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LEGON

PREVALENCE OF MALNUTRITION AMONG HIV INFECTED CHILDREN UNDER FIVE AT KOMFO ANOKYE TEACHING HOSPITAL

BY

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DECLARATION

DECLARATION

CANDIDATE'S DECLARATION

I, Linda Kafui Avornyotse, the undersigned do hereby declare that this dissertation is the result of my own original research and that no part of it has been presented for another degree in any University.



26/07/17

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27/07/17

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INTEGRI PROCEDAMUS

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DEDICATION

This project is dedicated my late father, Richard Avornyotse.

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ACKNOWLEDGEMENT

I thank the Almighty God who has brought me this far, without whose providence I would not have come to this successful end.

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DEFINITION OF KEYWORDS

Undernutrition is the result of inadequate nutrient intake as required by the body

Overnutrition is the result of taking in more nutrients than the body needs.

Nutrition: the scientific *study* of foods, food systems, and their nutrients and other constituents; and their interactions within the body.

Nutrients: Nutrients are chemical substances in food that can be metabolized to provide energy to maintain, repair, or build body tissues. They include macro nutrients and micro nutrients.

AIDS: Acquired Immunodeficiency Syndrome

DHS: Demographic and Health Survey

HIV: Human Immunodeficiency Virus

KATH: Komfo Anokye Teaching Hospital

OPD: Out Patient Department

PLWHA- People Living With HIV/AIDS

PMTCT- Preventing Mother To Child Transmission

SAM: Severe Acute Malnutrition

SDGs: Sustainable Development Goals

SSA: Sub-Saharan Africa

U5: Under five

WHO: World Health Organization

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ABSTRACT

Background: The need for adequate nutrition for early childhood development cannot be overemphasized. This is because the provision of ample nutrition for infants facilitates healthy growth, proper organ formation and functioning, a strong immune system, as well as neurological and cognitive development. Ensuring good nutrition among HIV infected children over the years has been a huge public health concern. This study aimed determine the prevalence of malnutrition among HIV infected children under five years at Komfo Anokye Teaching Hospital.

Objective: To determine the prevalence of malnutrition with its associated factors among HIV-infected children under five years**.**

Methods: The study was a cross-sectional survey involving HIV infected children under 5 and their care givers who are receiving treatment at KATH. Structured questionnaires were used to collect data from caretakers of children U5 that are receiving care at the Paediatric Ward at KATH.

Results and conclusions: A total of 105 children aged 6 to 59 months participated in the study. The majority (62%) of the respondents were malnourished based on their age-for-height z-score despite 83.8% of the patients having no identifiable clinical signs or symptoms of malnutrition.

43.8%) of respondents were severely malnourished, 9.5% were moderate and 8.6% , mild. With the aims to determine the prevalence of malnutrition among HIV-infected children under five as well as determine associated factors and extent of nutritional support, children whose caregivers had only primary education had a 95% higher odds of being malnourished ($p<0.05$) compared to those with no education. This study also found several associated factors to be associated with the development of severe acute malnutrition. Also, most (92.4%) of the participants had support from family.

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CHAPTER ONE

1.0 INTRODUCTION

1.1. Background to the Study

The need for adequate nutrition for early childhood development cannot be overemphasized. This is because the provision of ample nutrition for infants facilitates healthy growth, proper organ formation and functioning, a strong immune system, as well as neurological and cognitive development (Black *et al*., 2010). Economic growth and human development require well- nourished populations who can learn new skills, think critically and contribute to their communities (Lui et al,2012). The cognitive skills of children are developed by the extent to which they receive adequate nutrition for subsequent development. Studies have also shown that more than one-third of under five deaths are ascribed to under-nutrition or malnutrition (Rice et al., 2000; Burke et al., 2011).

Malnutrition is an imbalance in nutrition which could either be excess or inadequate nutrients intake as required by the body, termed as overnutrition and undernutrition respectively. Undernutrition may range from mild to severe and life threatening cases. The WHO Nutrition Landscape Information System(NLIS), suggests for the following anthropometric indicators for classifying malnutrition; Underweight - weight for age < –2 standard deviations (SD) of the WHO Child Growth Standards median; Stunting - height for age < –2 SD of the WHO Child Growth Standards median; Wasting - weight for height less than –2 SD of the WHO Child Growth Standards median (NLIS,2009). These measurements are taken to evaluate the nutritional status of young children. This evaluation allows identification of subgroups of the child population that are at increased risk of altered growth, disease, and death. Marked differences, particularly in regard to

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height-for-age, weight-for-height, and weight-for-age, are often seen among subgroups of children within the population (GDHS, 2014). Children who are malnourished may also present clinical symptoms such as Bilateral pitting oedema, loss of hair and muscles, oral thrush, dermatosis among others. Malnutrition may be diagnosed through one or a combination of the anthropometry, dietary assessment, laboratory investigations or biomarkers, and clinical examination. Nutrition has increasingly been known as a fundamental pillar for socioeconomic development. The need to significantly decrease infant and childhood malnutrition is essential to the achievement of the 2015 Sustainable Development Goals(SDGs)— particularly those related to the eradication of extreme poverty and hunger (SDG 1, 2). The seriousness of the global community towards addressing child developmental challenges is further articulated in efforts in ensuring child survival as well as good health and well-being at all ages (SDG 3).

The UNICEF (2008) reports that, Severe Acute Malnutrition (SAM), is the leading cause of morbidity and mortality in children under-five in developing countries. According to this report, malnutrition contributes over 50% of the 10 - 11 million deaths from preventable causes, which occur annually in this age group.

In developing countries, including Ghana, an estimated 230 million (39%) children under the age of five are chronically malnourished and about 54% of deaths among children younger than five are associated with malnutrition. The death rate for malnourished children under-five years in many developing countries is alarming. These deaths often happen at home without care, and even when hospital care is provided, the death toll for malnourished children is very high, ranging between 30-50% (WHO Fact sheet report (2012). According to the WHO Fact sheet report (2012), globally about a third of child mortality are associated with malnutrition. Children in sub-Saharan Africa are more than

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14 times more likely to die before the age of 5 than children in the developed region due to HIV, malnutrition, malaria, diarrhoea and some preterm birth complications.

The United Nations (2004), Brown (2003) and Blossner (2003) report that Under-nutrition is associated with >50% of all childhood mortality in developing countries with the risk of mortality being 5–8 fold among severely malnourished children compared to moderately malnourished children. This finding shows the intensity of the relationship that exists between acute malnutrition and child survival. Because of the high risk of death, most severely malnourished children are managed in hospital. Several factors contribute to the high case fatality in children hospitalized with severe malnutrition. These factors range from acute bacterial infections, electrolyte imbalance to micronutrient deficiencies. Although prompt and appropriate treatment of severely malnourished children should reduce case fatality, empirical evidence from sub-Saharan Africa does not meet the acceptable international level of 5%.

More than one in five children in Ghana is stunted According to UNICEF,(2013). The situation is worse in the Northern part if the country where 37 per cent of children is stunted due to childhood malnourishment. Despite the relatively high prevalence, most diagnoses are still missed (Antwi, 2008).

There seems however, to be a trend of the epidemiology of severe malnutrition in sub-Saharan Africa. .The shift is now towards the point where an increasing percentage of children requiring hospitalization comprises of those who are HIV-infected or HIV-exposed with high case-fatality rates. This change emanates from the high percentages of HIV infected children, which is still as high as 20–50% ((Heikens *et al*., 2008). In addition to this, the management of severe wasting and malnutrition in children, particularly in those infected with HIV remains insufficiently addressed. Child feeding in the context of

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HIV is complex because of the major influence that feeding practices exert on child survival. The quandary is to counteract acquiring HIV through breast milk with the higher risk of death from causes other than HIV, in particular, malnutrition and serious illnesses such as diarrhoea, among non-breastfed infants. However, the new WHO guidelines on HIV and infant feeding provide principles and recommendations on HIV and infant feeding. In addressing malnutrition among children already infected with HIV, The document which was reviewed in 2016, endorses exclusive breastfeeding for the first six months and continued breastfeeding for up to 2 years as per recommendation for the general public (WHO guidelines,2016).

