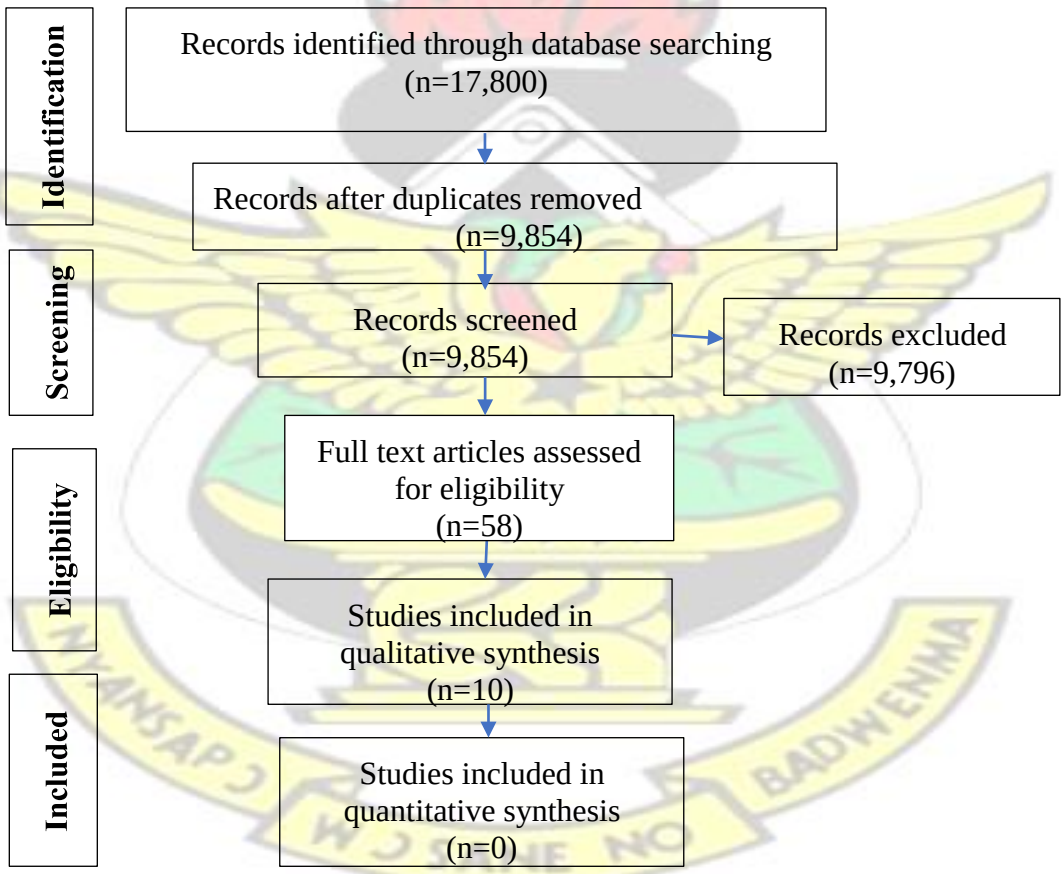


***Figure 2.3: Study selection process for systematic review***

Adopted from the study selection process for systematic review (Moher *et al*., 2009).

### 2.8.5 Quality Assessment

Quality rating of the Academy of Nutrition and Dietetics was used to assess the quality of the publications enrolled in this study. Studies that did not adequately address six or more validity questions were assigned a negative quality rating (Academy of Nutrition and Dietetics, 2016). All the ten studies were positively rated for relevance using the Quality Criteria Checklist and their quality assessments (Academy of Nutrition and Dietetics, 2016).

### 2.8.6 Data Analysis and Synthesis

Studies were grouped according to their concept or intervention tested, analyzed and described narratively. Meta-analysis was not used due to the heterogeneity of the studies outcomes measured and interventions tested.

### 2.8.7 Results

The studies reported varied views on the influence of nutrition support programmes on the health and nutritional status of PLWHA. Some studies reported that nutrition support programmes improves on ART adherence for the beneficiaries (Martinez *et al*., 2014), influenced weight gain, improved on the health status of its beneficiaries (Audain *et al*., 2015; Botros *et al*., 2013; Koethe *et al*., 2018; Mensah *et al*., 2015) and improved on beneficiaries quality of life (Tesfaye *et al*., 2016). On the contrary,

Sackey *et al*. (2017) and Tang *et al*. (2016) respectively reported that the Nutrition Assessment Counselling and Support (NACS) programme was not associated significantly with nutritional status (BMI) and had uncertain impact (on CD4+ cell counts, morbidity, ART adherence, quality of life and HIV viral load). A review of 14 randomized trials (involving 1725-adults and 271-children) found limited evidence that macronutrient formulas increase protein and energy intake of PLWHA and that there was no evidence that such supplementation translates into reductions in disease

progression or HIV-related complications (Grobler *et al*., 2013). Rehman *et al.* (2018) reported that potassium and phosphate provided in a supplementation programme though showed improved on health status, but the provision of excess and low amounts were associated with increased mortality of PLWHA.

### 2.8.8 Discussion

The studies reported varied views on the influence of nutrition support programmes on the health and nutritional status of PLWHA. Some studies showed that nutrition support programmes contribute to weight (Audain *et al*., 2015), ART drug adherence (Martinez *et al*., 2014), and improvement in the quality of life of PLWHA (Tesfaye *et al*., 2016) whiles other studies did not find evidence of improvement in nutritional and health status (Grobler *et al*., 2013; Sackey *et al*., 2017; Tang *et al*., 2016). The lack of evidence of improvement of nutritional and health status suggests that nutrition support programmes should strengthen the monitoring of these programme since limited evidence suggests that intakes may increase with supplementation (Grobler *et al*., 2013).

Sackey *et al.* (2017) and Tesfaye *et al.* (2016) suggested that well implemented and timely nutrition support programmes could influence the nutritional and health status of PLWHA. Also, studies from Audain *et al*. (2015) and Mensah *et al*. (2015) suggest that education components of nutrition support programmes/food assistance programmes are very crucial for the success of nutrition support programmes. Although there is not enough evidence to suggest that nutrition support programmes improve significantly on the nutritional and health status of PLWHA, there is also limited evidence to show that nutrition support programmes do not a significant improvement on the health and nutrition of its beneficiaries. It is therefore recommended that further studies employed not only quantitative methods, but qualitative methodologies such as Mensah *et al.* (2015) to help unearth strategies that would improve nutrition support programmes.

### 2.8.9 Conclusion

Timely, well-implemented and active participation of PLWHA in all phases of the nutrition support programme improves on nutritional and health status and reduces unfavourable outcomes of morbidity, mortality, and non-adherence to antiretroviral therapy (Rajabiun, 2001).



**Table 2.1: Extracted data on studies done on nutrition support programmes for PLWHA**

| Authors | Place of study | The aim of the studies | Study design Sample Size/ characteristics | Method | Summary of findings /conclusion |
|---|---|---|---|---|---|
| (Martinez *et al*., 2014) | Honduras | To examine the effect of providing household food assistance and Nutrition education on ART adherence. | Prospective Clinical trial. 400 study subjects. (203 received the food basket plus nutrition education and 197 received only nutrition education). | 12-month prospective a clinical trial compared the effect of a monthly household food basket plus nutrition education Versus nutrition education alone on ART adherence. | On-time prescription refills significantly improved for the household food basket plus nutrition education than the group receiving nutrition education alone after 6 months, with no further change at 12 months. Also, there was no change in selfreported missed ART doses and missed appointments and the intervention group did not differ significantly. |
| (Audain *et al*., 2015) | Sub-Saharan Africa | To review studies that examine the effectiveness of food supplementation in undernourished HIV patients in Sub-Saharan Africa | The study was a review. 10 primary studies were identified and 7 met the eligibility criteria | Searched PUBMED database for a 10-year period (2004–2014) | Food-based interventions help with weight gain and improve ART adherence. |
| (Botros *et al*., 2013) | - | Review nutrition and exercise interventions for HIV-infected patients. | The study was a review. The study enrolled 22 studies on with nutrition and lifestyle and 10 studies in an exercise in HIVinfected children, adults, and pregnant women. | Searched PUBMED between January 2010 and May 2012 | Approach to nutrition and physical activity improves health outcomes and negates the adverse metabolic, psychological, and cardiovascular consequences of HIV and its treatments. |

| | | | | | |
|---|---|---|---|---|---|
| (Tang *et al*., 2016) | - | To review NACS interventions and its impact on mortality, morbidity, retention in care, quality of life, and/or prevention of ongoing HIV transmission | The study is a review<br>21 articles met inclusion criteria | Published between 2005-2014 | The overall quality of evidence for the impact of NACS on clinical outcomes is extremely weak. NACS has an uncertain impact on CD4+ cell counts, morbidity, ART adherence, quality of life and HIV viral load. |
| (Mensah *et al*., 2015) | Ghana | To assess the impact of food supplementation services for PLHIV in Ghana on weight gained and factors associated with weight gained. | The cross-sectional study design used. Mixed methods of study design (Quantitative and qualitative techniques).<br>200 PLWHA selected. | Structured questionnaires, simple random sampling, and purposefully sampling.<br>14 semi-structured interviews and<br>8 focus group discussions. | Beneficiaries had a significant gain in weight.<br>Qualitative interviews revealed that anti-retroviral drugs make beneficiaries feel hungry and the food helped to alleviate that effect. |
| (Sackey *et al*., 2017) | Ghana | To evaluate the implementation of the nutrition assessment, counselling, and support (NACS) programme and assess whether the level of implementation of NACS is associated with the BMI) of PLWHA. | A cross-sectional study conducted in six HIV clinics<br><br>152 adults on ART excluding pregnant or breastfeeding women | Used a NACS implementation scale ranging from 0 to 8.<br><br>Compared 3-NACS designated facilities to 3 non-NACS facilities. | A higher score on the NACS implementation scale was not significantly associated with nutritional status of overweight or obesity.<br>The study reported poor NACS implementation since there was no difference in mean implementation score between NACS-designated, and non-NACS facilities. |

| | | | | | |
|---|---|---|---|---|---|
| (Rehman *et al*., 2018) | Tanzania and Zambia | Assess the association of baseline and time-varying serum Potassium (K) and phosphate concentrations with mortality within the first 12 | Randomised controlled trial. Participants at Baseline (phosphate-1764 and K-1701) and at subsequent measurement | Enriched lipid-based nutritional supplements used. Involved randomization and masking and laboratory | Both increases and decreases in serum electrolytes were associated with increased mortality. K and phosphate should be provided in amounts. |
| | | weeks after starting ART. | (phosphate-9096 and K8773). | test of serum phosphate and K. | |
| (Grobler *et al*., 2013) | - | To evaluate the effectiveness of various macronutrient interventions, given orally, in reducing morbidity and mortality in adults and children living with HIV infection. | The study is a review involving 14 randomized trials (Adults- 1725 and children-271) | The database searched were CENTRAL (up to August 2011), MEDLINE (1966 - August 2011), EMBASE (1988 - August 2011), LILACS (up to February 2012), and Gateway (March 2006-February 2010). | Macronutrient supplementation did not result in increasing protein and energy intake, nor reduction in morbidity and mortality. |
| (Koethe *et al*., 2018) | - | To review the evidence supporting macronutrient supplementation for PLWHA in resource-adequate and resource-constrained settings, and to highlight areas for research in the future. | The study is a review<br><br>Ten studies were enrolled in the review. | The study reported on clinical trials in resourceconstrained settings and resource-adequate settings. | There was no evidence for increasing the proportion of macronutrients beyond the recommended.<br><br>Recommended further studies on pathophysiologic for increased mortality of PLWHA. |

| | | | | | |
|---|---|---|---|---|---|
| (Tesfaye *et al*., 2016) | Ethiopia | To determine the effects of lipid-based nutrient supplements (LNS) on the quality of life of PLWHA during the first 3 months of ART and to investigate the effects of timing of supplementation. | Randomised controlled involving 282 participants (Delay LNS -93 Early LNS-189) | Participants were given daily supplements of 200g of LNS either during the first 3 months or the subsequent months of ART. Total quality-oflife scores were measured as an outcome. | Early supplementation may have more beneficial effects on certain domains of quality of life (higher scores on the social and spiritual domains) than delayed supplementation. |

# CHAPTER THREE

## 3.0 METHOD

### 3.1 STUDY DESIGN

Cross-Sectional study design was used for the study. This study design was selected to enable the researcher to assess the prevalence of malnutrition, dietary intakes and health status of people living with HIV/AIDS.

### 3.2 STUDY AREA

Eastern Region was selected for the study due to the high prevalence of HIV/AIDS as shown in Figure 3.1. Eastern Region is one of the ten administrative regions in Ghana and has 26 districts. It is bordered to the north and west by Ashanti region, north by Brong-Ahafo region, East by the Lake Volta, to the south by Greater Accra and Central regions. Eastern Region is located in the southern part of Ghana and covers an area of 19,323 square kilometres and lies between longitude 0°30' East and 10° 30' West and between latitude 60° and 70° N. The main spoken languages are Akan and Ewe, and has about 4,086 communities (rural & urban). According to the results of the 2010 population and housing census, it is the third most populous region in Ghana and has a total population of 2,633,154 with male and female populations of 49.1% and 51.0% respectively (Ghana Statistical Service, 2010).