The 2014 Ghana Demographic and Health Survey (GDHS) reports that 5% of children are wasted and less than 1 % are severely wasted, representing a decrease from the figures reported in 2008 (9% and 2%, respectively). Although differences by background characteristics are much smaller than those observed for stunting, wasting is highest among children age 6-11 months (10-11 %) and those living in the Upper East region (9 %).Results from the six GDHS surveys conducted between 1988 and 2014 also show a decline in childhood mortality over the past two and a half decades. However the decline is still too low to meet SDGs 2 which seeks to end hunger, achieve food security and improve nutrition, and SDG 3,which seeks to ensure healthy life and promote wellbeing for all. About 54% of all deaths beyond early infancy are associated with SAM, making this the single greatest cause of child mortality in Ghana (WHO, 2007a). The difficulty as a country has been how to manage children with HIV as against those without HIV, on malnutrition treatment interventions. Currently as of early 2013, there were very few evidence-based recommendations for managing children with severe acute malnutrition with HIV infection as compared to children with SAM without HIV infection (Bahwere *et al* 2008). WHO only recommends antiretroviral drugs, special foods such as (ready to use

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therapeutic feed (RUTF) and antibiotics, once tested positive or exposed (WHO, 2013). However, drug toxicity, antimicrobial use, fungal infections and persistent diarrhoea are likely to require extra consideration amongst HIV-infected children with SAM. This development calls for further attention and examination of the differentials in terms of the treatment outcomes for severe acute malnourished children with HIV and malnourished children without HIV.

1.2. Problem Statement

The majority of deaths due to malnutrition occurs at home due to improper care. Even with hospital care, the estimated value is between 30-50% and is likely to be 75% by 2020 (WHO Fact Sheet, 2012). According to Antwi (2008) despite the high prevalence rate of SAM in Ghana, the opportunity for such children to be diagnosed in clinical settings are mostly missed. Recent epidemiology of severe malnutrition in SSA demonstrates a shift towards higher fatality rates among children who require clinical and hospitalization services such as those with HIV or exposed to HIV (Aitpillah, 2015). According to scholars the shift can be ascribed to high percentage of HIV infected children representing 20-50% (Heikens *et al*., 2008; Aitpillah, 2015).

A study by Aitpillah, (2015) in Ghana shows that malnutrition among children has faced mismanagement and has been poorly addressed especially with regards to those infected with HIV. It is therefore necessary to investigate the prevalence of malnutrition among HIV infected children under five years at Komfo Anokye Teaching Hospital which is the only tertiary health facility in the Ashanti region of Ghana. Becquet *et al.* (2007) indicated that there are possible interventions to reduce mortality among children with malnutrition in HIV endemic areas. In spite of available literature on the prevalence of HIV among malnourished children, information relating to the association between risk factors for

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increased fatality among severely malnourished children during periods of HIV pandemic is still sketchy in the sub- Saharan Africa with little research on nutritional recovery. Evidence on nutrition recovery, survival, and growth among severely malnourished children is scanty (Sandige et al., 2004; Ndekha et al. 2005) and suggestive of slower weight gain compared with non-infected (Collins *et al*., 2006).

Ghana follows the WHO guidelines for treating SAM among HIV infected children which include the provision of antiretroviral therapy to manage the viral infection coupled with adequate therapeutic feeding.

Ghana's effort in attaining the SDGs 2 and 3 will be influenced by the success of malnutrition treatment interventions. In the bid to generate evidence to inform the management of malnutrition in the context of HIV infection among children, this research seeks to find answers to the following research questions:

1. What is the prevalence of malnutrition and what are the stages of malnutrition among HIV-infected children under five years?
2. What are the factors associated with malnutrition among HIV infected children under five years?
3. What is the extent of nutritional support received by HIV infected children under five years?

1.3. Research Objective

1.3.1. General Objective

This study's general objective is to determine the prevalence of malnutrition among HIV infected children under five years at Komfo Anokye Teaching Hospital.

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1.3.2. Specific Objectives

The specific objectives of the study are to:

1. Determine the prevalence of malnutrition and the various stages of malnutrition among HIV-infected children under five years.
2. Determine factors associated with malnutrition among HIV infected children under five years
3. Investigate the extent of nutritional support obtained by HIV infected children under five years

1.4. Rationale of Study/Justification

The epidemiology of severe malnutrition in sub-Saharan Africa, including Ghana has shifted to one where a growing percentage of children requiring hospitalization are composed of those who are HIV infected. (Tomkins, 2005).

This study will provide a clear analysis and description of the current prevalence of malnutrition at KATH and provide evidence that will help policy makers to design interventions to address malnutrition among HIV infected children at KATH. The study also should provide enough statistics for further studies on related areas, offer clinicians and public health nutrition officers the opportunity in identifying the special needs that are required for the different groups.

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CHAPTER TWO

2.0 LITERATURE REVIEW

This chapter explores reviewed literature on the main elements related to the study which includes the incidence and prevalence of malnutrition among HIV children, HIV and opportunistic infections, causes of malnutrition among others. The review bothers on empirical literature from developing and developed countries with emphasis on the findings and methodological issues.

2.1. HIV, Co-morbidities and Malnutrition

Over three million children around the globe have HIV and AIDS; with an expected 800 000 new infections yearly among infants and over 500 000 dying from AIDS related illnesses each year. This is the biggest epidemic in Sub-Saharan Africa (Tomkins 2005). Complications arising from HIV infections in children are usually characterized by failure to thrive and severe malnutrition cases. More than half of the children suffering from severe malnutrition are HIV infected. All countries across the globe are aiming to achieve Sustainable Development Goals two and three (SDGs 2 and 3) that is zero hunger and ensuring healthy lives and promote wellbeing for all at all ages.

In 2007, the World Health Organization said that, globally, malnutrition contributes to more than one-third of all childhood deaths. These include Neonatal 37%, acute respiratory infections is about 17%, HIV/AIDS with 2%, Measles also 4%, Malaria is 7%, Diarrhoea about 16%, injuries 4% and all others, 13%. (WHO, 2007). In Africa and some developing countries, the magnitude of the severity of malnutrition in HIV infected children is greater and more devastating than in uninfected children. Anti-retroviral therapy (ART) plays a key role in achieving healthier nutritional status (Heikens *et al*.,2008). According to Heikens *et al,* (2008), 75% of the mortalities among HIV infected

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children before the age of five are caused by co morbidities coupled with malnutrition. The mortality rate of malnourished HIV infected children is three times higher than in uninfected children in SSA. HIV has impacted the epidemiology, clinical presentation, pathophysiology, case management and survival of malnourished children. Even with the guidelines provided by WHO, case fatality rates are at 20-50%. An increasing number of HIV infected children are being admitted to the hospital each day (Heikens *et al*., 2008).Some authors have suggested that there is a high prevalence of diarrhea, sepsis and infections among HIV infected children. These seem to have a high case fatality rate and poor prognosis even with management according to guidelines (Heikens *et al*., 2008).

Furthermore, the nutritional status and dietary intake of mother could increase risk of Mother to Child Transmission (MTCT) due to prolonged period of breaskfeeding.(Tomkins, 2005, p.486). Suggestions have therefore been made to test mothers to know their HIV status, and this will require an Opt-out testing despite the challenges associated with it. According to Asante (2007), the difficulty with mother opting out for testing is due to the risks of stigma and discrimination. This was emphasized in a study conducted by Thurstans *et al*., (2008), exploring HIV and SAM at national level in Malawi where 523 (91.7%) of parents agreed for their malnourished children to be tested, but only 368 (70.6%) agreed to be tested themselves for HIV.

There have been observations that infants with HIV infected mothers have low weight gain and height in first four months, abnormal weight loss is also observed in these infants. The lower weight gain in HIV infected children can often be ascribed to the presence of infections in such children (WHO, 2007). According to Fenton and Silverman, (2008), opportunistic infections can occur due to immunosuppression caused by the virus, and this can be viral, bacterial, parasitic or fungal (Torún, 2006; Collins *et al*., 2006; Heikens *et al*., 2008).

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Regarding lower respiratory tract infections (RTIs), TB is 22 times more prevalent in HIV-infected children than children without HIV (Heikens *et al*., 2008). Since nutrition and HIV are closely related, weight loss and wasting are problems associated with inadequate intake due to anorexia, mal-absorption, digestion, metabolic irregularities, and increased excretion of nutrients through vomiting and reduced absorption. Also, abnormal energy utilization, increased requirements and uncontrolled opportunistic infections are also involved in weight loss and wasting (Torún, 2006, p.883; Fenton and Silverman, 2008, p.1008).

Several other factors that also cause decreased food intake in infected children include medications, depression, infection, nausea, diarrhoea, dyspnea, weakness, neurological disease, fever, pain, and dementia. Low oral intake is also caused by problems in the mouth and oesophagus, such as thrush and oral herpes and dyspepsia due to zinc or other micronutrients deficiency. The reduced intake results in inadequate energy which is needed to support resting and rebuild energy expended. Other deficiencies caused by poor feeding in asymptomatic HIV infected children include beta-carotene, folate, and iron, reduced plasma levels of retinol which become acuter when AIDS set in (Tomkins, 2005, p.486). There is low serum levels of Vitamin A, Vitamin B6, Vitamin B12, Vitamin C and Vitamin E, selenium beta-carotene, zinc, and iron. Vitamin A deficiency is associated with a higher risk of HIV infection and higher risk of Mother To Child Transmission (MTCT). Mineral and vitamin deficiencies also lead to a higher risk for opportunistic infections and progression of AIDS, which can lead to death (Drain *et al*., 2007; Tang *et al*., 2005).

The gastrointestinal (GI) tract is one of the viable organs in the acquisition of HIV. HIV infection in children leads to mal-absorption caused by epithelial cell malfunction and bacterial overgrowth, diarrhoea, and infections. Mal-absorption causes watery stools,

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diarrhoea or vomiting, which can be caused by medications, a developed intolerance to lactose, fat or gluten (Fenton and Silverman, 2008, p.1008) and small intestinal damage. According to Fenton and Silverman, (2008), the immune variations seen in AIDS and SAM are alike. HIV infected persons experience protein, calcium, copper, zinc, selenium, and iron, essential fatty acids, pyridoxine, folate and Vitamins A, C, E deficiencies which interfere with immune function. Direct and indirect mechanisms are responsible for the impact of nutrition on HIV. Nutrition plays a direct role in immune-cell activation, interaction and manifestation and this secondarily also plays a role in DNA and protein synthesis as well as the physiologic integrity of cell tissues, lymphoid tissues and organ systems.

The HIV epidemic has an adverse effect on food (Tang *et al*., 2005). This is due to the fact that the secondary effects of the HIV epidemic include loss of human resource, increased need for health care and funerals, low household agricultural production due to sick household members who are unable to work, diminished ability to care and cater for young children and vulnerable individuals and the loss of financial resource, which directly or indirectly affect productivity and can lead to food insecurity.

2.2: Prevalence of Malnutrition in Children in Developing Countries.

Malnutrition is a major child health problem worldwide and a main cause of childhood morbidity and deaths, especially in developing countries and even worse in war torn zones such as Sudan. Children are more susceptible to malnutrition in developing countries because they are growing rapidly and are prone to infections (Mohammed et al, 2014). Majority of the studies addressing the issue of malnutrition in Sudan were only conducted during disasters, such as war, drought, famine or displacement hence a high record of malnutrition in Sudan. Even though there have been recent changes in the demography

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and socio-economic status of the Sudanese community, new studies conducted still show high prevalence of malnutrition in Sudan (Mohammed et al, 2014).

2.2.1. Incidence and Prevalence of HIV /AIDS In Children with Severe Acute Malnutrition

HIV virus attacks and reduces the efficacy of the body's natural defense system against disease and infection. The defense system of an infected person thus becomes vulnerable over time to other viruses that further weaken the body and cause symptoms and illnesses like diarrhoea, fever, vomiting, thrush, or anaemia (Seumo-Fosso *et al*., 2004). These kinds of ailments leads to depletion of individual nutrients that are implicated in malnutrition, including vitamins A, Vitamin E, Vitamin C, Vitamin B6 and Vitamin B12, as well as zinc (Zn), Selenium (Se) and iron (Fe) (Chandra, 1999; Semba *et al*., 2010).

In a study of 454 children with severe acute malnutrition (SAM) conducted , 17.4% (n = 79) of children were infected with HIV; with significantly higher deaths recorded among HIV infected children compared to their uninfected counterparts (35.4% vs. 10.4%, p=0.001). This strengthens the fact that in terms of mortality among children with SAM, those with HIV infection died earlier than those without. The relationship between HIV and malnutrition results in a deleterious cycle for the immune system. This was also confirmed by Fergusson *et al* (2009) in a Prospective cohort study of the Lilongwe district in Malawi.

Rapid diagnostic tests for HIV, however, can give untrue (inconclusive) results in children under 18 months due to the presence of the mother's HIV antibodies taking some time to clear. Alternatives measures are however needed for accurate diagnosis. At the moment, PCR (Polymerase chain reaction) detection of HIV is the recommended mode of testing for children under 18 months. Studies in which majority of HIV-infected children have

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severe immune suppression and are poorly nourished at presentation, constant report 5–10% early mortality among HIV-infected children starting ART (Puthanakit *et al*., 2007; Sutcliffe *et al*., 2008).

World statistics for 2007 on HIV/AIDS shows that about 2.5 million persons were newly infected and over 70% of the people died of the disease. The number of newly infected persons continues to increase on a daily basis (up to 1500). Africa has the highest HIV prevalence rates in the world ranging from 0.1%-28% with SSA being the worst hit region with AIDS as the leading cause of death in the region (UNAIDS,2008).

Malnutrition and HIV/AIDS are multi-related with malnourished children more likely to be infected with HIV as compared to children who are well nourished (Fergusson and Tomkins, 2009). Thurstans *et al*., (2008) estimated that 19 million children are severely malnourished in developing countries and malnutrition is the cause 11% of the total global disease burden and 35% of child deaths worldwide. In some regions, notably sub-Saharan Africa, human immunodeficiency virus (HIV) infection poses an added challenge to the care of malnourished children. While the clinical context and interventions for many common causes of childhood mortality globally have been addressed over the last decade, the management of severe wasting disease and malnutrition in children—particularly in those infected with.

HIV —remains poorly addressed (Hesseling *et al*., 2005). This population of HIV infected malnourished children are in many ways very different from the uninfected population for which international malnutrition guidelines (WHO 2005) were originally developed.

In sub-Saharan Africa, the epidemiology of severe malnutrition has shifted significantly to one where an increasing percentage of children requiring hospitalization is composed of those who are HIV infected or HIV exposed with case-fatality rates still as high as 20–

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50% (Heikens *et al*., 2008). Researches of varying kinds reveal that individuals who are severely malnourished [body mass index (BMI)<16.0 kg/ square meter] have been found to have six times higher risks of dying in the first 3 months than those with a normal nutritional status (Zachariah *etal*., 2006).

2.3. The Cycle of Malnutrition and HIV

There is a strong and adverse relationship between nutrition and HIV due to the fact that immune system impairments as a result of HIV/AIDS leads to malnutrition in majority of cases and malnutrition leads to immune impairments. This worsens the effect of HIV and is a contributing factor to a more rapid progression to AIDS (Cambodia, 2013; Colecraft, 2008; Mehta and Fawzi, 2007; Oguntibeju *et al*., 2007; Suttajit, 2007).

An accelerated progression of HIV infection to AIDS leads to Micronutrient deficiencies which vary across populations and according to disease stage. These deficiencies are predictive of AIDS -related mortality. Malnutrition is responsible for about 5.6 million out of 10 million child deaths per year, with severe malnutrition contributing to about 1.5 million of these deaths (Heikens *et al*., 2008). The nutritional status of children is the best sign of the wellbeing of children. The different causes of malnutrition are connected and these include immediate causes, underlying causes and basic causes (UNICEF, 2004). All these factors operate together and not independently (Williams, 2005).

The HIV virus acts by replicating inside the white blood cells from the point of infection, window period, through sero-conversion to asymptomatic and symptomatic phases. However, the immune system plays vital role in preventing severe infection. The CD4 cells are seen as critical to the immune system. Both the immune system and the levels of nutrients correlate with the progression of the disease. This implies that malnutrition results in increased replication of HIV and the former is a result of HIV itself. Bachou *et*

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al (2006) reported low CD4% in HIV-infected children with SAM in a study in Uganda. In addition, Chinkhumba *et al* (2008) conducted a study in Malawi which identified that low CD4% is linked with increased risk of mortality. Hughes *et al* (2009) also observed in Zambia that CD4 count examined was low in all HIV-infected children with SAM, even with apparent nutritional recovery.

Due to the high basal metabolic rate which attacks the HIV viral infection in extreme cases, the body mobilizes fats and proteins later on leading to weight loss, muscle wasting, weakness and nutrient deficiencies. In advanced stages, opportunistic infections that interfere with ingestion, digestion and absorption (i.e. mouth sores) and necrosis of the gastro intestinal tract set in. Poor nutrient absorption stops the body from using the nutrients provided by foods and contributes to energy and nutrient losses, which will eventually hamper the capacity and ability of people living with HIV/AIDS to meet their increased nutritional needs. If mal-absorption of nutrients is not properly addressed, the deficit in energy and nutrients will increase and further weaken the person and their immune system and speed up the progression of the disease. According to Mukhopadhyay C. *et al* (2007) research conducted in Zambia, Uganda, Thailand and Nepal report HIV infection as being associated with pathogens that are not easily treated as accompanied with prolonged diarrhoea.