Four (4) hospitals in the Eastern Region of Ghana were selected for the study. These include the Koforidua Central Hospital, Saint Martin's Hospital, Kibi Government Hospital, and Holy Family Hospital located in the New Juabeng Municipal, Upper Manya Krobo District, East Akim Municipal and Kwahu West District respectively. These hospitals were selected because of their well-established ART clinics, the number of patients on ART. The total population of the four districts selected for the study was;

East Akim Municipal (167,896), Upper Manya Krobo (72,098), Kwahu West District (93,584), and New Juabeng Municipal (183,727) and their rural population were 40.4%, 87.2%, 48.8%, and 6.7% respectively (Ghana Statistical Service, 2010).

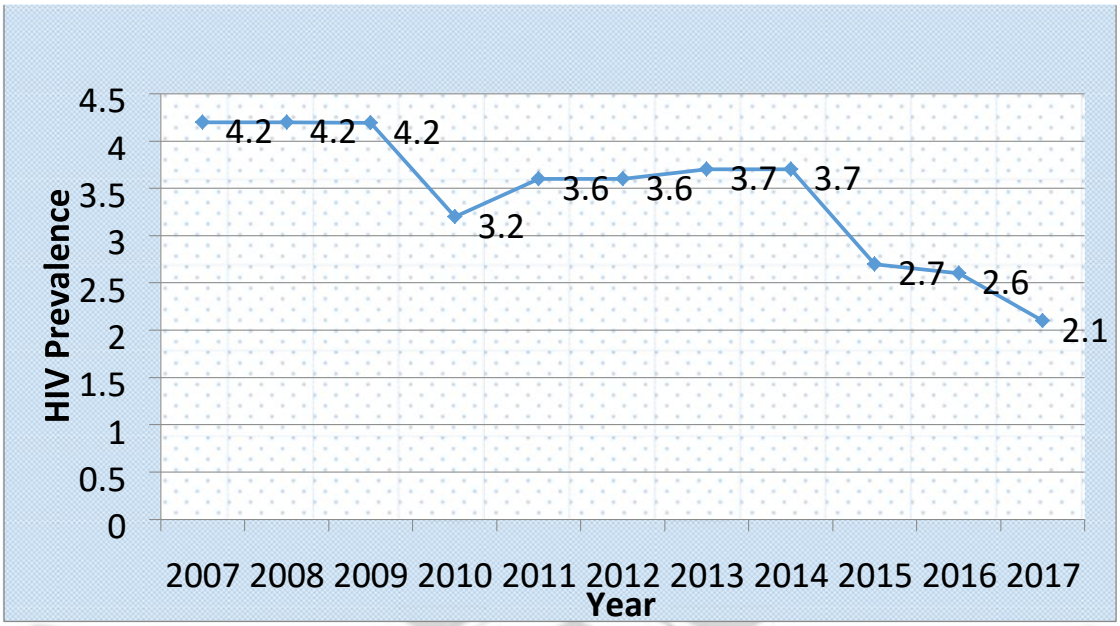


***Figure 3.1: Trend of the prevalence of HIV in the Eastern Region***

(GAC/NACP, 2017)

### 3.3 STUDY POPULATION

The study population was people living with HIV/AIDS (18-60 years) in four selected hospitals in the Eastern Region of Ghana. The four hospitals had well-established antiretroviral therapy (ART) clinics and are successfully attending to many patients on ART. Two hospitals were government hospitals (Kibi and Koforidua Hospitals) and the other two (Holy family and Saint Martin's hospitals) were Christian Health Association of Ghana (CHAG) Hospitals.

#### 3.3.1 Eligibility Criteria

##### 3.3.1.1 Inclusion Criteria

- PLWHA aged 18-60 years.
- PLWHA on ART were selected.

### 3.3.1.2 Exclusion Criteria

- PLWHA not compliant with scheduled follow-up visits to the health facility.
- HIV positive pregnant women.

## 3.4 SAMPLE SIZE AND SAMPLING METHOD

The sample size (n) was determined using the formulae below;

$$n = \{\frac{z^2_{\alpha/2}}{e^2}\ p(1-p)\}$$ (Israel, 2013)

Where e represents margin of error (e = 5%) , Z score ( $Z_{\alpha/2}$ = 1.96) and p represents population prevalence of malnutrition among people living with HIV/AIDS (p = 12.3%) (Hailemariam *et al*., 2013).

$$n = \{\frac{z^2_{\alpha/2}}{e^2}\ p(1-p)\} \quad \rightarrow n = \{\frac{1.96^2}{0.05^2}\ 0.123\ (1-0.123)\} = 165.76 = 166$$

For a 20% non-response rate of 34, the required sample size was increased to 200. The number of participants selected in each hospital is shown in Table 3.1.

**Table 3.1: Number of participants selected in each Hospital**

| Name of Hospital | Number | Percentage |
|---|---|---|
| Kibi Government Hospital | 50 | 25.00 |
| Holy Family Hospital | 50 | 25.00 |
| Saint Martins' Hospital | 50 | 25.00 |
| Koforidua Hospital | 50 | 25.00 |
| **Total** | **200** | **100.00** |

### 3.4.1 Sampling Method

Purposive sampling was used to select four (4) hospitals for the study. These hospitals were selected because of their well-established ART clinics, the number of patients on ART. A convenience sampling technique was used to select the participants who were in the health facility for their follow up visits. Those who met the criteria for selection,

and willing to participate were recruited into the study until the required 200 sample size was reached.

### 3.5 DATA COLLECTION TECHNIQUES/TOOLS

A structured-questionnaire was used to collect data on demography and socioeconomic status of all the study participants. To assess the nutritional and health status of people living with HIV/AIDS, anthropometric data, dietary intake, biochemical and clinical history were collected and compared with previous data (within 6 months prior to the research).

#### 3.5.1 Anthropometry

To determine the prevalence of malnutrition among the study participants, the height, weight, MUAC, waist and hip circumference, body fat, visceral fat, and muscle mass were measured and recorded.

##### 3.5.1.1 Height Measurement

The height was taken with a Tanita HR stadiometer to the nearest 0.1cm. Standard procedures for height measurement by the Center for Disease Control (CDC) was adopted. These procedures include ensuring that participants stand with back against the board, remove shoes, ensure that the shoulder blades, back of the head, buttocks, and heels in contact with the board, and aligned in Frankfort Horizontal Plane among others (CDC, 2007).

##### 3.5.1.2 Weight, muscle mass, visceral and total body fat

The weight, muscle mass, visceral fat, and total body fat was taken with a body composition monitor (BF511). The weight was taken to the nearest 0.1kg. Standard procedures for weight measurement by the Center for Disease Control (CDC) was adopted. These procedures include ensuring that the participant removed extra clothing

and jewellery, emptied his/her pocket, the head is up and weight distributed between both feet among others (CDC, 2007).

#### 3.5.1.3 Waist and hip circumference measurement

The waist circumference was measured at the level of the abdomen just above the hipbone (midpoint between the lower margin of the least palpable rib and the top of the iliac crest). However, the hip circumference was measured around the widest portion of the buttocks (level of the symphysis pubis and the place most protruding of the hip). A stretch_resistant measuring tape was used to take both hip and waist measurements. The measurement was taken with the participant made to stand with feet close together, body weight evenly distributed, arms at the side, removed extra clothing's. Each measurement was repeated twice ensuring that they are within 1 cm of one another and the average calculated (WHO, 2008).

#### 3.5.1.4 MUAC Measurement

Mid-Upper Arm Circumference (MUAC) was measured using a flexible tape, nonstretchable plastic MUAC tape on a straight left arm (in right-handed people), midway between the tip of the shoulder (acromion process of scapula) and the tip of the elbow (olecranon process of the ulna).

### 3.5.2 Biochemical Assessment

The blood sample was collected by a well-trained, licensed and practising Medical Laboratory Scientist. Approximately, 5 mL of venous blood was obtained from the study participants to assess the full blood count and viral load.

#### 3.5.2.1. Full blood count determination

The full blood count was determined using the autoanalyzer Micro E60s haematology Analyzer. The parameters measured included: White Blood Cell (WBC),

Haemoglobin (Hb), Red Blood Cell (RBC), Haematocrit (Hct), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC), Mean Corpuscular Volume (MCV), Mean Platelet Volume (MPV), Platelets Distribution Width (PDW), Random Distribution Width (RDW), Platelets (PLT) and Plateletcrit (PCT).



**PROCEDURE:** A Stuart scientific blood tube rotator was used to uniformly mix the blood contained in a 3 mL EDTA for 3 minutes. All the sample number were coded on the analyzer and the result of the analyzed sample was printed out by the Micro E60s.

### 3.5.2.2 Viral load determination

The HIV viral load test was performed using the COBAS TaqMan 48 Analyzer. The specimen was collected in venipuncture in a sterile EDTA tube and each specimen labelled with a unique identifier and kept between 2°C and 25°C before testing (ICAP, 2016).

**PROCEDURE**: The test is based on three major processes using procedure outlined by the manufacturer of the COBAS AmpliPrep Instrument (Roche, France): (1) specimen preparation to isolate HIV-1 RNA; (2) reverse transcription of the target RNA to generate complementary DNA (cDNA), and (3) simultaneous PCR

amplification of target cDNA and detection of cleaved dual-labeled oligonucleotide probe specific to the target (Wang, 2010).

### 3.5.3 Dietary intake assessment

A repeated 24-hour dietary recall (one weekend and two weekdays) and a food frequency questionnaire were interviewers administered to estimate the dietary intakes of the people living with HIV/AIDS. The repeated 24-dietary recall and food

frequencies questionnaire enabled respondents provided detailed information on their dietary intakes. Respondents were asked to provide a detailed description of food consumed over the previous 24 hours (including method of preparation, time, source and portion size of foods and drinks). Food frequency questionnaire was used to assess respondents' frequencies of intake of food within the past 12 months. Respondents were asked to indicate whether a particular food item was taken daily, weekly (1-3times), monthly, occasionally and never. Food models and household handy measures such as stew and soup ladles, teaspoon, dessertspoon, tablespoon, matchbox, cups, sardine tins, oranges among others were used to estimate the portion

sizes.

### 3.6 DATA PROCESSING AND ANALYSIS

The data were analyzed with Stata software version 15. The final data set was evaluated to check the accuracy and normality of data before analysis. Checks of normality of continuous data were performed by comparing a histogram of the sample data with the normal probability curve. Reliability check was conducted on all analyses performed. The independent variables (e.g. age ) and the dependent variable (nutritional status (e.g. BMI) and health status (e.g. viral load and full blood count) were all collected as continuous variables and were later transformed into categorical variables. BMI was categorized into underweight (<18.5kg/$m^2$), normal (18.524.9kg/$m^2$), overweight (25-29.9kg/$m^2$), and obese (≥30kg/$m^2$). Other nutritional status indicators such as mid-upper arm circumference, waist-hip ratio, muscle mass and, visceral fat were categorized before analysis. An independent sample t-test was used to analyze the continuous data while categorical data were analyzed with Pearson's Chi-square test and Fischer's test where appropriate with $p<0.05$

considered as significant in all the statistical test.

The West African Food Composition Table was used to determine the nutrient intakes of the respondents (Stadlmayr *et al*., 2012). Nutrient intakes of respondents were categories into inadequate (RDA/AI <70%), adequate (RDA/AI ≥70%) and excess (RDA/AI > 100%) intakes respectively. Pearson correlation test was used to determine the relationship between nutrient intakes and biochemical/haematological parameters. Pearson correlation test was also used to determine the relationship between anthropometric measures and biochemical/haematological parameters. Dependent sample t-test was used to compare previous (within 6months prior to the study) and the current means of weight, Hb, viral loads, and other haematological parameters. The data were presented as frequencies, percentages, means and standard deviation in tables and figures.

### 3.7 ETHICAL APPROVAL

Ethical clearance for the study was sought from the Committee of Human Research, Publication, and Ethics, School of Medical Sciences, KNUST (CHRPE/AP/506/18). In addition, the approval of the study was obtained from the Eastern Regional Health Directorate, District Health Directorates and Hospitals (ERHD/1931/18). Verbal informed consent was sought and participants were recruited based on their willingness to participate. The participants were at liberty to withdraw entirely or opt out mid-way without consequences. All information collected in this study was given code numbers and names were not used. All patients benefited from nutrition education and the results of the study were communicated to them.

# CHAPTER FOUR

## 4.0 RESULTS

### 4.1 GENERAL CHARACTERISTICS OF RESPONDENTS

The study sought to assess the nutritional and health status of people living with HIV/AIDS (PLWHA). Two hundred (200) people living with HIV/AIDS were selected in four hospitals in the Eastern Region of Ghana.

As shown in Table 4.1, most of the respondents were females (88.0%). Most respondents were in the age groups (40-49) years (38.5%) and 50+ years (35%). Majority of the respondents were Christians (94.5%) and the rest were Muslims (4.5%). About 37% of the respondents were married whiles 25% were widow/widowers. Most of the respondents (75%) had monogamous families and 73% of respondents were from rural areas. About 55.5% of the respondents completed JHS/Middle school whiles 54.5% of the respondents were traders.

In Table 4.2, most of the respondents (84.5%) earn less than GH¢500.00 income per month. About 63.5% of the respondents had a household size of (1-4) people whiles about 51% of the respondents had a man as head of the family. About 43.5% and 36% of the respondents were on ART medication for (24-59) months and (60-200) months/ (5years and above) respectively. Majority of the respondents (74%) were counselled on nutrition and about 72% and 6.5% respectively of people living with HIV/AIDS drink from the bore-hole/pipe and stream.

**Table 4.1 General characteristics of respondents**

| Variable | Number | Percentage |
|---|---|---|

| | | |
|---|---|---|
| **Sex** Male | | |
| | 24 | 12.00 |
| Female | 176 | 88.00 |
| **Age (years)** <30 | | |
| | 16 | 8.00 |
| 30-39 | 37 | 18.50 |
| 40-49 | 77 | 38.50 |
| 50+ | 70 | 35.00 |
| **Religion** Christian | | |
| | 189 | 94.50 |
| Traditionalist | 0 | 0.00 |
| Muslim | 9 | 4.50 |
| Others | 2 | 1.0 |
| **Marital Status** | | |
| Single | 38 | 19.00 |
| Divorced | 28 | 14.00 |
| Married | 74 | 37.00 |
| Widow/Widower | 51 | 25.50 |
| Cohabiting | 9 | 4.50 |
| Others | 0 | 0.00 |
| **Family setting** | | |
| Monogamous | 150 | 75.00 |
| Polygamous | 10 | 5.00 |
| **Place of residence** Urban | | |
| | 54 | 27.00 |
| Rural | 146 | 73.00 |
| **Ethnicity** Akan | | |
| | 92 | 46.00 |
| Krobo | 77 | 38.50 |
| Ewe | 19 | 9.00 |
| Others | 13 | 6.50 |
| **Educational status** | | |
| Primary | 35 | 17.50 |
| JHS/Middle School | 111 | 55.50 |
| SHS/Technical/Vocational | 11 | 5.50 |
| Tertiary | 4 | 2.00 |
| Non-formal education | 17 | 8.50 |
| Not educated | 22 | 11.00 |
| **Occupational status** | | |
| Trader | 109 | 54.50 |
| Farmer | 40 | 20.00 |
| Civil Service | 7 | 3.50 |
| Unemployed | 24 | 12.00 |

| | | |
|---|---|---|
| Others | 20 | 10.00 |

JHS-Junior High School, SHS-Senior High School **Table 4.2: General characteristics of respondents**

| **Variable** | **Number** | **Percentage** |
|---|---|---|
| **Average monthly income** | | |
| <GH¢500 | 169 | 84.50 |
| GH¢500-1000 | 25 | 12.50 |
| GH¢1000-1500 | 4 | 2.00 |
| GH¢1500-2000 | 1 | 0.50 |
| >GH¢2000 | 1 | 0.50 |
| **Head of household** Man | 102 | 51.00 |
| Woman | 98 | 49.00 |
| **Household size** 1-4 | 127 | 63.50 |
| 5-9 | 68 | 34.00 |
| 10-14 | 4 | 2.00 |
| 15-20 | 1 | 0.50 |
| **Duration on antiretroviral drugs (months)** | | |
| 6-11 | 1 | 0.50 |
| 12-23 | 40 | 20.00 |
| 24-59 | 87 | 43.00 |
| 60-200 | 72 | 36.00 |
| **Counselled on nutrition** Yes | 148 | 74.00 |
| No | 52 | 26.00 |
| **Sources of drinking water** Pipe-borne water/bore-hole | 144 | 72.00 |
| Well | 13 | 6.50 |
| River/Stream | 13 | 6.50 |
| Sachet/Bottle water | 80 | 40.00 |
| Others sources | 2 | 1.00 |

GH¢= Ghana cedis

In table 4.3, the mean age for people living with HIV/AIDS was 45.48±10.32years. The mean weight for males was 56.33±2.05kg whiles the mean weight for females 60.28±12.91kg. The mean waist-hip ratio for males was 0.88±0.04 whiles the mean

waist-hip ration for females was 0.90±0.13. The mean mid-upper arm circumference, visceral fat, and muscle mass respectively were 27.61±4.25cm, 29.17±5.64%, and 5.69±2.64%.

**Table 4.3: General characteristics of respondents**

| Variable | Male | Female | Total |
|---|---|---|---|
| Age (years) | 45.71+13.00 | 45.45+9.94 | 45.48±10.32 |
| Weight (kg) | 56.33±2.05 | 60.28±12.91 | 59.81±12.64 |
| Height (cm) | 167.71±10.30 | 159.09±6.19 | 160.13±7.33 |
| Mid-upper Arm Circumference (cm) | 25.50±3.33 | 27.90±4.29 | 27.61±4.25 |
| Waist circumference (cm) | 78.33±6.41 | 84.92±10.58 | 84.13±10.38 |
| Hip Circumference (cm) | 88.88±6.24 | 94.77±10.49 | 94.06±10.25 |
| Body Mass index (kg/m²) | 19.94±4.60 | 23.77±4.61 | 23.31±4.60 |
| Waist-Hip ratio | 0.88±0.04 | 0.90±0.13 | 0.90±0.13 |
| Muscle mass (%) | 38.90±7.11 | 28.01±4.13 | 29.17±5.64 |
| Visceral fat (%) | 3.86±2.31 | 5.91±2.60 | 5.69±2.64 |
| Total body fat (%) | 15.30±9.74 | 32.32±10.01 | 30.50±11.27 |
| Resting Metabolic Rate | 1408.91±126.36 | 1305.98±146.73 | 1317.0±147.87 |

## 4.2 NUTRITIONAL STATUS OF PEOPLE LIVING WITH HIV/AIDS

Table 4.4 shows the nutritional status of people living with HIV/AIDS. The prevalence of undernutrition among PLWHA (using BMI) was 17% (male= 29.2% and female=15.3%). The prevalence of overweight/obesity using BMI was 37% (male=4.2% and female=41.5%). About 10% of respondents were underweight using MUAC as indicator nutritional status (male= 16.7% and female=9.1%). The study found 11.7% of people living with HIV/AIDS with low visceral fat (0-2%) whiles 1.5% of them had high visceral fat (≥12%).

**Table 4.4: Nutritional status of people living with HIV/AIDS**

| Variable | Male (n=24) n (%) | Female (n=176) n (%) | Total (n=200) n (%) |
|---|---|---|---|
| **BMI (kg/m²)** underweight (<18.5) | 7(29.17) | 27(15.34) | 34(17.00) |
| Normal (18.5-24.9) | 16(66.67) | 76(43.18) | 92(46.00) |
| Overweight (25-29.9) | 1(4.17) | 61(34.66) | 62(31.00) |
| Obese (≥30) | 0(0.00) | 12(6.82) | 12(6.00) |
| **Visceral fat (%)** Low (0-2) | 5(23.81) | 18(10.29) | 23(11.73) |
| Normal (3-11) | 16(76.19) | 154(88.00) | 170(86.73) |
| High (≥12) | 0(0.00) | 3(1.71) | 3(1.53) |
| **MUAC (cm)** | | | |
| SAM (<21) | 1(4.17) | 6(3.41) | 7(3.50) |
| MAM (≥21 to <23) | 3(12.50) | 10(5.68) | 13(6.50) |
| Normal (≥23) | 20(83.33) | 160(90.91) | 180(90.00) |
| **Muscle mass (%)** | | | |
| Low | 3(14.29) | 27(15.43) | 30(15.00) |
| Normal | 4(19.05) | 105(60.00) | 109(54.50) |
| High | 10(47.62) | 33(18.86) | 43(21.50) |
| Very high | 4(19.05) | 10(5.71) | 14(7.00) |
| **Total body fat (%)** Under fat | 8(38.10) | 43(24.57) | 51(25.50) |
| Healthy | 9(42.86) | 50(28.57) | 59(29.50) |
| Over fat | 1(4.76) | 40(22.86) | 41(20.50) |
| Obese | 3(14.29) | 42(24.00) | 45(22.50) |
| **Waist-Hip Ratio** Normal | 17(70.83) | 2(1.14) | 19(9.50) |
| Overweight | 7(29.17) | 22(12.50) | 29(14.50) |
| Obese | 0(0.00) | 152(86.36) | 152(76.00) |

Total body fat (Male) (%): Under fat (<10), Healthy (10-24.9), Overfat (25-24.9), and Obese (≥30)
Total body fat (Female) (%): Under fat (0-24.9), Healthy (25-34.9), Overfat (35-39.9), and Obese (≥40)
Muscle mass (Male) (%): Low (<33.2), Normal (33.2-39.2), High (39.3-43.9), and Very high (≥44.0)
Muscle mass (Female) (%): Low (<24.2), Normal (24.2-30.3), High (30.4-35.3), and Very high (≥35.4)
Waist-Hip Ratio (Males): Normal (<0.90), Overweight (0.90-0.99), and Obese (≥1)
Waist-Hip Ratio (Females): Normal (<0.80), Overweight (0.80-0.84), and Obese (≥0.85)

### 4.3 DIETARY INTAKES OF PEOPLE LIVING WITH HIV/AIDS

#### 4.3.1 Characteristics of nutrient intake of people living with HIV/AIDS

Table 4.5 shows the characteristics of the nutrient intake of people living with HIV/AIDS. The nutrient intakes analysis did not include nutrient supplements. The average of three days (one weekend and two weekdays) 24-hour dietary recall was used. The mean energy (1966.2kcal), calcium (370.3mg/day), and iron (13.1mg/day) were below the Recommended Dietary Allowance (RDA) of 2580kcal, 1300mg/day, and 18mg/day respectively. The mean percentages of carbohydrate (60.2%), protein (12.4%) and fat (27.5%) were within the adequate macronutrient distribution range of 45-65%, 10-35%, and 20-35% respectively. The minimum vitamin A was 14.5 mcg of Retinol Activity Equivalent (RAE) per day whiles the maximum vitamin A was 2724.7 mcg of RAE/day. The minimum intake of protein, fibre, folate, and zinc of respondents was 11.6g/day, 4.5g/day, 44.1mcg/day and 1.18mg/day respectively. The maximum intake of fat, sodium, potassium, and phosphorus was 333.3g/day, 8506.7mg/day, 8902.7mg/day, and 2711.3mg/day respectively.

**Table 4.5 Characteristics of nutrients intake of people living with HIV/AIDS.**

| Variable | AMDR/RDA/AI | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| Energy (kcal) | **2580** | 1966.16 | 832.78 | 593.49 | 6667.57 |
| Carbohydrate % energy contribution | *45-65* | 60.16 | 9.16 | 35.71 | 83.38 |
| Protein % energy contribution | *10-35* | 12.38 | 3.02 | 3.69 | 23.82 |
| Fat % energy contribution | *20-35* | 27.46 | 9.66 | 6.87 | 56.46 |
| Protein (g/d) | **56** | 60.79 | 25.89 | 11.62 | 159.57 |
| Fat (g/d) | **77** | 64.69 | 24.76 | 6.29 | 333.28 |
| Carbohydrate (g/d) | **130** | 295.42 | 113.15 | 66.22 | 807.65 |
| Fibre (g/d) | 38* | 26.36 | 10.24 | 4.48 | 64.07 |
| Folate (mcg/d) | **400** | 398.77 | 358.79 | 44.12 | 2922.59 |
| Vitamin A (mcg of RAE/d) | **900** | 268.22 | 353.61 | 14.51 | 2724.68 |
| Thiamine (Vitamin $B_{1)}$ (mg/d) | **1.2** | 1.38 | 1.10 | 0.23 | 8.79 |
| Riboflavin (vitamin $B_{2)}$ (mg/d) | **1.3** | 1.17 | 1.10 | 0.20 | 8.66 |
| Niacin (vitamin $B_{3)}$ (mg/d) | **16** | 22.18 | 18.56 | 3.49 | 150.17 |
| Pantothenic acid (vitamin $B_{5)}$ (mg/d) | 5* | 4.21 | 1.63 | 0.97 | 9.27 |

| | | | | | |
|---|---|---|---|---|---|
| Vitamin $B_6$ (mg/d) | **1.7** | 2.13 | 1.33 | 0.44 | 11.27 |
| Vitamin $B_{12}$ (mcg/d) | **2.4** | 4.64 | 5.20 | 0 | 34.69 |
| Vitamin C (mg/d) | **90** | 127.41 | 102.73 | 7.40 | 777.07 |
| Vitamin E (mg/d) | **15** | 8.07 | 7.09 | 1.29 | 53.00 |
| Zinc (mg/d) | **11** | 7.99 | 5.42 | 1.18 | 44.26 |
| Sodium (mg/d) | 1500* | 3169.32 | 1313.62 | 625.98 | 8506.71 |
| Potassium (mg/d) | 4700* | 3057.64 | 1358.94 | 320.86 | 8902.68 |
| Phosphorus (mg/d) | **1250** | 1051.60 | 422.16 | 239.02 | 2711.28 |
| Calcium (mg/d) | **1300** | 370.27 | 246.69 | 59.75 | 1123.81 |
| Magnesium (mg/d) | **420** | 360.70 | 155.14 | 77.7 | 1163.12 |
| Iron (mg/d) | **18** | 13.14 | 7.57 | 2.25 | 49.15 |
| Selenium (mg/d) | 55* | 86.81 | 42.43 | 6.3 | 244.00 |
| Manganese (mg/d) | 2.3* | 3.88 | 1.92 | 0.74 | 11.98 |
| Copper (mcg/d) | **900** | 1410 | 571.74 | 499.74 | 3791.30 |

Nutrient intakes analysis did not include nutrient supplements and an average of three 24-hour diet recall was used. Recommended Dietary Allowance-RDA is represented in bold print, Adequate (AI) with an asterisk and AMDR in italics, RAE-Retinol Activity Equivalent.