The relationship between HIV/AIDS and malnutrition is a classic example of the vicious cycle of immune dysfunction and infectious diseases. There exist differences in terms of HIV prevalence and SAM. Studies conducted by Akenami *et al* (1997) and Fergusson (2009) all demonstrate high rates of HIV among children with SAM. On the contrary, studies undertaken by Bahwere, (2008) at the community level depict a low rate of HIV among children with SAM. This calls for caution in overgeneralization of relationship between HIV and SAM. In all these researches the relationship between HIV status and

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nutritional recovery is not extensively detailed. Malnutrition can weaken the immune system and increase vulnerability to infections and may speed up the progression of HIV disease.

A major side effect of nutrient depletion is generalized malnutrition which leads to widespread atrophy of lymphoid tissues, the greatest of which is in the T-lymphocyte areas. According to Isanaka (2009) such atrophy results in immunosuppressive effects including a reduction in the number and function of T-helper (CD4) cells, an inverted T-helper/T-suppressor (CD4:CD8) ratio, and decreased potential of killer lymphocytes to identify and eliminate foreign tissues. In other words, the bodies of those with malnutrition have reduced and less active lymphocytes that are needed to enhance the immune systems response to infection. Malnutrition is also associated with the presence of many of other types of lymphocytes (T-suppressor cells) that normally suppress the immune system to keep it in balance. Decreased immunity may lead to increased probability of infections, which lead to increased nutrient requirements. If such requirements are not sufficiently met, the result is even more malnutrition, and higher potential for secondary infections by opportunistic agents (Seumo-Fosso *et al*., 2004).

2.3.1 Immediate causes of malnutrition in people living with HIV

Immediate causes of malnutrition in people living with HIV are as follows;

1. Disease/illness: HIV/AIDS, opportunistic infections, and related complications
2. Inadequate food intake due to;
    - Loss of appetite due to high viral load, illness, drugs, depression, anxiety, fatigue, changes in taste.
    - Nausea or vomiting

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- Oral problems such as mouth sores, oral thrush, and pain or difficulty in chewing swallowing
- Abdominal pains/cramps,
- Drug-food interactions including drugs that need to be taken while fasting or with food. Inappropriate food preparation such as overcooking, and inappropriate textures for those with oral problems
- higher nutrient requirement as a result of illness
- Sub-optimal breastfeeding of infants
- Cultural perception in food distribution especially with quantity(men eating first)

2.3.2. Severe Acute Malnutrition and HIV/AIDS.

Koethe, *et al* (2010) are of the view that HIV contributes to malnutrition in various ways. HIV infection can indirectly or directly lead to decreased caloric intake, increased loss of nutrients, and increased use of energy. Factors that lead to malnutrition in HIV infected children include but are not limited to the following: metabolic alterations, infections, fever, gastrointestinal changes and sickness, developmental/neurological problems, and economic/financial and psychological issues. In the opinion of Magadi (2011) HIV infected children in sub-Saharan Africa are significantly more likely to be stunted, wasted, and underweight. HIV also has an impact on the lean body or muscle mass more aggressively than some other infections, resulting in a disproportionate loss of muscle as compared with the causes of malnutrition. Since there is an increased production of cytokines in HIV, infection may also contribute to wasting in HIV infection. According to Magadi (2011), increased nutritional needs, reduced food intake and increased loss of nutrients and can lead to death. Inadequate nutrition results in weight loss, muscle wasting, weakness, nutrient deficiencies, impaired immune system, poor ability to fight HIV and

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other infections and increase oxidative stress increased susceptibility of HIV infected persons to infection such as flu and TB hence increased HIV replication, hastened disease progression, increased morbidity HIV/AIDS.

Sauvageot *et al* (2010) hammered on the commonness of malnutrition in HIV-infected children for which reason their treatment have to be done jointly. All infections, especially HIV infection alters the metabolism of energy, and several other nutrients such as carbohydrates, fats, proteins, vitamins, and minerals, thereby increasing the body's requirement for these nutrients. An onset of fever may increase protein utilization and increases calorie needs by 12% for each degree Celsius above normal and 7% for each degree Fahrenheit above normal. Though there is some varying views and opinions, it is thought that HIV infection may increase resting energy expenditure (the amount of energy that the body uses to run basic cell and tissue functions at rest), which could lead to wasting (Maitland *et. al*., 2006).

Akech, *et al* (2010) reporting on their study in Kenyan children with hypervolemia and severe malnutrition, found that in such instance where resting energy is expended leading to severe wasting, there could be complications in treating children with SAM.

The relations of HIV with the GI tract can profoundly impact nutritional status especially in infants. Diarrhoea increases caloric intake and requirement by 25% and often leads to a decrease in oral intake. Mal-absorption, which is the inability of the body to absorb nutrients from the GI tract, may be associated with diarrhoea or occur without diarrhoea because of metabolic changes associated with HIV (Morand Tzipori, 2008). It can lead to vitamin, mineral, protein, fat, and carbohydrate losses as well as a decrease in oral intake.

Dehydration from diarrhoea may result in an acute weight loss and can be very life-threatening resulting from diarrhoea, which calls for recommendation of the treatment of dehydration. Severe oral candidiasis, oesophageal candidiasis, viral esophagitis, and

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gastritis can make swallowing difficult and excruciating causing decreased oral intake or feeding refusal, nausea and vomiting caused by drugs, infection, and/or illness can also result in poor oral intake, dehydration, and loss of nutrients.

Children and adults with HIV/AIDS can develop feeding problems, often due to neurological malfunctioning related to HIV, leading to inadequate intake of nutrients. Infants with HIV can have a weak suckling reflex, resulting in inadequate intake of breast milk or formula. Older children may develop poor chewing and feeding skills. Difficulty in swallowing can as well lead to poor oral intake or refusal to eat. The unfortunate aspect of this development is that the metabolic and nutritional needs of HIV-infected children are not well known as reported by Mody *et al*.; and Musoke and Fergusson (2014; 2011). Again, the high risk of aspiration and pneumonia, which is usually common in infants, can also bring about swallowing problems leading to FTT (failure To Thrive). Financial issues and poverty resulting in inadequate nutritional intake as required by the body are frequent contributors to malnutrition in many settings. These issues include an inadequate food supply, loss of household income or livelihood (such as farming) due to illness, and limited cooking and storage facilities. HIV-infected adults may be too ill or uninterested to care for themselves and their children. Depression in an adult or child can also lead to a reduction in appetite and poor nutrient intake. (Trehan *et al*., 2012). Malnutrition can be caused either by its immediate, underlying or basic causes.

Variations in Nutritional Recovery 0f Severe Acute Malnutrition in HIV Infected Children and Non-HIV Infected Children

Having adequate knowledge of the treatment outcomes of malnourished HIV children is very important. Interestingly, the use of ART in HIV-infected children with side effects of malnutrition must always be guided with regards to its optimal timing, regimen and dosing (WHO, 2005/2009).

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The need for malnourished HIV infected children to be managed in facilities is increasing by the day (Heikens *et al*., 2008). There is substantial evidence in Sub-Saharan African countries to prove that HIV infected children can recover their maximum nutritional status when given the right treatment for severe acute malnutrition (SAM). Nevertheless, Collins *et al*., (2006), report that their recovery is slower than that of uninfected children.

One treatment outcome of the use of the ART among malnourished HIV AIDS (those suffering from marasmus) is that there is an increased rate of death in those with severe Marasmus (Callens *et al*., 2009), but no trial evidence exists to suggest that waiting until a child's nutritional status improves has any association with improved outcomes. In fact, an important recent retrospective study postulates that malnourished children who start promptly have higher rates of nutritional recovery and weight gain than those in whom ART is delayed (Kim *et al*., 2012).

In a study conducted in Zambia, Hughes *et al*., (2009) discovered that the nutritional status of severely malnourished HIV-infected children is not enough to improve their immunological status without ART. Another study by Fergusson *et al*. (2009) agrees with Hughes. In the study by Fergusson, the findings confirmed that HIV-positive and HIV negative SAM children achieved nutritional recovery (85% weight for height and no oedema), regardless of HIV status. Those with HIV- infection had similar weight gain compared to HIV-uninfected children (8.9 vs. 8.0g/kg/d). This did not prove significant.

2.3.3. Immediate Causes of Malnutrition

The major causes of malnutrition especially in children according to the UNICEF (2004) are inadequate diet, stress, trauma, disease or recurrent infections and poor psychosocial care. Inadequate dietary intake may refer to poor breastfeeding practices, , delayed introduction of complementary feeding, early weaning and lack of protein, carbohydrate,

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vitamins and macronutrients as required by the body The inadequate intake of dietary requirements can also be traced to mistreatment and domestic abuse (UNICEF, 2004; Williams, 2005).