### 4.3.2 Comparison of macronutrient intake of PLWHA with AMDR.

In Table 4.6 the macronutrients intake of people living with HIV//AIDS were compared with the acceptable macronutrient distribution range (AMDR). Most respondents had dietary intakes within the AMDR of carbohydrate (63%), protein (78%), and fat (55%). About 31.5% and 21.5% of respondents had their dietary intakes of carbohydrate and fat above the AMDR respectively whiles 22% of respondents had protein intakes below the AMDR.

**Table 4.6: Comparison of macronutrient intakes of PLWHA with AMDR**

| Macronutrient | Number | Percentage |
|---|---|---|
| **Carbohydrate (%)** | | |
| Below AMDR (<45) | 11 | 5.50 |
| Within AMDR (45-65) | 126 | 63.00 |
| Above AMDR (65+) | 63 | 31.50 |
| **Protein (%)** | | |
| Below AMDR (<10) | 44 | 22.00 |
| Within AMDR (10-35) | 156 | 78.00 |
| Above AMDR (35+) | 0 | 0.00 |
| **Fat (%)** | | |
| Below AMDR (<20) | 46 | 23.00 |
| Within AMDR (20-35) | 111 | 55.50 |

| | | |
|---|---|---|
| Above AMDR (35+) | 43 | 21.50 |

AMDR- Acceptable Macronutrient Distribution Range

### 4.3.3 Comparison of nutrient intake of people living with HIV/AIDS with RDA/AI

Table 4.7 shows nutrient intakes of people living with HIV/AIDS compared with Recommended Daily Allowance (RDA) or Adequate Intakes (AI). The nutrient intakes were interpreted as inadequate (%RDA/AI <70%), adequate (%RDA/AI ≥70%), and excess (%RDA/AI > 100%) with their corresponding percentage in brackets. Most respondents had inadequate intakes of energy (48%) and fibre (56%) whiles about 96% and 26% of people living with HIV/AIDS had excess consumption of carbohydrate and fat respectively. It was observed that most respondents had inadequate intakes of vitamin A (94%), riboflavin (50%), vitamin E (77.5%) and folate (40.5%). Most respondents had inadequate intakes of zinc (54%), iron (55%), and calcium (95%) whiles most respondents had excess intakes of sodium (93%), copper (83.5%), manganese (76%), and selenium (77%).

**Table 4.7: Comparison of nutrients intake of PLWHA with RDA/AI**

| Dietary Intake | Inadequate | Adequate | Excess |
|---|---|---|---|
| Energy(kcal) | 96(48.00) | 75(37.50) | 29(14.50) |
| Protein (g/d) | 35(17.50) | 64(32.00) | 101(50.50) |
| Fat (g/d) | 97(48.50) | 51(25.50) | 52(26.00) |
| Carbohydrate (g/d) | 1(0.50) | 7(3.50) | 192(96.00) |
| Fibre (g/d) | 112(56.00) | 66(33.00) | 22(11.00) |
| Vitamin A (µg/d) | 188(94.00) | 3(1.50) | 9(4.50) |
| Thiamine (Vitamin $B_1$) (mg/d) | 56(28.00) | 47(23.50) | 97(48.50) |
| Riboflavin (vitamin $B_2$) (mg/d) | 100(50.00) | 49(24.50) | 51(25.50) |
| Niacin (vitamin B3) (mg/d) | 39(19.50) | 43(21.50) | 118(59.00) |
| Pantothenic acid (vitamin B5) (mg/d) | 72(36.00) | 70(35.00) | 58(29.00) |

| | | | |
|---|---|---|---|
| Vitamin B6 (µg/d) | 21(10.50) | 64(32.00) | 115(57.50) |
| Vitamin B12 (mcg/d) | 50(25.00) | 31(15.50) | 119(59.50) |
| Vitamin C (mg/d | 31(15.50) | 45(22.50) | 124(62.00) |
| Vitamin E (mg/d) | 155(77.50) | 26(13.00) | 19(9.50) |
| Folate (µg/d) | 81(40.50) | 56(28.00) | 63(31.50) |
| Zinc (mg/d) | 108(54.00) | 64(32.00) | 28(14.00) |
| Sodium (mg/d) | 9(4.50) | 5(2.50) | 186(93.00) |
| Potassium (mg/d) | 129(64.50) | 46(23.00) | 25(12.50) |
| Magnesium (mg/d | 77(38.50) | 65(32.50) | 58(29.00) |
| Copper (µg/d) | 9(4.50) | 24(12.00) | 167(83.50) |
| Iron (mg/d) | 110(55.00) | 61(30.50) | 29(14.50) |
| Selenium (mg/d) | 25(12.50) | 21(10.50) | 154(77.00) |
| Calcium (mg/d) | 190(95.00) | 10(5.00) | 0(0.00) |
| Phosphorus (mg/d) | 0(0.00) | 141(70.50) | 59(29.50) |
| Manganese(mg/d) | 15(7.50) | 33(16.50) | 152(76.00) |

Results were compared to Recommended Dietary Allowance/Adequate Intake (American dietary guidelines) and interpreted as inadequate (%RDA/AI <70%), adequate (%RDA/AI ≥70%) and excess (%RDA/AI > 100%) with their corresponding percentage in brackets. Nutrient intakes analysis did not include nutrient supplements and an average of three 24-hour diet recall used.

### 4.3.4 Frequency of food intake of people living with HIV/AIDS

In Table 4.8, people living with HIV/AIDS daily intake of fruits, vegetables, legumes, and animal foods were 10.1%, 26.2%, 2.5%, and 7.3% respectively. About 57.6% of PLWHA consume cereal, grains, and starches at least weekly.

**Table 4.8: Frequency of food intake of people living with HIV/AIDS**

| | Distribution of Intakes (%) | | |
|---|---|---|---|
| **Food group** | **Male** | **Female** | **Total** |
| **Fruits** | | | |
| Daily | 10.83 | 10.00 | 10.10 |
| Weekly(1-3times) | 32.92 | 36.82 | 36.35 |
| Monthly | 24.58 | 22.90 | 23.1 |
| Occasionally | 23.75 | 24.72 | 24.6 |

| | | | |
|---|---|---|---|
| Never | 7.92 | 5.57 | 5.85 |
| **Vegetables** Daily | | | |
| | 25.42 | 26.25 | 26.15 |
| Weekly(1-3times) | 29.17 | 32.84 | 32.4 |
| Monthly | 23.33 | 18.75 | 19.3 |
| Occasionally | 18.75 | 17.67 | 17.8 |
| Never | 3.33 | 4.49 | 4.35 |
| **Legumes** | | | |
| Daily | 0.00 | 2.85 | 2.51 |
| Weekly(1-3times) | 26.60 | 24.79 | 25.00 |
| Monthly | 21.28 | 24.93 | 24.50 |
| Occasionally | 35.11 | 32.91 | 33.17 |
| Never | 17.02 | 14.53 | 14.82 |
| **Animal foods** Daily | | | |
| | 7.14 | 7.34 | 7.32 |
| Weekly(1-3times) | 18.07 | 16.69 | 16.85 |
| Monthly | 28.57 | 25.69 | 26.03 |
| Occasionally | 36.13 | 40.37 | 39.86 |
| Never | 10.08 | 9.92 | 9.94 |
| **Cereal, grains & starches** Daily | | | |
| | 15.00 | 14.28 | 14.36 |
| Weekly(1-3times) | 38.33 | 43.91 | 43.24 |
| Monthly | 28.33 | 22.24 | 22.97 |
| Occasionally | 15.83 | 16.21 | 16.17 |
| Never | 2.50 | 3..36 | 3.25 |

The frequency of food intake is in percentages

### 4.3.5 Association between nutrient intakes and haematological/biochemical parameters of PLWHA

Table 4.9 shows the relationship between nutrient intakes and biochemical/ haematological parameters. There was a positive association (r = 0.2589, p-values =0.0093) between Vitamin C and lymphocytes. The correlations between Vitamin C and lymphocytes was weak. There were negative correlation between sodium and PDW (r = -0.2074, p-value = 0.0384), potassium and PDW(r = -0.3101, p-value = 0.0017) and Vitamin E and PDW (r = -0.266, p-value =0.0075). Similarly, the negative

correlations of sodium, potassium and Vitamin E with platelet distribution width (PDW) of respondents were weak.



**Table 4.9: Pearson's correlation between nutrient intakes and biochemical/haematological parameters of PLWHA**

| Biochemical /haematological parameter | Calorie | Protein | Zinc | Iron | Phosphorus | Calcium | Sodium | Potassium | Vitamin A | Vitamin $B_{12}$ | Vitamin C | Vitamin E | Folate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Viral load** | 0.0144 | 0.0219 | 0.0633 | 0.0330 | 0.0506 | 0.0290 | 0.0256 | -0.0436 | -0.0387 | 0.0011 | 0.0373 | -0.0011 | 0.0100 |
| **Hb** | -0.0812 | -0.0729 | -0.1496 | -0.0149 | -0.0747 | -0.0544 | -0.0271 | 0.1398 | 0.0525 | -0.0853 | 0.0524 | 0.0727 | -0.0492 |
| **WBC** | -0.0939 | -0.1103 | -0.1458 | -0.1090 | -0.0768 | -0.1880 | 0.0003 | -0.0319 | -0.1123 | -0.0725 | -0.0379 | -0.0421 | -0.0459 |
| **RBC** | 0.0242 | -0.1107 | -0.1286 | -0.0015 | -0.0862 | 0.0589 | 0.0728 | 0.1146 | 0.0408 | -0.1604 | 0.1489 | 0.1277 | -0.0343 |
| **MCV** | -0.0864 | -0.0312 | -0.0378 | -0.0305 | -0.0028 | -0.1084 | -0.0939 | -0.0028 | -0.0155 | 0.1492 | -0.0895 | -0.0411 | -0.0766 |
| **MCH** | -0.0382 | 0.0482 | 0.0268 | 0.0277 | 0.0721 | -0.0597 | -0.1271 | 0.0491 | 0.0276 | 0.1031 | -0.0769 | -0.0535 | -0.0064 |
| **LYM** | 0.0053 | 0.0410 | -0.0385 | -0.0317 | -0.0215 | 0.0893 | -0.0288 | 0.0738 | 0.1334 | 0.1388 | 0.2589* | 0.1225 | -0.0808 |
| **PDW** | -0.1905 | -0.0083 | 0.0474 | -0.0527 | -0.0283 | -0.1093 | -0.2074* | -0.3101* | -0.1392 | 0.0762 | -0.1796 | -0.266* | -0.0881 |
| **PCT** | -0.0709 | 0.0115 | -0.1283 | -0.0787 | -0.0357 | -0.1000 | -0.0399 | -0.0977 | -0.1114 | 0.0051 | -0.0375 | -0.0239 | 0.0245 |

A strong significant correlation is represented by two stars (**), while a weak significant correlation is represented by one star (*).Hb: haemoglobin, WBC: White Blood Cell, RBC-Red Blood Cell, MCV: Mean Corpuscular Volume, LYM-lymphocyte, MCH: Mean Corpuscular Haemoglobin and PDW: Platelet distribution Width, PCT-Plateletcrit

## 4.4 HEALTH STATUS OF PEOPLE LIVING WITH HIV/AIDS

### 4.4.1 Characteristics of haematological/biochemical parameters of PLWHA

Table 4.10 shows the characteristics of haematological/biochemical parameters of PLWHA. The mean monocytes (14.0%) of respondents were above the normal range of 2-10% whiles the mean percentages of mean platelet volume (8.81%) was lower than the normal range of 9.5-12.3%. The minimum viral load was 0cp/mL whiles the maximum viral load was 1782019cp/mL. The minimum haemoglobin, red blood cells, mean corpuscular volume, mean corpuscular haemoglobin concentration and mean platelet volume of respondents were 5.8 g/dL, 2.1 x $10^{12}$/µL, 51fL, 24 g/dL, and 6.6% respectively. The maximum white blood cell, lymphocytes (%) granulocytes (%), and platelets of respondents were 23.6 x $10^{9}$/µL, 74.6%, 79.8%, and 562 x$10^{3}$/µL respectively. None of the respondents had Hb, RBC, PDW, MPV, Hct, and MCHC respectively greater than or equal to 16g/dl, 5.5 x $10^{12}$/µL, 25%, 12.3%, 54%, and 36g/dL.