Insufficient Diet

Evidence shows that, families who are faced with the issue of unemployment and low income-earning end up enjoying cheaper food, which contains little to no nutrition, leading to weight loss and malnutrition (UNICEF, 2009b). Animal sources of protein are usually more expensive in Sub-Saharan Africa, children's intake of proteins and nutrients from these food groups decreases when income is low (Christiaensen & Alderman, 2004) Worldwide, the practice of exclusive breastfeeding for a period of at least six months is declining and this contributes to the high prevalence of malnutrition worldwide (Davies-Adetugbo, 1997; Faruque *et al*., 2008; Onah *et al*., 2014). Again, nutrient deficiencies and low energy and protein intake seen in children are due to the increased use of diluted cow's milk and vegetable foods and a delay in giving children family foods (Kapur *et al*., 2005; Torún 2006). Even though breast milk is rich in high quality protein (Torún, 2006), prolonged breastfeeding causes a delay in the complementary feeding and can lead to micronutrient deficiencies and further cause severe malnutrition , as human milk is low in iron and other micronutrients. (Kalanda *et al*., 2005). Conversely, babies are sometimes weaned too early because of new birth, causing the mother to cease breastfeeding of the first baby. Babies are then often weaned on a diet of cereals or grains with low quality protein. Substitutes for breast milk may be unsuitable because of a high renal solute load (cow milk) or low energy density (diluted cow's milk or incorrect formula) (Duggan and Golden, 2005).

A study conducted by Kapur *et. al*. (2005) in India showed that there is the likelihood of growth faltering by the fourth month of life due to the early introduction of weaning foods.

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In the Prevention of Mother to Child Transmission (PMTCT) initiative , mothers that opted for exclusive breastfeeding had a mean duration of exclusive breastfeeding of less than one month (UNICEF, 2007).

Diseases and Malnutrition

Majority of children who die between the ages of 6-59 months old had complications from malnutrition and infection (Mahgoub and Adam, 2012; Vygen *et al*., 2013).In the year 2004, the principal cause of deaths in young children globally were: diarrhoea (60,7%), pneumonia (52,3%), measles (44,8%) and malaria (57,3%); all of which can also worsen malnutrition (Caulfield *et al*, (2004). Some additional causes associated with child mortality were found by Muller and Krawinkel (2005) and UNICEF (2009) to be perinatal causes, acute respiratory infections and others. Infections play a major role in the aetiology of SAM because they result in increased needs and a high-energy expenditure, lower appetite, nutrient losses due to vomiting, diarrhoea, poor digestion, mal-absorption and the utilization of nutrients and disruption of metabolic equilibrium (Ambrus and Ambrus, 2004; Schaible and Kaufmann, 2007; Schneider *et al*., 2004). Malnourished children take more time to recover from respiratory and diarrhoea diseases and this increases the risk of morbidity and mortality among malnourished children. Repeated illnesses contribute to ill health and compromised nutritional status.

2.3.4. Underlying Causes of Malnutrition.

The underlying causes of malnutrition as stated by UNICEF, (2004) and Müller *et al,* (2005), include inadequate care of children, average to below average educational levels and information, inadequate health service, an unhealthy environment (non-availability of sanitation and safe water) and insufficient levels of household food security. For

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malnutrition to improve there must be specific emphasis on social norms, gender equality and maternal access to formal education (UNICEF, 2009c).

Inadequate Care of Children

Childcare practices must emphasize protecting children's food and drinks from contamination to reduce the risk of infections. In majority of cases, ignorance is directly associated with poor infant and parenting practices, misconceptions about food, insufficient feeding during illness (especially infectious diseases and diarrhoea), improper food distribution among family members, poor maternal care and high birth rates (Bain *et al*., 2013; Ijarotimi, 2013).

In Southern Africa, a decrease was recorded in caring capabilities of caregivers the moment poverty and food insecurity increases (Shoo, 2007). Poverty can indirectly negatively affect caring practices. For instance, When the household income decreases, it is usually the women who try to earn extra income. This causes the mother to have less time for childcare and also make sue the children eat healthy food. In cases where the female children are also sent out to look for work, it results in poor school attendance, which affects education, leading to poor knowledge and caring practices for their family (UNICEF, 2009b).

Malnutrition and Formal Education

Access to information in Africa can be quite tedious. In most cases insufficient knowledge and information leads to a worsened state of malnutrition, especially when there is lack of maternal nutrition education (Abuya *et al*., 2012; Gupta *et al*., 1991). This ultimately leads to unhealthy dietary habits, poor nutrition-related practices, negative attitudes and perceptions and negative sociocultural practice. All of these issues can adversely influence nutritional status. For families to be healthy with a good nutritional status, they need

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knowledge regarding growth, purchasing, processing, and preparation and feeding on a variety of food, in the right quantities and combinations (Gupta *et al*., 1991; Owoaje *et al*., 2014; Silveira *et al*., 2010a). A lack of nutritional knowledge can also lead to misconceptions about food and negative food traditions that are passed on from generation to generation (Owoaje *et al*., 2014; Silveira *et al*., 2010a).

The association between maternal schooling and child health still needs to be investigated further. Formal or school education and knowledge can influence the child's health and nutritional status in three major ways: (1) formal education leads directly to a higher knowledge of mothers; (2) literacy acquired in school ensures that mothers are more capable of identifying health problems in children; and (3) comparatively mothers who have attended school are more aware of modern diseases and where to get help and information. Even though nutrition knowledge is not directly gained in the classroom, the school education that mothers receive can help with caring for children and the household. Both female and male education can have an immensely positive effect on the child's nutritional status. (Owoaje *et al*., 2014; Silveira *et al*., 2010a).

Knowledge they say is power and its acquisition can lead to a higher household income and better nutritional status when the education is linked with strategies to improve both. Maternal nutrition knowledge is even more important when the child falls within the high-risk group of younger than three years, as there is correlation between low maternal literacy and poor nutritional status of children three to 23 months (UNICEF, 2009c).

2.3.5. Basic Causes of Malnutrition

There are several factors that lead to or cause malnutrition. Among them are insufficient availability and control of resources (political, social, ideological and economic), environmental degradation, poor agricultural practices which lead to shortage of food,

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war, political instability (which is rampant in Africa), urbanization, population growth, size and distribution, conflicts, trade agreements and natural disasters, religious and cultural factors (UNICEF, 2004a; Torún, 2006). In addition, landlessness and migrant labour are also considered to be basic causes of malnutrition.

Other basic causes include market failures due to economic decline, conflict and political upheavals that can lead to a reduction in food yields and price increases (Mason *et al*., 2005).

Loss of food after a harvest can also occur when storage conditions are poor and food is inadequately distributed (Torún, 2006). If issues related to the economic position of the family are affected negatively, it can influence the chances of a child being stunted and underweight (UNICEF, 2004a).

2.4. Conclusion

Management of malnutrition has shown to be pertinent in the development of any country, especially those in the lower-middle-income countries (LMICs). It requires prioritization as a nation with special focus on children with HIV. There is enough evidence that when the education is linked with strategies can lead to better management and better nutritional status and improve both.

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CHAPTER THREE

3.0: METHODOLOGY

3.1 Introduction

This chapter outlines how the study was conducted by describing study design, type of data sources, method of data collection, data analysis and ethical issues considered.

3.2 Study Area

The study was conducted at the Komfo Anokye Teaching Hospital in the Ashanti Region of Ghana. Komfo Anokye teaching hospital (KATH) is the second largest hospital in Ghana and the only tertiary health institution in Ashanti Region (Ghana Health Service report, 2015). KATH has a bed capacity of 1500, and 14 Directorates including Child Health Directorate (Ghana Health Service report, 2015). The Child Health Department is made up of the PEU (Pediatric Emergency Unit); Nutritional and Gastroenterology conditions as well as Infectious Diseases e(WardB4); Neurological, Haematological and Oncological conditions (WardB5); Mother and Baby Unit (MBU); Paediatric and Neonatal Intensive Care Unit (PICO and NICO) among others (Ghana Health Service report, 2015).

3.3 Study Design

A cross-sectional survey involving HIV infected children under 5 and their care givers who are receiving treatment at KATH, was conducted in June 2017. Data was collected using closed ended questionnaire. Data was entered directly into excel for analysis.