**Table 4.10 Characteristics of haematological/biochemical parameters of PLWHA**

| Parameter | NORMAL RANGE | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| Viral load (cp/mL) | <50 | 41386 | 209368 | 0 | 1782019 |
| WBC (x$10^{9}$/µL) | 2.60-8.50 | 5.03 | 2.37 | 2.2 | 23.6 |
| LYM (%) | 20.0-40.0 | 37.65 | 12.52 | 15.2 | 74.6 |
| MON (%) | 2.00-10.00 | 14.04 | 3.94 | 3.80 | 25.50 |
| GRA (%) | 40.00-75.00 | 48.23 | 12.75 | 14.30 | 79.80 |
| LYM (x$10^{9}$/µL) | 1.00-3.00 | 1.73 | 0.82 | 0.50 | 4.30 |
| MON (x$10^{9}$/µL) | 0.20-1.00 | 0.62 | 0.48 | 0.20 | 4.40 |
| GRA (x$10^{9}$/µL) | 1.8-7.7 | 2.37 | 1.65 | 0.4 | 15.5 |
| RBC (x$10^{12}$/µL) | 4.50-5.50 | 3.80 | 0.58 | 2.07 | 5.06 |
| Hb (g/dL) | 11.0-16.0 | 11.29 | 1.59 | 5.8 | 15.2 |
| Hct (%) | 37.0-54.0 | 35.42 | 4.83 | 18.9 | 45.9 |
| MCV (fL) | 80.0-100.0 | 88.11 | 8.25 | 51.0 | 113.0 |
| MCH (pg/cell) | 27.0-34.0 | 29.34 | 3.74 | 12.4 | 38.6 |

| | | | | | |
|---|---|---|---|---|---|
| MCHC (g/dL) | 31.0-36.0 | 31.61 | 1.57 | 24.0 | 35.4 |
| RDW (%) | 11.0-16.0 | 14.43 | 1.71 | 10.8 | 21.5 |
| PLT ($x10^3/\mu L$) | 150-450 | 232.65 | 76.62 | 89 | 562 |
| MPV (%) | 9.5-12.3 | 8.81 | 0.93 | 6.6 | 11.2 |
| PCT (%) | 0.15-0.62 | 0.20 | 0.06 | 0.07 | 0.46 |
| PDW (%) | 8.3-25.0 | 15.07 | 2.64 | 6.3 | 24.0 |

WBC-White Blood Cell, Hb-Haemoglobin, RBC-Red Blood Cell, Hct-Haematocrit, MCH-Mean Corpuscular Haemoglobin, MCHC-Mean Corpuscular Haemoglobin Concentration, MCV-Mean Corpuscular Volume, MPV-Mean Platelet Volume, PDW-Platelets Distribution Width, RDW-Random Distribution Width, PLT-Platelets, and PCT-Plateletcrit, GRA-Granulocytes, LYM- lymphocytes, MON- Monocytes

### 4.4.2 Health status of people living with HIV/AIDS

In Table 4.11 and Table 4.12, the study showed that about 61.3% of people living with HIV/AIDS on ART with low viral load (<50cp/mL) whiles 20% of them had very high viral (≥1000cp/mL). The study also showed about 38% of respondents with low Hb (<11g/dL) whiles 0.0% of respondents had high Hb (≥16g/dL). Most of the respondents had low RBC (88%), Hct (66%), and MPV (69%) whiles 87% and 39% of them had high monocytes and lymphocytes respectively. Majority of the respondents had their white blood cells (97%), platelets (89%), and platelets distribution width (98%) respectively within the normal ranges of (2.60-8.49)%,

(150.0-449.9) x $10^3/\mu L$ and (8.30-24.9)%.

**Table 4.11: Health status of people living with HIV/AIDS**

| **Parameter** | **Male n (%)** | **Female n (%)** | **Total n (%)** |
|---|---|---|---|
| **Viral load (cp/mL)** | | | |
| Low (<50) | 5(55.56) | 44(61.97) | 49(61.25) |
| Normal (50-199.9) | 0(0.00) | 10(14.08) | 10(12.50) |
| High (200-999.9) | 0(0.00) | 5(7.04) | 5(6.25) |
| Very High (≥1,000) | 4(44.44) | 12(16.90) | 16(20.00) |
| **WBC ($x10^9/\mu L$)** | | | |
| Low (<2.60) | 0(0.00) | 1(1.14) | 1(1.00) |
| Normal (2.60-8.49) | 12(100.00) | 85(96.59) | 97(97.00) |
| High (≥8.50) | 0(0.00) | 2(2.27) | 2(2.00) |

| | | | |
|---|---|---|---|
| **LYM (%)** | | | |
| Low (<20.0) | 1(8.33) | 6(6.82) | 7(7.00) |
| Normal (20.0-39.9) | 6(50.00) | 48(54.55) | 54(54.00) |
| High (≥40.0) | 5(41.67) | 34(38.64) | 39(39.00) |
| **MON (%)** | | | |
| Low (<2.00) | 0(0.00) | 0(0.00) | 0(0.00) |
| Normal (2.00-9.99) | 2(16.67) | 11(12.50) | 13(13.00) |
| High (≥10.00) | 10(83.33) | 77(87.50) | 87(87.00) |
| **GRA (%)** | | | |
| Low (<40.00) | 5(41.67) | 20(22.73) | 25(25.00) |
| Normal (40.00-74.99) | 6(50.00) | 68(77.27) | 74(74.00) |
| High (≥75.00) | 1(8.33) | 0(0.00) | 1(1.00) |
| **LYM (x$10^9$/µL)** | | | |
| Low (<1.00) | 3(25.00) | 15(17.05) | 18(18.00 |
| Normal (1.00-2.99) | 7(58.33) | 67(76.14) | 74(74.00) |
| High (≥3.00) | 2(16.67) | 6(6.82) | 8(8.00) |
| **MON (x$10^9$/µL)** | | | |
| Low (<0.20) | 0(0.00) | 0(0.00) | 0(0.00) |
| Normal (0.20-0.99) | 10(83.33) | 80(90.91) | 90(90.00) |
| High (≥1.00) | 2(16.67) | 8(9.09) | 10(10.00) |
| **GRA (x$10^9$/µL)** | | | |
| Low (<1.80) | 4(33.33) | 29(32.95) | 33(33.00) |
| Normal (1.80-7.69) | 8(66.67) | 58(65.91) | 66(66.00) |
| High (≥7.70) | 0(0.00) | 1(1.14) | 1(1.00) |
| **RBC (x$10^{12}$/µL)** | | | |
| Low (<4.50) | 8(66.67) | 80(90.91) | 88(88.00) |
| Normal (4.50-5.49) | 4(33.33) | 8(9.09) | 12(12.00) |
| High (≥5.50) | 0(0.00) | 0(0.00) | 0(0.00) |
| **Hb (g/dL)** | | | |
| Low (<11.0) | 3(25.00) | 35(39.77) | 38(38.00) |
| Normal (11.0-15.9) | 9(75.00) | 53(60.23) | 62(62.00) |
| High (≥16.0) | 0(0.00) | 0(0.00) | 0(0.00) |

White Blood Cell (WBC), Haemoglobin (Hb), Red Blood Cell (RBC), lymphocytes (LYM), Monocytes (MON), Granulocytes (GRA)

**Table 4.12: Health status of people living with HIV/AIDS**

| **Parameter** | **Male n (%)** | **Female n (%)** | **Total n (%)** |
|---|---|---|---|
| **Hct (%)** | | | |
| Low (<37.0) | 4(33.33) | 62(70.45) | 66(66.00) |
| Normal (37.0-53.9) | 8(66.67) | 26(29.55) | 34(34.00) |
| High (≥54.0) | 0(0.00) | 0(0.00) | 0(0.00) |
| **MCV (fL)** | | | |
| Low (<80.0) | 0(0.00) | 8(9.09) | 8(8.00) |
| Normal (80-99.9) | 11(91.67) | 76(86.36) | 87(87.00) |
| High (≥100.0) | 1(8.33) | 4(4.55) | 5(5.00) |

| | | | |
|---|---|---|---|
| **MCH (pg/cell)** | | | |
| Low (<27.0) | 0(0.00) | 15(17.05) | 15(15.00) |
| Normal (27.0-33.9) | 11(91.67) | 68(77.27) | 79(79.00) |
| High (≥34.0) | 1(8.33) | 5(5.68) | 6(6.00) |
| **MCHC (g/dL)** | | | |
| Low (<31.0) | 1(8.33) | 30(34.09) | 31(31.00) |
| Normal (31-35.9) | 11(91.67) | 58(65.91) | 69(69.00) |
| High (≥36.0) | 0(0.00) | 0(0.00) | 0(0.00) |
| **RDW (%)** | | | |
| Low (<11.0) | 0(0.00) | 1(1.14) | 1(1.00) |
| Normal (11.0-15.9) | 10(83.33) | 71(80.68) | 81(81.00) |
| High (≥16.0) | 2(16.67) | 16(18.18) | 18(18.00) |
| **PLT ($x10^3/\mu L$)** | | | |
| Low (<150.0) | 1(8.33) | 8(9.09) | 9(9.00) |
| Normal (150.0-449.9) | 11(91.67) | 78(88.64) | 89(89.00) |
| High (≥450.0) | 0(0.00) | 2(2.27) | 2(2.00) |
| **MPV (%)** | | | |
| Low (<9.50) | 10(83.33) | 59(67.05) | 69(69.00) |
| Normal (9.50-12.29) | 2(16.67) | 29(32.95) | 31(31.00) |
| High (≥12.30) | 0(0.00) | 0(0.00) | 0(0.00) |
| **PCT (%)** | | | |
| Low (<0.50) | 1(8.33) | 17(19.32) | 18(18.00) |
| Normal (0.50-0.61) | 11(91.67) | 71(80.68) | 82(82.00) |
| High (≥0.62) | 0(0.00) | 0(0.00) | 0(0.00) |
| **PDW (%)** | | | |
| Low (8.30) | 0(0.00) | 2(2.27) | 2(2.00) |
| Normal (8.30-24.9) | 12(100.00) | 86(97.73) | 98(98.00) |
| High (≥25.00) | 0(0.00) | 0(0.00) | 0(0.00) |

Hct-Haematocrit, MCH-Mean Corpuscular Haemoglobin, MCHC-Mean Corpuscular Haemoglobin Concentration, MCV-Mean Corpuscular Volume, MPV-Mean Platelet Volume, PDW-Platelets Distribution Width, RDW-Random Distribution Width, PLTPlatelets, and PCT-Plateletcrit.

### 4.4.3 Comparison of previous and current nutritional and health status of PLWHA.

Table 4.13 compares the previous (within past 6months prior to the study) and current nutritional and health status of people living with HIV/AIDS. There was no significant difference between the current and previous means of weight, haemoglobin, lymphocytes, and viral load of respondents. Comparing the current and previous means, the weight of respondents decreased by 0.8% (0.50±4.41kg) whiles their haemoglobin

level increased by 4.6% (0.53±2.04g/dL). The lymphocyte, monocytes, and viral load of respondents respectively increased by 20.8%, 47.4%, and 82%. There was a significant difference between the current and previous mean of monocytes (p=0.0478). Their current mean monocytes (15.45±2.23)% was higher than the previous mean monocytes (8.13±6.26)% indicative of increase infection. Figure 4.1 and 4.2 show a box plot of current and previous Hb and weight of people living with HIV/AIDS.

**Table 4.13: Comparison of current and previous nutritional and health status**

| Variable | Previous (P) | Current (C) | Difference (C-P) | Percentage (C-P)/C*100 | p-value |
|---|---|---|---|---|---|
| Weight (kg) | 60.24±13.41 | 59.74±13.21 | -0.50±4.41 | 0.84 | 0.1924 |
| Haemoglobin (g/dL) | 10.94±2.07 | 11.47±1.48 | 0.53±2.04 | 4.62 | 0.2587 |
| Lymphocytes (%) | 31.20±28.18 | 39.41±17.60 | 8.21±43.33 | 20.83 | 0.5640 |
| Monocytes (%) | 8.13±6.26 | 15.45±2.23 | 7.32±6.88 | 47.38 | **0.0478** |
| Viral load (cp/mL) | 18442± 41766.41 | 102152.1± 397775.4 | 83710.05± 400920.6 | 81.95 | 0.3621 |

Current= value recorded or sample taken during the period of data collection/study, and previous = value recorded within past 6months of the data collection/study.

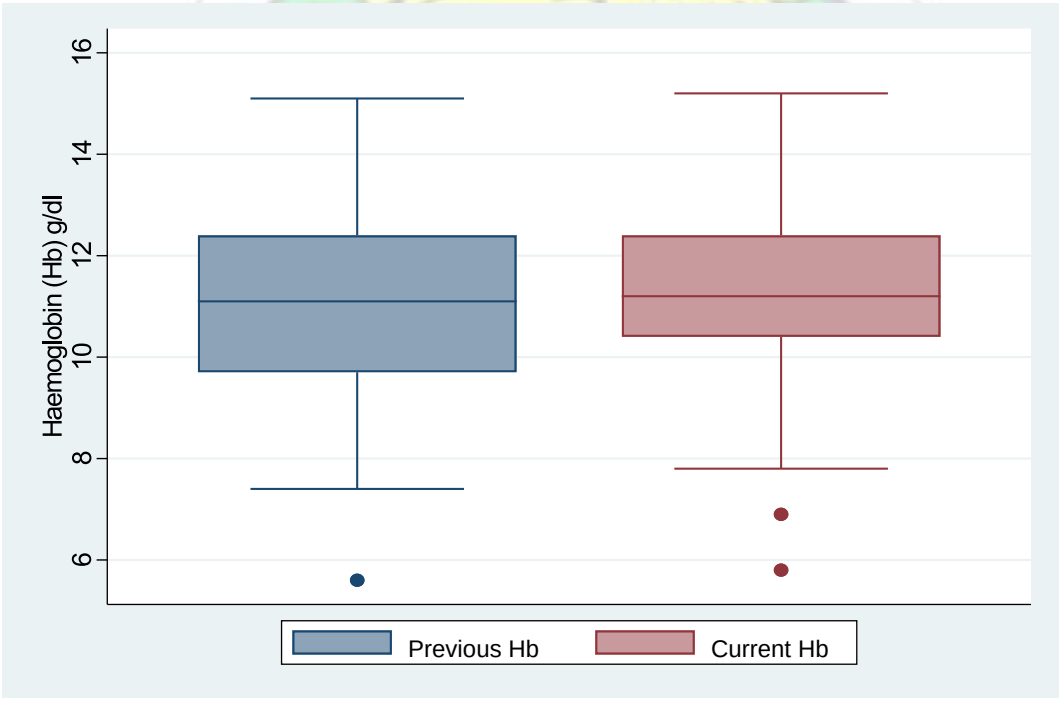

***Figure 4.1: Box plot showing the median and interquartile range of patients' Hb current and previous (within 6 prior to the study)***

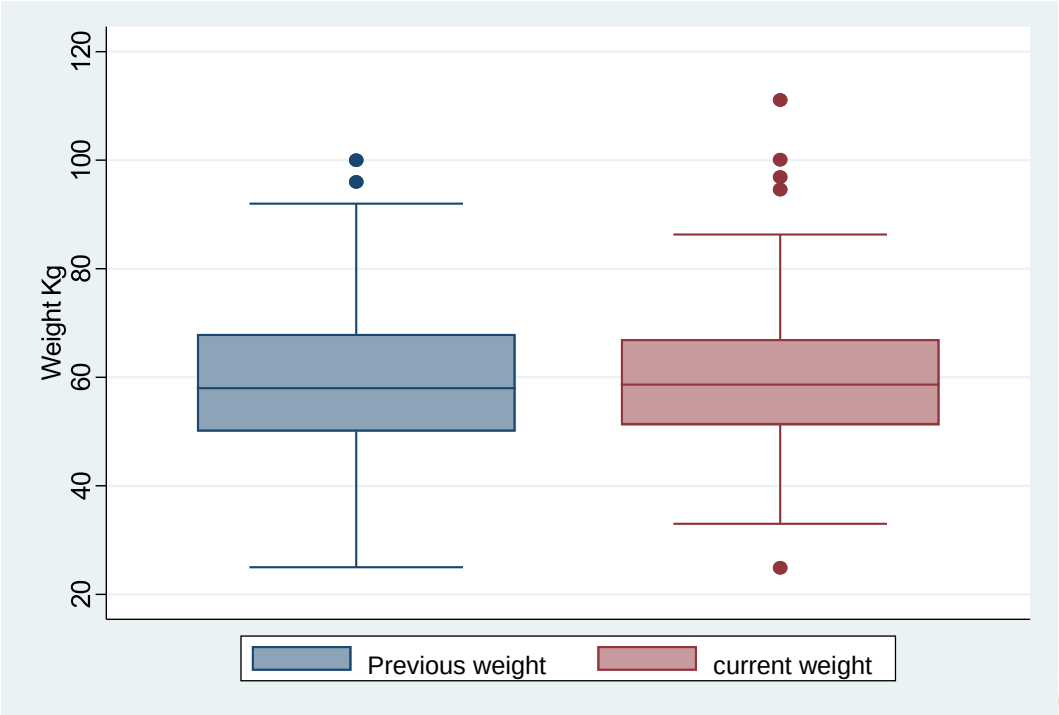


***Figure 4.2: Box plot showing the median and interquartile range of patients' weight current and previous (within 6 months prior to the study)***

### 4.4.4 Association between anthropometric and haematological/biochemical parameters of PLWHA

Table 4.14 shows the relationship between anthropometric and biochemical/ haematological parameters. There was a positive association (r=0.2317, pvalues=0.0204) between Hb and BMI. Positive association were found between Hb and MUAC (r= 0.3009, p-value= 0.0023), Hb and hip circumference (r=0.2444, pvalue=0.0143), and between Hb and waist circumference (r=0.2260, p-value =0.0237). The correlations between Hb and BMI, Hb and MUAC, Hb and hip circumference, and Hb and waist circumference were weak. Viral load had weak positive correlation with

muscle mass (r=0.3692, p-value=0.0009) but negative correlation with total body fat (r= -0.2970, p-value=0.0083). Similarly, there were weak positive correlations between red blood cell (RBC) and MUAC (r=0.2160, pvalue=0.0309) and granulocytes and waist circumference (r=0.2339, p-value =0.0192).



**Table 4.14: Pearson's correlation between the anthropometric measures and biochemical parameters of PLWHA**

| Parameter | Viral load | Hb | WBC | LYM | RBC | HCT | RDW | PDW | GRA |
|---|---|---|---|---|---|---|---|---|---|
| **BMI** | -0.1837 | 0.2317* | 0.0257 | 0.1609 | 0.1351 | 0.256 | -0.1352 | 0.0134 | -0.0973 |
| **MUAC** | -0.1509 | 0.3009* | 0.1045 | 0.1502 | 0.2160* | 0.3104* | -0.1232 | 0.0411 | -0.0669 |
| **WHR** | -0.1432 | 0.0138 | 0.1086 | -0.1959 | -0.0628 | 0.0608 | -0.0182 | 0.0975 | 0.2339* |
| **Waist circumference** | -0.1593 | 0.2260* | 0.0994 | 0.0528 | 0.0458 | 0.2513* | -0.1817 | 0.0975 | 0.2339* |
| **Hip circumference** | -0.1162 | 0.2444* | 0.0553 | 0.1585 | 0.0785 | 0.2488* | -0.1981* | 0.0357 | -0.1009 |
| **Visceral fat** | -0.1860 | 0.1843 | -0.0166 | 0.1213 | 0.0499 | 0.2069* | -0.2045* | 0.0645 | -0.0755 |
| **Muscle Mass** | 0.3692* | 0.0012 | 0.0039 | -0.0391 | -0.0334 | -0.0447 | 0.2655* | 0.0466 | 0.0055 |
| **Total body fat** | -0.2970* | 0.1192 | 0.0266 | 0.0987 | 0.0319 | 0.1384 | -0.3193* | -0.0130 | -0.0437 |

Weak significant correlation is represented by one star (*) whiles strong correlation is represented by two stars (**), while BMI-Body Mass Index, MUAC- Mid Upper Arm Circumference, WHR-Waist- Hip Ratio Hb: haemoglobin, WBC: White Blood Cell, HCT: Haematocrit, LYM: Lymphocytes, RBC-Red Blood Cell, Hct-Haematocrit, RDW- Random Distribution Width, PDW-Platelet distribution Width, GRAGranulocytes

# CHAPTER FIVE

## 5.0 DISCUSSION

### 5.1 NUTRITIONAL STATUS OF PEOPLE LIVING WITH HIV/AIDS

The study found a high prevalence of malnutrition (undernutrition =17% and overnutrition =37%) among people living with HIV/AIDS in the Eastern Region of Ghana. This was similar to studies in Botswana, Ethiopia, Senegal, and China (Benzekri *et al*., 2015; Gedle *et al*., 2015; Hu *et al*., 2011; Nnyepi, 2009). Previous studies have attributed the high malnutrition among people living with HIV/AIDS to chronic diarrhoea, high nutrients requirement, co-infection, reduction in dietary intake, abnormal protein metabolism, mal-absorption, increased energy expenditure, and abnormal utilization of substrates (Hsu and Pencharz, 2005; Rose *et al*., 2014). The high overnutrition and undernutrition reported by this study unveiled the double burden of malnutrition experienced by people living with HIV/AIDS who are more vulnerable to the drivers and determinants of the double burden of malnutrition (WHO, 2016b). Similarly, Martinez *et al*. (2014) reported both high undernutrition and overnutrition prevalence rate among people living with HIV/AIDS.

The undernutrition prevalence rate of 17% reported by this present study was higher than a demographic health surveys meta-analysis in Sub-Saharan Africa with prevalence of 10.3% (Uthman, 2008) and studies in Ethiopia and Honduras with their prevalence of 12.3% and 11% respectively (Hailemariam *et al*., 2013; Martinez *et al*., 2014). However, other studies reported higher undernutrition prevalence than this present study. These include studies in Botswana, Ethiopia, Senegal, and China with the prevalence of undernutrition of 28.5%, 25.2%, 22.9%, and 37.2% respectively (Benzekri *et al*., 2015; Gedle *et al*., 2015; Hu *et al*., 2011; Nnyepi, 2009). People living with HIV/AIDS suffer from food insecurity, hunger, and eating difficulties which accelerate the

prevalence of undernutrition and poor health outcomes (Gedle *et al*., 2015; Martinez *et al*., 2014; Ndakala *et al*., 2017; Weiser *et al*., 2014). Martinez *et al*. (2014) and Normen *et al*. (2005), reported 65% and 48% respectively of food insecurity among people living with HIV/AIDS. Food insecurity and hunger among the study subjects were suggested to have resulted in poor nutritional status. This present study also reported 10% of people living with HIV/AIDS with mid-upper circumference (MUAC) <23 cm. This was lower than a study in Senegal, which undernutrition of 22% using MUAC (Benzekri *et al*., 2015).

The overweight/obesity prevalence rate of 37% reported by this present study was lower than a study in Ghana which reported about 47% of overweight/obesity among people living with HIV/AIDS (Sackey *et al*., 2017). It was, however, higher than a study in Honduras with 31% of overweight/obesity (Martinez *et al*., 2014). This study reported 3.4% of the study participants with high visceral fat (≥12%), 46.9% of females with higher total body fat (>35%), and 14% of males with high total body fat (>25%). Studies have established a significant association of high body fat (abdominal fat/visceral fat) with insulin resistance and high risk of developing diabetes and other cardiovascular diseases (Amato *et al*., 2010; Carey *et al*., 1996). The females, therefore, had a higher risk of insulin resistance and cardiovascular diseases than males.

## 5.2 DIETARY INTAKES OF PEOPLE LIVING WITH HIV/AIDS

The study compared the micronutrients and macronutrients of respondents with Recommended Dietary Allowance/Adequate Intake (RDA/AI). The present study found about 48% and 17.5% of people living with HIV/AIDS with an inadequate intake of energy and protein respectively. This was lower than a study in China which showed about 59.6% and 54.3% of people living with HIV/AIDS with insufficient energy and protein intake respectively (Hu *et al*., 2011). A similar study in Botswana showed that the average estimated energy intake of people living with HIV/AIDS was about 75% of

the median energy requirement set for healthy adults 18 years and older (Nnyepi, 2009). The present study found most respondents with an inadequate intake of vitamin A (94%) and calcium (95%). Inadequate vitamin A intake or deficiencies could accelerate HIV progression and predisposition them to opportunistic infections whiles calcium deficiencies interfere with nerve impulse transmission, muscle contraction and bone development (Falco and Silveira, 2015). The mean consumption of fibre (26.4g/day) was higher than a study in Botswana which showed 20g/day of fibre consumption among people living with HIV/AIDS (Nnyepi, 2009). High fibre intake is associated with reduced risk of fat disposition (Hendricks *et al*., 2003). The present study found mean intakes of phosphorus, potassium and sodium respectively as 1051.6±422.2mg/day, 3057.6±1358.9mg/day, and 3169.3±1313.6mg/day. A study showed that both increased and decreased intakes of potassium and phosphorus are associated with mortality of people living with HIV/AIDS (Rehman *et al*., 2018).
Excess sodium intake is also associated with cardiovascular diseases (Whelton and Appel, 2014).

Most respondents had dietary intakes within the acceptable macronutrient distribution range (AMDR) of carbohydrate (63%), protein (78%), and fat (55%). Studies suggest that adhering to the AMDR and total dietary patterns reduce the risk of chronic diseases (Bowen *et al*., 2018; Lasker *et al*., 2008). The study participants, therefore, had a reduced risk of chronic diseases as far as their macronutrient consumption pattern is a concern. In this study, it was observed that daily consumption of fruits, vegetables, and animal foods were 10.1%, 26.2%, and 7.3% respectively. A minimum of 400g of fruits and vegetables is recommended by WHO to prevent chronic diseases (WHO, 2003a). The consumption of animal food in this study was different from the frequency of

consumption of animal foods in a study in China which reported over 40% of people living with HIV/AIDS consuming < 100 grams of meat per day (Hu *et al*., 2011).

### 5.3 HEALTH STATUS OF PEOPLE LIVING WITH HIV/AIDS

The present study found 38% of people living with HIV/AIDS with low Hb (<11g/dL). This was lower than a study in Tanzania which found 59% of people living with HIV/AIDS with low Hb (<11g/dL) (Makubi *et al*., 2015). Low haemoglobin level could be due to the type of medication, stage of HIV disease, age, and sex (Belperio & Rhew, 2004). The prevalence and severity of anaemia increase as the HIV disease progresses (Belperio & Rhew, 2004). A study found patients initiating zidovudine (ZDV)-containing HAART had a greater risk of developing new anaemia or worsening anaemia than patients initiating non-ZDV-containing HAART (Curkendall *et al*., 2007).

In addition, the present study did not find a significant association between nutritional status (BMI<18.5 kg/m2) and haemoglobin. This was different from a study in West Africa, which showed low haemoglobin levels associated with BMI <18.5 kg/$m^2$ (Sicotte *et al*., 2015). A study found the risk of developing severe anaemia increased by 49% among patients with a BMI of <18.5 kg/$m^2$, by approximately 2-fold among patients with the WHO stage III, and by 3-fold among patients with WHO stage IV illness (Makubi *et al*., 2015).

The study found 80% of people living with HIV/AIDS with viral load <1000 copies/mL. Viral load test results below the threshold of <1000 copies/mL is considered as suppressed viral loads or treatment success according to 2016 WHO consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection (WHO, 2016a). Globally, 47% [35–58%] of people living

with HIV are virally suppressed (UNAIDS, 2018a). When a person living with HIV is taking effective antiretroviral therapy, the viral load becomes so low that it is undetectable (less than 50cp/mL) (UNAIDS, 2018a, 2018b). The present study 80% of viral load <1000 copies/mL although higher than the global virally suppressed population but was below the USAIDS 90-90-90 fast tract target of 90% of all people receiving antiretroviral therapy with viral suppression (UNAIDS, 2014).