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3.4 Data types and sources

Data for this study comprised both primary and secondary data. Primary data were obtained from caregivers of HIV-infected children using questionnaires. Relevant data on medical history, referral for diet therapy as well as dietary management during hospitalizations (where applicable) were obtained from folders of children.

3.5 Study population

The study respondents were children and caretakers of children under the age of five years attending the Paediatric Ward of the KATH.

3.6 Inclusion criteria

The study involved HIV infected children aged between 6 months and 5 years who have records at KATH. This included those on admission and OPD cases.

3.6.1 Exclusion criteria

Children who are on admission at the paediatric ward with other chronic diseases will be excluded from the study. As well as children, whose HIV status are not known but are suffering from malnutrition.

3.7 Sample Size Determination

The sample used was HIV positive tested children attending the Komfo Anokye Teaching Hospital who have their records with the hospital regarding their age, HIV status and other useful data. For purposes of sample size calculation, this study estimated prevalence of underweight in HIV positive infants aged < 60 months to be 10% for developing regions

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(World Health Statistics, 2014). At a confidence interval of 95% and the margin of error at 5%, the sample size is calculated as,

n= (z2pq)/d2

Where

z =confidence level of 1.96 at 95%

p=estimated prevalence of malnutrition and HIV, 10% or 0.10

q= (1-0.10) = 0.9

d= margin of error of 5% or 0.05

n= 138

A non-response rate is adjusted for at 5%, giving approximately 150 participants.

3.8 Sampling Method

Systematic random sampling was employed in selecting participants, at a random starting point and periodic interval of 3. Where a selected participant was unwilling to participate, the systematic sampling technique was repeated till the required number was obtained. The register or attendance list for pediatric HIV patients was used with data from most recent attendance backwards until required sample size is attained. Appointments were booked with care givers of eligible children over the data collection period.

3.9 Data Collection Technique/Procedure

Systematic random sampling method was used to select children who met the inclusion criteria and had caregivers who were willing to participate in the study, till the sample size was obtained.

Eligible children U5 were weighed with hospital weighing scale (Proscale-made in China)and height checked with a stadiometer (H&D scale-made in China) and figures

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were recorded. Children less than 2 years were weighed with a baby scale and height checked with an infantometer. With children who were very sick and above 2 years, weight was taken with the caregiver carrying the child on a balance scale (Proscale-made in China) and then caregiver's weight was subtracted to obtain the child's weight. All weighing equipment were calibrated and cleaned prior to use. Only children above six months had their Mid Upper Arm Circumference (MUAC) taken and figure recorded. All measurements taken were recorded in their exact figure or rounded up to the nearest millimeter. Other needed information was obtained from hospital record files. Data were collected within a period of three (3) weeks. Questionnaires (Appendix II) were administered to caregivers; questions were interpreted in local language well understood by the caregiver.

3.9.1 Data processing

The data obtained were directly entered into excel and coded. The data was exported to STATA Version 14.1 for management and analysis.

3.9.2 Variables

Two main variables considered in this study: outcome/dependent variable and independent variables. The outcome variable for this study is prevalence of malnutrition. Independent variables considered in this study include socio-demographic characteristics, medical history, clinical characteristics, weight, height/length and history of use of nutritional management services.

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3.9.3 Data Analysis

Descriptive statistical analysis was performed to describe children's demographic characteristics and results and presented in presented in tables and graphs. Regression analysis (multiple logistic regression) was employed to assess the factors that determine malnutrition among HIV children. Confidence level of 95% was reported on all estimated Odds and $P<0.05$ (at 5% level of significance) will considered as significant. The following anthropometric indicators were used classifying malnutrition(wasting): "Mild"= weight for height < –1 standard deviations (SD) ; "Moderate"=weight for height < –2 standard deviations (SD); "Severe"- weight for height < –3standard deviations (SD).

These cut off point and Z scores were arrived at using the WHO Child Growth Standards for weight for height.

3.9.4 Ethics

Approval to conduct the survey was obtained from the Ethical Review Committee of the Ghana Health Service (GHS/RDD/ERC/ADMIN/17/538), see appendix III. Permission was also sought from the Metropolitan Director of Health Service and hospital management of the Komfo Anokye Teaching hospital before collecting data in the facility (appendix II). Written informed consent (Appendix I) was obtained from all participants (caregivers). The consent form was written in English language and translated into a local language of the participant's choice so they could understand. Participants were asked to append their signature or thumb print after the interviewer/ research assistant had explained the intent of the study and the content of the informed consent form. The interviews were conducted at the premises of the health facility but in an environment, that ensured privacy and confidentiality with one interview at a time.

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CHAPTER FOUR

4.0: RESULTS

4.1: Background characteristics

A total of 105 children aged 6 to 59 months participated in the study. The mean age was 27.6 months (SD=14.5). As shown in Table 1, the highest proportion of children were within the first and second year of life, followed by those within the second and third. Majority of the respondents were thus 3years and younger. Majority of the caregivers (84.8%) indicated that they were married, and employed, albeit in the informal sector. Most of these caregivers (82.9%) receive a monthly income of GHS 200-500. Also, a fifth of the caregivers had received no formal education and 11.4% had obtained tertiary education.

Most (83.8%) of the patients did not have any identified clinical signs or symptoms of malnutrition. However, 16.2% had recorded at least one sign attributable to the presence of malnutrition which included pitting pedal edema, general malaise, skin and hair changes, oral changes as well as musculoskeletal disorders. About 25% of the children had recorded concomitant comorbidities or illnesses from their hospital folders. These consisted of tuberculosis (9.5%), pneumonia (2.9%), otitis media (1.9%), renal impairment (1.0%) among others. As of the time of the study, 45.7% of the respondents were not on any anti-retroviral medication.

Table 1 shows that the number of patients who had previously been admitted on account of HIV related illnesses was 63.8%, while those who had never been admitted accounted for 36.2% of the children.

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Table 3: Background characteristics of respondents

Background characteristics	N	%
Sex		
Male	60	57.1
Female	45	42.9
Age (Months)		
0-12	15	14.3
13-24	35	33.3
25-36	30	28.6
37-48	12	11.4
49-60	13	12.4
Caregiver's marital status		
Married	89	84.8
Not married	16	15.2
Caregiver's level of education		
None	21	20.0
Primary	37	35.3
Secondary	35	33.3
Tertiary	12	11.4
Monthly Income (GHS)		
200.00-500.00	87	82.9
600.00-900.00	14	13.3
Above 1000.00	4	3.8
Manifestation of at least one clinical sign		
Present	17	16.2
Not present	88	83.8
Frequency of feeding		
Twice	3	2.9
Three times	58	55.2
Four times	13	12.4
Five or more	31	29.5
Presence of diagnosed comorbity		
Present	26	24.8
Not present	79	75.2
ART administration		
Currently on ART	57	54.3
Not on ART	48	45.7
History of previous admissions		
Previously admitted	67	63.8
Never been admitted	38	36.2

4.2 Prevalence of malnutrition

Although 83.8% of the patients had no identifiable clinical signs or symptoms of malnutrition ,the majority (62%) of the respondents were malnourished based on their weight-for-height z score ranging from mild to severe degrees of wasting as shown in

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Table 2. The remaining 38% of the total respondents were normal and well-nourished as determined by the weight-for height z score shown in the fiigure below (figure 1).