# CHAPTER SIX

## 6.0 CONCLUSION AND RECOMMENDATION

### 6.1 CONCLUSION

The study found a high prevalence rate of underweight (17%) and overweight/obesity (37%) among people living with HIV/AIDS. Most people living with HIV/AID had adequate dietary intakes of phosphorus, inadequate intakes of calcium, vitamin E, vitamin A, and excess intakes of sodium. In addition, a significant proportion of people living with HIV/AIDS had a high viral load.

### 6.2 RECOMMENDATION

Further studies employing quantitative and qualitative methods should be carried out to find out reasons for high malnutrition and unsuppressed viral load among people living with HIV/AIDS on antiretroviral treatment. People living with HIV/AIDS during their follow up visits to the health facilities should be educated on their nutritional status, health status and adequate dietary practices.

### 6.3 LIMITATIONS OF THE STUDY

The 24-hour recall (one weekend and two weekdays) was not complete for some participants due to inability to recall and fear of stigma by others who may spot them in the facility. Weighed food record was also not used to estimate dietary intakes and supplements were excluded in the nutrient estimation. Highly skilled and trained nutrition officers with vast experience of work with people living HIV/AIDS were used to collect the data in order to minimize the effect of the limitations on the validity of the results.

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## APPENDIX 1: QUESTIONNAIRE DEPARTMENT OF BIOCHEMISTRY AND BIOTECHNOLOGY

## COLLEGE OF SCIENCE

## KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

## QUESTIONNAIRE ON ASSESSING THE NUTRITIONAL AND HEALTH STATUS OF PEOPLE LIVING WITH HIV/AIDS IN THE EASTERN REGION OF GHANA.

**Participant ID**

| | | |
|---|---|---|
| | | |

**IDENTIFICATION**

(a) Date of the interview (DD/MM/YYYY)……./……./……

(b) Name of interviewer ……..……

(c) Patient folder number……..

(d) Name of Hospital Kibi Government hospital [ ] Koforidua Central Hospital [ ] Saint Martin's Hospital [ ] Holy Family Hospital [ ]

**SECTION A: DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS**

Q1. Date of birth (DD/MM/YYYY)……./……./…… Age ……years

Q2. Sex of respondent

Male [ ] Female [ ]

Q3. Religion of respondent

Christian [ ] Muslim [ ] Traditionalist [ ] other (specify)……

Q4. Marital status of the respondent

Single [ ] Married [ ] Divorced [ ] Widow/Widower [ ] Cohabiting [ ] other (specify)……..

Q5. Which ethnic group do you belong?

Akan [ ] Krobo [ ] Ga [ ] Ewe [ ] Other (specify)……

Q6. Educational status of the respondent

Primary [ ] JHS/Middle School [ ] SHS/Technical/Vocational [ ] Tertiary [ ]

Non formal education [ ] Not educated [ ] Other (specify)……..

Q7. Occupation of respondent

Trader [ ] Farmer [ ] Civil service [ ] Unemployed [ ] Other (specify)……

Q8. Family setting monogamous [ ] Polygamous [ ]

Q9. Who is the head of the household? Man [ ] Woman [ ]

Q10. How many individuals are in a household? …… ≤ 4 [ ] 5-10 [ ] >10 [ ]

Q11.What is the average monthly family income of respondent? GH ¢.....

< GH¢ 500 [ ] GH ¢500-1000 [ ] > GH¢ 1000 [ ]

Q12. Place of residence of respondent (Specify) … Rural area [ ] urban area [ ]

Q13. Distance to hospital ……km ≤ 5 [ ] 6-10 [ ] >10 [ ]

Q14. What are the sources of drinking water of respondent at home? ***(Accept multiple responses)***

Pipe-borne water/bore-hole [ ] Well [ ] River/Stream [ ] Sachet/Bottle [ ]

Others (specific)…….

Q15. Availability of treatment monitor/caregiver Yes [ ] No [ ]

**SECTION B: MEDICAL AND DRUG HISTORY (Confirm information using patient folder)**

Q16. Type of HIV HIV I [ ] HIV II [ ] HIV I & HIV II [ ] unknown [ ]

Q17. Is the client on TB treatment? Yes [ ] No [ ]

Q18. WHO clinical stage Stage 1 [ ] Stage 2 [ ] Stage 3 [ ] Stage 4 [ ]

Q19. State current medical

Q20.State previous medical diagnosis (<6months)

(If available)……

Q21. How long have you been taken anti-retroviral drugs...../……. (mm/yyyy)

≤ 5months [ ] 6-11months [ ] 12-23months [ ] 24-59months [ ] >59months [ ]

Q22. What medication do you take apart from the antiretroviral drugs? Haematinics [ ]

Cotrimoxazole [ ] Fluconazole [ ] others (specify).....

**SECTION C: NUTRITION SUPPORT PROGRAMME**

Q23. Have you been counselled on nutrition at the health facility? Yes [ ] No [ ]

Q24. Are you benefiting from nutrition support programme?

Yes [ ] No [ ] **If No, SKIP to Q33**

Q25. If **Yes**, how long have you been on nutrition support programme? .....months

<6months [ ] 6-10months [ ] 10months< [ ]

Q26. How many food supports did you benefit within 6 months prior to the study? .....supports ***(Confirm from folder/facility record***). 1 -2 support [ ] 3-4 supports [ ] 5 supports ≤ [ ]

Q27. Who makes decisions in patient household over the use of the nutrition support? Self [ ] Parents/Caregiver [ ] Husband [ ] wife [ ] Couple [ ] other (specify)……

Q28. Does patient eat alone all food supplied to him/her? Yes [ ] No [ ]

Q29. If **No**, how many people share food with client? .....people ≤ 4 [ ] 5-10 [ ] >10 [ ]

Q30. Challenges of nutrition support programme (fill the table below)?

| **Problem/Challenges** | **Response** | If **YES**, which problems did you have **(Accept multiple responses)** |
|---|---|---|
| Q30a. Collecting and carrying the food | Yes [ ]<br>No [ ] | Illness/sickness [ ] Long distance to health facility [ ]<br>Stigma [ ] Unfavourable weather [ ] Poor health staff attitude [ ] Others (specify)…… |

| | | |
|---|---|---|
| Q30b. Household level | Yes [ ]<br>No [ ] | Large size of family [ ] Inadequate fuel for cooking [ ]<br>Others (specify)…… ……. |
| Q30c. Individual level | Yes [ ]<br>No [ ] | Don't prefer taste of food supplied [ ] Allergic to food [ ]<br>Others (specify)…… …….. |
| Q30d. Others challenges (specify)…… ……<br>……..…… | | |



Q31. Are you satisfied with the nutrition support programme? Yes [ ] No [ ]

Q31 a. If **Yes,** why……

Q31 b. If **No,** why…….

Q32. What is your view should be done to improve the nutrition support programme?
.....……
……
……..

Q33. Fill the table below with information on the nutrition support programme (**confirm with facility records).**

| **Date supplied** (dd/mm/yyyy) | **Food item** | **The quantity of ration supplied** | **The period ration is to be consumed** | **Actual Quantity consumed** | **Actual Period consumed** | **Remarks** |
|---|---|---|---|---|---|---|
| ----/---/--------- | Oil | | | | | |
| | Beans | | | | | |
| | Tom vita | | | | | |
| | Plumpy nut | | | | | |
| | Others (specify) ……. | | | | | |
| ----/---/--------- | Oil | | | | | |
| | Beans | | | | | |
| | Tom vita | | | | | |
| | Plumpy nut | | | | | |
| | Others (specify) ……. | | | | | |
| | Oil | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| ----/---/--------- | Beans | | | | | |
| | Tom vita | | | | | |
| | Plumpy nut | | | | | |
| | Others (specify) ……. | | | | | |
| ----/---/--------- | Oil | | | | | |
| | Beans | | | | | |
| | Tom vita | | | | | |
| | Plumpy nut | | | | | |
| | Others (specify) ……. | | | | | |



**SECTION D: ANTHROPOMETRIC AND BIOCHEMICAL**

**/HAEMATOLOGICAL DATA**

Q34. Fill the table below (Previous data should be within the **12mths period (Jan- Dec 2018**).

| **Anthropometric Parameters** | **Previous Value (dd/mm/yyyy)** ----/---/---------- | **Previous Value (dd/mm/yyyy)** ----/---/---------- | **Previous Value (dd/mm/yyyy)** ----/---/---------- | **Current Value (dd/mm/yyyy)** ----/---/---------- | **Reference / normal value** |
|---|---|---|---|---|---|
| Weight (kg) | | | | | |
| Height (cm) | | | | | |
| BMI ($kg/m^2$) | | | | | |
| MUAC | | | | | |
| Total body fat | | | | | |
| Visceral fat | | | | | |
| Muscle mass | | | | | |
| Waist circumference | | | | | |
| Hip circumference | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Oedema (indicate the degree of oedema) | | | | | |

| **Biochemical/ Haematological Parameter** | **Previous Value (dd/mm/yyyy) ----/---/---------** | **Previous Value (dd/mm/yyyy) ---/---/---------** | **Previous Value (dd/mm/ yyyy) ----/---/--- ------** | **Current Value (dd/mm/yyyy) ----/---/---------** | **Referen ce/ normal value** |
|---|---|---|---|---|---|
| CD4 | | | | | |
| Viral load | | | | | |
| **Full blood count** | | | | | |
| WBC (x109/μL) | | | | | |
| LYM (%) | | | | | |
| MON (%) | | | | | |
| GRA (%) | | | | | |
| LYM ($x10^9$/μL) | | | | | |
| MON ($x10^9$/μL) | | | | | |
| GRA ($x10^9$/μL) | | | | | |
| RBC ($10^{12}$/μL) | | | | | |
| Hb (g/dL) | | | | | |
| Hct (%) | | | | | |
| MCV (fL) | | | | | |
| MCH (pg/cell) | | | | | |
| MCHC (g/dL) | | | | | |
| RDW (%) | | | | | |
| PLT ($x10^3$/μL) | | | | | |
| MPV (%) | | | | | |
| PCT (%) | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| PDW (%) | | | | | |
| C-reactive protein | | | | | |
| Serum iron | | | | | |
| Iron transferrin | | | | | |
| Ferritin | | | | | |
| **Liver function test** | | | | | |
| AST | | | | | |
| ALT | | | | | |
| ALP | | | | | |
| Albumin | | | | | |
| Total bilirubin | | | | | |
| **Kidney function test** | | | | | |
| Creatinine | | | | | |
| Urea | | | | | |
| Sodium | | | | | |
| Bicarbonate | | | | | |

**SECTION E: DIETARY ASSESSMENT**

Q 35. Fill the table below by providing one answer to a question if available.