Figure 3: Proportion of malnourished children based on weight-for-height z-score

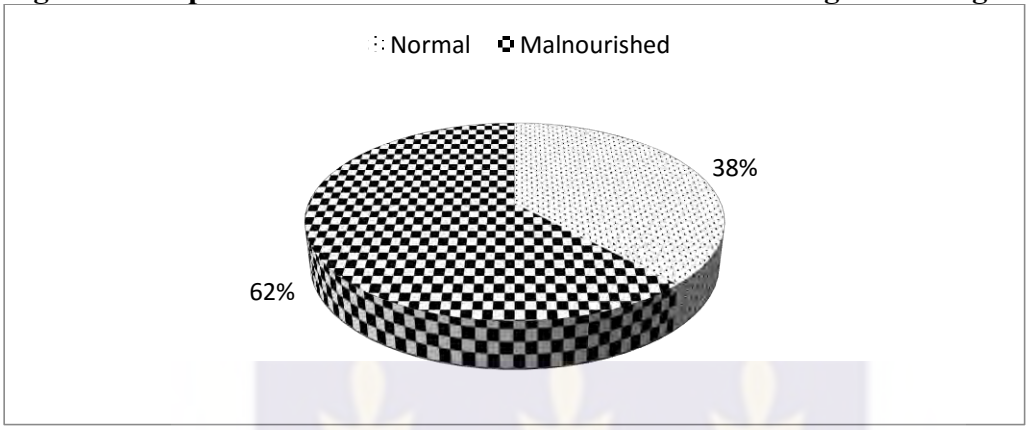


Figure 4: Proportion of malnourished children based on the MUAC

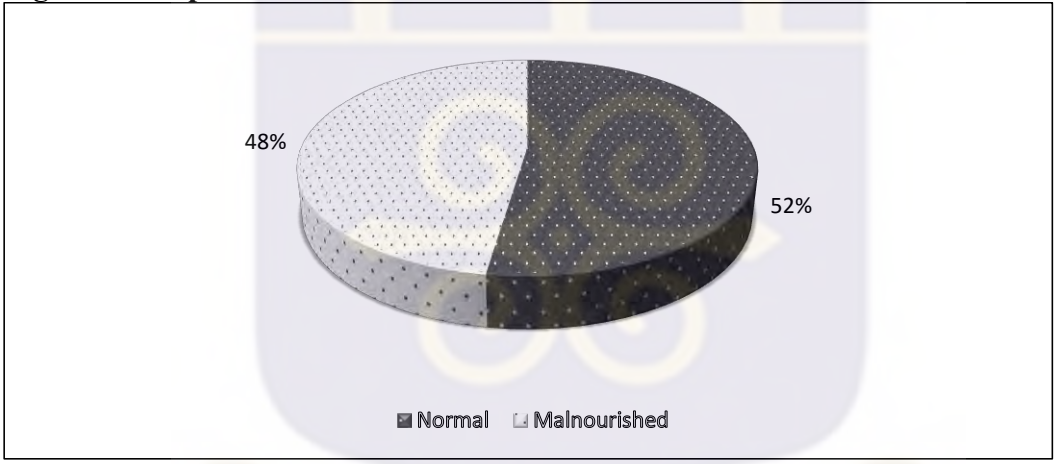


Table 4: Prevalence of malnutrition based on weight-for-height z-score

Normal	40	33.0 (14.3)	38.1
Mild(<-1)	9	26.3 (14.2)	8.6
Moderate(<-2)	10	36.1 (19.0)	9.5
Severe(<-3)	46	21.4 (11.0)	43.8
Total	105	27.6 (14.5)	100.0

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Table 2 describes the various stages of malnutrition (wasting) based on weight for height z scores. The majority (43.8%) of respondents were severely malnourished.

Table 5: Factors associated with malnutrition

	Unadjusted		Adjusted	
	OR (95% CI)	P-value	OR (95% CI)	P-value
Sex		0.6095		
Male	Ref			
Female	1.23 (0.56, 2.67)			
Caregiver's education level		0.0213		0.0871
None	Ref		Ref	
Primary	4.71 (1.44, 15.46)		1.70(0.54, 5.36)	
Secondary	1.31 (0.44, 3.86)		0.54(0.21, 2.05)	
Tertiary	1.10 (0.26, 4.55)		0.23(0.15, 1.47)	
Caregiver's income level		0.6426		
<500	Ref			
500+	0.78 (0.26, 2.21)			
Exclusive breastfeeding		0.1772		
No	Ref			
Yes	0.59 (0.27, 1.28)			
Previous admission		0.0193		0.117
No	Ref		Ref	
yes	2.68(1.15, 6.28)		2.14(0.83, 5.54))	
Child on ART		0.0130		0.227
No	Ref		Ref	
yes	2.73(1.22, 6.11)		1.77(0.70, 4.44)	
Regular checkups		0.4502		
No	Ref			
yes	0.62(0.18, 2.17)			
Other Siblings with hiv		0.0043		0.054
No	Ref		Ref	
yes	5.87(1.53, 22.510)		4.17(0.10, 1.02)	

In determining the factors associated with malnutrition, logistic regression was run for the following variables; sex, caregivers educational level, caregivers income level, exclusive breastfeeding , previous admission, child on ART, children with other siblings and regular checkups, against severe malnutrition as the outcome variable, to determine their effects and the level of risk associated with malnutrition.

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As shown in table 4.3, children whose caregivers had only primary education had 4.7 times higher odds of being malnourished ($p<0.05$) compared to those with no education, however the odds of the child being malnourished decreases as the educational level of the caregiver increases beyond primary level. After adjusting for the effect of other significant variables, the association between education and severe malnutrition was no longer significant although the trend remained similar.

Children who had been previously admitted were 2.68 times more likely ($p<0.05$) to also be malnourished compared to those who were not. Also, those who were on ART were 2.73 times more likely to be malnourished compared to those who were not ($p<0.05$). Those with other HIV positive siblings also had a higher odds of being malnourished ($p<0.01$). After adjusting for the joint effect of these variables, these associations were no longer significant as seen in Table 4.3. Having a sibling who was also HIV positive remained the only factor closely associated with malnourishment ($p=0.054$) after this adjustment. The initial associations were likely due to chance.

Table 6: Nutritional support

Nutritional support	N	%
Number of visits to the nutrition officer		
More than a month ago	6	5.7
Once	50	47.62
Twice	4	3.81
No record	45	42.87
Supplementary food given		
No	2	1.90
Yes	27	27.62
Counseling given		
No	5	4.79
Yes	52	49.52
Do you pay for nutritional support?		
No		
Yes	56	53.33
	1	.095

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4.3 Nutritional support

Out of the 105 respondents, 57.13% respondents visited the nutritionist routinely for check-up, out of which 5.7% respondents visited the nutritionist at least once in two months. 47% visited once in a month and 3.81% visited twice in a month. The remaining 42.87% (45) respondents however failed to visit monthly. Almost all who visited were counseled and about half of them were given supplementary feed, based on nutritional assessment. Also, 92.38% of total respondents received support from family and friends.

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CHAPTER FIVE

5.0 DISCUSSION

With the aims to determine the prevalence of malnutrition among HIV-infected children under five, as well as determine associated factors and extent of nutritional support, this study determined that the prevalence to be 62% (MUAC). This study also found several associated factors to be associated with the development of severe acute malnutrition. Also, most (92.4%) of the participants had support from family.

5.1: Background characteristics

This study had a higher number of boys (57.1%) having HIV as compared to the girls (42.9%).there is evidence that girls are at higher risk of HIV infection than boys (Biggar et al., 2006; Taha et al., 2005). However the higher proportion of HIV infected boys in the outcome of this study however may not necessarily represent gender susceptibility to infection but a local social inclination to ensure that the male-child survives.

Most (82.9%) of the caregivers of the children had salaries within the GHS 200 and GHS 500 income range. This implied that most caregivers of HIV children are low-income earners. While this may not reflect entire household earnings since most indicated they were married, poverty has been well recognized to be a strong indicator of the spread of HIV (WHO, 2011).

The pathophysiology of HIV is well noted in medical literature to make the infected more susceptible to other infections and conditions. Findings of this study confirmed this assertion with a 24.8% occurrence of recorded comorbid conditions (Torún, 2006). This may however not all be complications of the disease condition but may as well be synchronous.

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5.2: Prevalence of malnutrition

Many methods have been used to measure malnutrition over the years (Ge & Chang, 2001). In this study however, the indicators used in the assessment of malnutrition are mid upper arm Circumference less than 11.5cm (MUAC) and weight-for-height z-score, a standard well described by the WHO (WHO, 2016). This study's finding of 62% prevalence of malnutrition based on the WFH z score is similar to a study conducted in central and west Africa by Jesson et al (2015) who reported a prevalence of 42%. This study found a significant proportion of respondents with severe malnutrition which has implications for disease progression and survival of children under five. According to Black et al. (2008), severe acute malnutrition (SAM) is associated with increased severity of common infectious diseases, and death amongst children with SAM is almost always as a result of infection. In the same population, using the MUAC, the prevalence was found to be 52%. The two systems were however found to be associated. ($p<0.001$), favorably comparing to findings in literature (Ge & Chang, 2001).

5.3: Factors associated with malnutrition

From the variables investigated, this study showed caregiver's educational level, children with other siblings and children on ART were found to be significantly associated with severe malnutrition. According to Hein and Hoa (2009), a network of factors influence nutritional status, including sex, caregivers income level, caregivers educational level, exclusive breastfeeding, previous admission, child on ART among others.

Higher caregiver/parent educational level was found protective against severe acute malnutrition. Knowledge can lead to a higher household income and better nutritional status when the education is linked with strategies to improve both. Maternal nutrition knowledge matters even more when the child falls within the high-risk group of younger

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than three years, as there is an association between low maternal literacy and poor nutritional status of children three to 23 months (UNICEF, 2009c). The GDHS (2014), has emphatically established that there is an inverse relationship between mothers' education and child survivorship.