**Food frequency questionnaire:** Assess consumption patterns of PLWHA over the past 6 months **(July-December, 2018**).

| **Meal/Food consumed** | **Code** | **Daily** | **Weekly (1-3) times** | **Monthly** | **Occasionally** | **Never** | **Size of Portion in hand measure (g)** |
|---|---|---|---|---|---|---|---|
| **FRUITS** | | | | | | | |
| Watermelon | 1a | | | | | | |
| Banana | 2a | | | | | | |
| Citrus (orange, tangerine) | 3a | | | | | | |
| Grapefruit | 4a | | | | | | |
| Mango | 5a | | | | | | |
| Pineapple | 6a | | | | | | |
| Pawpaw | 7a | | | | | | |
| Apple | 8a | | | | | | |
| Avocado | 9a | | | | | | |
| Coconut | 10a | | | | | | |
| Others (specify)…… | 11a | | | | | | |
| | 12a | | | | | | |
| **VEGETABLES** | | | | | | | |
| Tomatoes | 1b | | | | | | |
| Garden eggs | 2b | | | | | | |
| Kwansosaa(abedru) | 3b | | | | | | |
| Lettuce | 4b | | | | | | |
| Kontomire | 5b | | | | | | |
| Okra | 6b | | | | | | |
| Carrot | 7b | | | | | | |
| Cabbage | 8b | | | | | | |
| Ayoyo leaves | 9b | | | | | | |
| Green pepper | 10b | | | | | | |
| Green beans | 11b | | | | | | |
| Onions | 12b | | | | | | |
| Cucumber | 13b | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Others (specify)…… | 14b | | | | | | |
| | 15b | | | | | | |
| **LEGUMES AND NUTS** | | | | | | | |
| Beans | 1c | | | | | | |
| Soya beans | 2c | | | | | | |
| Lentils | 3c | | | | | | |
| Groundnut | 4c | | | | | | |
| Agushie stew | 5c | | | | | | |
| Others (specify)……. | 6c | | | | | | |
| | 7c | | | | | | |
| **ANIMAL FOODS AND PRODUCTS** | | | | | | | |
| Pork | 1d | | | | | | |
| Meat | 2d | | | | | | |
| Chicken poultry | 3d | | | | | | |
| Offal | 4d | | | | | | |
| Snails | 5d | | | | | | |
| Luncheon meat | 6d | | | | | | |
| Bushmeat | 7d | | | | | | |
| Others (specify)…….. | 8d | | | | | | |
| **DAIRY PRODUCTS** | | | | | | | |
| Milk | 1e | | | | | | |
| Skimmed milk | 2e | | | | | | |
| Egg | 3e | | | | | | |
| Milk powder | 4e | | | | | | |
| Soy milk | 5e | | | | | | |
| Butter | 6e | | | | | | |
| Cheese | 7e | | | | | | |
| Yoghurt | 8e | | | | | | |
| Others (specify)…… | 9e | | | | | | |
| **SEA FOODS/ FISH** | | | | | | | |
| Sardines | 1f | | | | | | |
| Canned mackerel | 2f | | | | | | |
| Tilapia | 3f | | | | | | |
| Tuna flakes | 4f | | | | | | |
| Herrings | 5f | | | | | | |
| Smoked fish | 6f | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Shrimps | 7f | | | | | | |
| Crabs | 8f | | | | | | |
| Anchovies | 10f | | | | | | |
| Others (specify)…… | 11f | | | | | | |
| **CARBOHYDRATES** | | | | | | | |
| **GRAIN & CEREALS** | | | | | | | |
| Oats | 1g | | | | | | |
| Wheat | 2g | | | | | | |
| Hausa Koko | 3g | | | | | | |
| Rice water | 4g | | | | | | |
| Kenkey | 5g | | | | | | |
| Corn porridge | 6g | | | | | | |
| Brown rice | 7g | | | | | | |
| Polished rice | 8g | | | | | | |
| Roasted corn | 9g | | | | | | |
| Banku | 10g | | | | | | |
| Boiled rice | 11g | | | | | | |
| Sugar | 12g | | | | | | |
| Tu zaafi | 13g | | | | | | |
| Kokonte | 14g | | | | | | |
| Fufu | 15g | | | | | | |
| Gari | 16g | | | | | | |
| Bread | 17g | | | | | | |
| Others (specify)…… | 18g | | | | | | |
| **ROOTS AND TUBERS** | | | | | | | |
| Plantain | 1h | | | | | | |
| Cocoyam | 2h | | | | | | |
| Yam | 3h | | | | | | |
| Cassava | 4h | | | | | | |
| Others (specify)…… | 9h | | | | | | |
| **DRINKS** | | | | | | | |
| Alcoholic drinks | 1i | | | | | | |
| Fizzy drinks | 2i | | | | | | |
| Sobolo | 3i | | | | | | |
| Asana | 4i | | | | | | |
| Milo drink | 5i | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Tea | 6i | | | | | | |
| 0thers (specify)…… | 7i | | | | | | |
| **SNACKS** | | | | | | | |
| Rock buns | Ij | | | | | | |
| Spring rolls | 2j | | | | | | |
| Meat pie | 3j | | | | | | |
| Chips | 4j | | | | | | |
| Roasted nuts | 5j | | | | | | |
| Others (specify)…… | 6j | | | | | | |
| | 7j | | | | | | |
| **OTHER FOODS** | | | | | | | |
| Ketchup | 1k | | | | | | |
| Soy sauce | 2k | | | | | | |
| Mayonnaise | 3k | | | | | | |
| Salad cream | 4k | | | | | | |
| Sandwich | 5k | | | | | | |
| Others (specify)…….. | 6k | | | | | | |

Q 36. Fill the table below. (**24-Hour recall (one weekend and two weekdays)**

| **Day 1: Menu and Time** | **Meal /Food (state preparation/cooking method)** | **Quantity (Handy measure)** | **Weight (g) or Volume(ml)** |
|---|---|---|---|
| Breakfast Time…….. | | | |
| Snack Time…… | | | |
| Lunch Time…….. | | | |
| Snack Time…….. | | | |
| Supper Time……. | | | |
| Snack Time……. | | | |

| **Day 2: Menu and Time** | **Meal /Food (state preparation/cooking method)** | **Quantity (Handy measure)** | **Weight (g) or volume(ml)** |
|---|---|---|---|
| Breakfast Time…….. | | | |
| Snack Time…… | | | |
| Lunch Time…….. | | | |
| Snack Time…….. | | | |
| Supper Time……. | | | |
| Snack Time…… | | | |

| **Day 3: Menu and Time** | **Meal /Food (state preparation/ cooking method)** | **Quantity (Handy measure)** | **Weight (g) or volume(ml)** |
|---|---|---|---|
| Breakfast Time…….. | | | |
| Snack Time…… | | | |
| Lunch Time…….. | | | |
| Snack Time…….. | | | |
| Supper Time……. | | | |
| Snack Time…… | | | |

## APPENDIX 2: ETHICAL APPROVAL LETTER

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
**COLLEGE OF HEALTH SCIENCES**
SCHOOL OF MEDICAL SCIENCES / KOMFO ANOKYE TEACHING HOSPITAL
**COMMITTEE ON HUMAN RESEARCH, PUBLICATION AND ETHICS**

Ref: CHRPE/AP/506/18

23rd August, 2018.

Dr. Alexander Kwarteng
Department of Biochemistry
and Biotechnology
School of Medical Sciences
KNUST-KUMASI.

Dear Sir,

**LETTER OF APPROVAL**

***Protocol Title:*** ***"Assessing the Nutritional Status of People Living with HIV/AIDS in the Eastern Region of Ghana."***

***Proposed Site:*** ***Eastern Region (Kibi Government Hospital, East Akim Municipal; Holy Family Hospital, Kwahu West District; Saint Martin's Hospital, Upper Manya Krobo District and Koforidua Central Hospital, New Juabeng Municipal).***

***Sponsor:*** ***Principal Investigator.***

Your submission to the Committee on Human Research, Publications and Ethics on the above-named protocol refers.

The Committee reviewed the following documents:

- A notification letter of 11th June, 2018 from the Eastern Region Health Directorate (study site) indicating approval for the conduct of the study in the Region.
- A Completed CHRPE Application Form.
- Participant Information Leaflet and Consent Form.
- Research Protocol.
- Questionnaire.

The Committee has considered the ethical merit of your submission and approved the protocol. The approval is for a fixed period of one year, beginning 23rd August, 2018 to 22nd August, 2019 renewable thereafter. The Committee may however, suspend or withdraw ethical approval at any time if your study is found to contravene the approved protocol.

Data gathered for the study should be used for the approved purposes only. Permission should be sought from the Committee if any amendment to the protocol or use, other than submitted, is made of your research data.

The Committee should be notified of the actual start date of the project and would expect a report on your study, annually or at the close of the project, whichever one comes first. It should also be informed of any publication arising from the study.

Yours faithfully,

Osomfo Prof. Sir J. W. Acheampong MD, FWACP
**Chairman**

Room 7 Block J, School of Medical Sciences, KNUST, University Post Office, Kumasi, Ghana
Phone: +233 3220 63248 Mobile: +233 20 5453785 Email: chrpe.knust.kath@gmail.com / chrpe@knust.edu.gh

## APPENDIX 3: LETTER OF APPROVAL AND NOTIFICATION OF STUDY

In case of reply the number and the date of this letter should be quoted

My Ref No: ERHD/1931/18

You're Ref. No

Eastern Reg. Health Directorate
GHANA HEALTH SERVICE
P. O. Box KF 179
Koforidua
GHANA
Tel: (0342) 023341
Fax: (0342) 023351
Email: rdhs.er@ghanail.org

11th June, 2018.

DISTRICT DIRECTORS OF HEALTH SERVICES;
MEDICAL SUPERINTENDENTS;
AS PER DISTRIBUTION ATTACHED

**LETTER OF INTRODUCTION**

This is to introduce to you **Mr. Apungu Francis Kwotua**, an MPhil student of KNUST (Department of Biochemistry and Biotechnology). He is conducting a study on the topic; ***"Assessing the Nutritional Status of People living with HIV/AIDS in the Eastern Region of Ghana."***

Kindly facilitate his entry into your facility and assist him for a successful exercise.

Attached is the letter of introduction from his School.

Counting on your cooperation.

Thank you.

MR. ASARE BEDIAKO MICAH
DEPUTY DIRECTOR, HASS.
FOR; REGIONAL DIRECTOR OF HEALTH SERVICES.
EASTERN REGION.

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF SCIENCE
FACULTY OF BIOSCIENCES

University Post Office
Kumasi, Ghana
West Africa

DEPARTMENT OF BIOCHEMISTRY AND BIOTECHNOLOGY
Loc. Aboagye Menyeh Complex, Room No. GF-4

Our Ref: BC/R/3/Vol.2

GHANA HEALTH S... 01 JUN 2018 2436 P.O BOX KF 173 KCF

Date: 31st May, 2018

Director of Health Services
Eastern Region

Dear Sir/ Madam

**LETTER OF INTRODUCTION: MR. APUNGU FRANCIS KWOTUA**

This is to introduce Mr. Apungu Francis Kwotua, a first year MPhil Human Nutrition and Dietetics student of this Department.

Mr. Apungu Francis Kwotua wants to involve subjects within your institution to collect data for the research titled: **"Assessing the Nutritional Status of People living with HIV/AIDS in the Eastern Region of Ghana."**

The study will not be harmful to the subjects.

Any courtesies extended to him would be appreciated.

Thank you.

Yours sincerely,

**P. TWUMASI (PhD)**
**Head of Department**

Dag Research Officer
05/06/18

cc: Directors of Health Services:
1. East Akim Municipal
2. Lower Manya Krobo District
3. Kwahu West District
4. New Juabeng Municipal

cc: Medical Superintendents:
5. Kibi Government Hospital, Kibi
6. Koforidua Central Hospital, Koforidua
7. Holy Family Hospital, Nkawkaw
8. St. Martin's Hospital, Agormanya

Tel: +233 - 03220 - 60298, Email: biochem@knust.edu.gh / bbtsci@gmail.com / Fax: +233 - 03220 - 60298/60137 / Website: biochemistry.knust.edu.gh

**APPENDIX 4: PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM**

**Title of Study:** Assessing the nutritional and health status of people living with HIV/AIDS (PLWHA) in the Eastern Region of Ghana.

**Name and affiliation of the researcher:** This study is being conducted by Dr. Alexander Kwarteng (Principal Investigator /Supervisor) and Mr. Apungu Francis Kwotua (Student pursuing MPhil Human Nutrition and Dietetics in the Department of Biochemistry and Biotechnology, Kwame Nkrumah University of Science and Technology, Ghana).

**Background:** Nutritional and health status assessment is important for people living with HIV/AIDS (PLWHA) since they are vulnerable to malnutrition, morbidity, and mortality. However, there is limited knowledge on the nutritional and health status of people living with HIV/AIDS in the Eastern Region which forms the focus of this study.

**Purpose(s) of research:**

1. To determine the prevalence of malnutrition among PLWHA in selected facilities in the Eastern Region.
2. To determine the dietary intakes of people living with HIV/AIDS.
3. To assess the health status (viral load and full blood count) of people living with HIV/AIDS.

**The procedure of the research:** This is a cross-sectional study where People living with HIV/AIDS will be sampled in four hospitals in the Eastern Region. Hospitals participating in the study are; Kibi Government Hospital, Saint Martin's Hospital, Holy Family Hospital, and Koforidua Central Hospital. Data collection will include; anthropometric data, biochemical/haematological data and dietary assessment. Approximately, 5ml of venous blood

will be obtained from study participants to assess the full blood count and viral load. For this study, 200 study participants will be selected to participate based on their willingness to participate.

**Risk(s):** Risks associated with this study are the pain participants will go through during taking the blood samples and risk of loss of confidentiality. Trained laboratory officers will be used to reduce the risk of the pain of participants during taking the blood samples. Standard procedures and infection prevention principles will be adhered to by the trained laboratory officers. Data coding system will be used to minimize the risk of loss.

**Benefit(s):** All results will be communicated to the study participants. Participants will benefit from nutrition education.

**Confidentiality:** All information collected in this study will be given code numbers and names will not be used. Officials of the ethical committee will only be allowed to access the information you are providing.

**Voluntariness:** Choosing to participate in this study is entirely voluntary and you can withdraw at any point in time.

**Alternatives to participation:** Deciding not to participate will not affect the treatment you will receive in the hospital.

**Withdrawal from the research:** You are at liberty to withdraw entirely from the study anytime or decide not to respond to questions you don't want to provide answers.

**The consequence of Withdrawal:** There are no consequences for withdrawal.

**Costs/Compensation:** You will be provided with a cake of soap to show our appreciation for your participation.

**Contacts:** If there is the need for further clarification with regards to this study, please contact Dr. Alexander Kwarteng (0503322170) and Apungu Francis Kwotua (0245804626) or afranciskwotua@yahoo.com

**Also, if there is any issue or concern with regards to the conduct of this study, your rights or welfare as a research participant, you may contact:**

**The Office of the Chairman**

**Committee on Human Research and Publication Ethics**

**Kumasi**

**Tel: 03220 63248 or 020 5453785**



**CONSENT FORM**

**Statement of person obtaining informed consent:**

"I have fully explained this research to _____ and have given sufficient information about the study, including that on procedures, risks and benefits, to enable the prospective participant to make an informed decision to or not to participate".

DATE: _____ NAME: _____

**Statement of person giving consent:**

I have read the information on this study or the study has been translated into a language I understand. I understand that my participation is voluntary and I know enough about the purpose, methods, risks, and benefits of the study to decide that I want to take part in it. I understand that I may freely stop being part of this study at any time without having to explain myself and I have received a copy of this information leaflet and consent form to keep for myself.

NAME: _____

DATE: _____ SIGNATURE/THUMB PRINT: _____

**Statement of the person witnessing consent (Process for Non-Literate Participants):**

I _____ (Name of Witness) certify that information given to (Name of Participant), in the local language, is

a true reflection of what l have read from the study Participant Information Leaflet, attached.

WITNESS' SIGNATURE (maintain if participant is non-literate): _____