Evidence from Zambia shows that simply improving the nutritional status of severely malnourished HIV-infected children is insufficient to improve their immunological status without ART (Hughes *et al*., 2009). The role of anti-retroviral therapy (ART) in achieving better nutritional status is vital Heikens *et al*.,(2008),.However, findings from this study suggest children on ART are 2.73 times more likely to be malnourished compared to those not on ART.

Most of the respondents were diagnosed between 8 months to 2 years. Of the 105 respondents, 56 (53.8%) were on ART at the time this study was conducted. However, the UNAIDS vision 90-90-90: treatment for all by 2020 recommends that 90% of all people living with HIV will know their HIV status,90% of all people with diagnosed HIV infection will receive sustained antiretroviral therapy, 90% of all people receiving antiretroviral therapy will have viral suppression by 2020. From this study, a lot is required in attaining the vision 90-90-90 target especially pertaining to early initiation of ART for children diagnosed with HIV.WHO recommends that ART be initiated in all children living with HIV younger than 1 year old at any CD4 cell count (WHO guidelines, 2015). This finding requires further investigation to better understand the relationship between ART usage and malnutrition in this population. .

This study also found children who had other siblings to be 5.87 times more likely to be malnourished than children without siblings. Although there was no investigation on number of sibling from this study, a study by (Shoo, 2007) revealed that increased number

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of children in a household coupled with food insecurity affects the quality and quantity of food intake which may not be enough as required by the body. Improper food distribution and lack adequate parental care and among family members with high birth (Bain *et al*., 2013; Ijarotimi, 2013).

5.4: Nutritional support

This study found that respondents who visited the nutritionist for check-up were adequately supported with supplements such as RUTF, a means which has been endorsed by WHO (WHO, 2011). Ready to use therapeutic food (RUTF) interventions started more than a decade ago; they have proven nutritional superiority and effectiveness and also make community management of the malnourished possible, however Cost and sustainability are the current limitations of RUTF for developing countries including Ghana (UNICEF, 2007). From this study, nutritional support from hospital, were only received by patients who visited the nutritionist. Community Based Management of Malnutrition (CMAM), a viable option to improve service coverage and outcomes in health systems where inpatient therapeutic care alone cannot suffice, seems to have been left out. Although CMAM is integrated into the Ghana Health Sector Medium Term Development Plan 2010–2013 has seen extended coverage since the successful rollout of the programme , very little is reported on the program in recent times (Maleta & Amadi, 2014). Almost all caregivers received support from family and friends although a few of them (7.62%) single-handed fend for themselves and their children. most of these caregivers were female who were aunties, grandmothers, or single mothers. Yet a study conducted by Aranka et al. (2011), indicated that nutrition support services in SSA were mainly situated in the urban areas and mostly from donors and organizations rather than family and friends. UNICEF provides support for nutritional assessments and counseling

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to manage HIV disease and the side effects of antiretroviral drugs. UNICEF also supports therapeutic feeding, together with antiretroviral therapy, for children living with HIV and suffering from severe acute malnutrition (UNICEF, 2010). From this study, nutrition counseling was available to most respondents if not all, which is similar to finding of Aranka et al. (2011), where nutritional was reported to be available to 95% of respondents.

5.5 Limitations

It was recognized that data from this study that some contextual factors such as number of siblings, specific occupation of caregiver, nutritional status of caregiver and paternal involvement were missed and therefore not included in the analysis. It is likely that these unobserved factors may moderate the observed relationships between HIV/AIDS, child malnutrition and associated factors observed.

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CHAPTER SIX

6.0 Conclusions

This study revealed a high prevalence of malnutrition , with severe acute malnutrition (SAM) being predominant. Factors significantly associated with SAM among HIV infected children under five years are caregiver's educational level, child having other siblings with HIV and ART usage. Most caregivers received financial support from family and friends and the hospital provides nutritional support to visiting patients who visit the nutritionist.

6.1 Recommendations

In view of the findings from this study, the following are recommended:

There is the need for more frequent nutritional assessment and support provided to HIV-infected children, by tertiary health institutions in Ghana.

There is the need for early initiation of ART for children with HIV provided by Ghana AIDS Commission and Ghana Health Service. While it is also evident that these children receive nutritional support before onset on malnutrition symptoms of malnutrition could lead to optimum clinical response and survival of ART-treated children.

Community–Based management of malnutrition (CMAM), an initiative for treating children with malnutrition in the community before they become seriously ill, should be intensified in Ashanti region by Ghana Health Service,to reduce the pressure on regional health facility for nutritional support and as well save patients cost of transportation to health facilities and at large, reduce preventable mortalities among HIV infected children under five.

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Caregivers should be properly counseled by healthcare providers, on the need for nutritional support and scheduled for timely visits to the nutritionist to ensure adequate growth monitoring and supervision

Further research needs to be carried out to investigate ART adherence and malnutrition in children with HIV.

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APPENDICES

CONSENT FORM

Title of Research: Prevalence of malnutrition among HIV infected children under five years at Komfo Anokye teaching hospital

General information about the study Malnutrition is basically an imbalance in nutrition which could either be excess or inadequate nutrients intake as required by the body, termed as overnutrition and undernutrition. Nutrition has increasingly been recognized as a fundamental pillar for socioeconomic development. The death rate for malnourished children under-five(U5) years in many developing countries is alarming. This study is being conducted by Linda Kafui Avornyotse, an MPH student of the School of Public Health, University of Ghana, Legon; for the purpose of describing the prevalence of malnutrition among HIV infected children U5 at KATH and to investigate the level nutritional support and counselling available to them.

You will be asked some questions about the health of the child, your health and personal information. Body measures of the child will also be taken as it is relevant for the study Questions will be asked in the language you can speak and understand for effective communication. Interview and procedures should take approximately 20 minutes.

Possible risk and discomfort: This research does not expose you to additional risks beyond that encountered when seeking healthcare. However, care giver may have to disclose their HIV status and other personal information which may be quite discomforting. You are advised in such cases to talk to the counselors at the HIV clinics at Komfo Anokye Teaching Hospital

Possible benefit: Information obtained from this study will be used to describe the state of malnutrition among HIV infected children under five which may then inform policies and

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prompt aids and support from charitable organizations if need be. This will improve the quality of nutritional support and care given to HIV infected children.

There are no costs for participating in this study other than time spent during the interview.

Voluntary participation: Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, do feel free to express any discomfort with regards to any questions asked .If you decide not to participate in this study at any time, there will be no penalty of any kind.

Confidentiality: Please be assured that your identity and all other information obtained will not be disclosed to anyone and is solely for the purpose of this study hence you are not required to provide any name.

Compensation: Participants will be given 20ghc each for transportation back home as a form of compensation

For further clarification or questions concerning this study, you may contact ;

Linda Kafui Avornyotse on phone number 0503397669 or via email

gemmalyne18@gmail.com

If you have any questions about your rights as a research participant, you can contact the Ghana Health Service Ethical Review Committee at the following address:

Hannah Frimpong

GHS-ERC Administrator

GHS-Ethical Review Committee

Research and Development Division

Ghana Health Service

P. O. Box MB 190

University of Ghana http://ugspace.ug.edu.gh

Accra-GhanaOffice: 233(0)243235225 / 0507041223 Email:

Hannah.Frimpong@ghsmail.org

Title of Research Project:

PREVALENCE OF MALNUTRITION AMONG HIV INFECTED CHILDREN UNDER FIVE AT KOMFO ANOKYE TEACHING HOSPITAL

The study has been described to me in language that I understand and I freely and voluntarily agree to participate. My questions about the study have been answered. I understand that my identity will not be disclosed and that I may withdraw from the study without giving a reason at any time and this will not negative.

Participant's name……

Participant's signature……

Witness……..

Date……

Signature of person obtaining consent ……

Date……..

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KOMFO ANOKYE TEACHING HOSPITAL

RESEARCH AND DEVELOPMENT UNIT (R & D)

CERTIFICATE OF REGISTRATION

REG. NO *RD/CR17/209*

This is to certify that

Prof/Dr/Mrs/Mr/Ms. *Avornyotse Linda Kafui*

has registered his/her proposed study titled *Prevalence of Malnutrition among HIV Infected Children Under 5 at Komfo Anokye Teaching Hospital*

with the Research and Development Unit.

Date *21st June, 2017*

Name of issuing officer *Ms. Juliet Ampoah Frimpong*

Signature

K/16/0381471

Receipt No

***This certificate does not constitute ethical clearance for the conduct of the study but proof of registration of study with KATH. Ethical clearance from the Committee of Human Research Publications and Ethics (CHRPE) is required to conduct the study*