NUTRITION STATUS OF CHILDREN UNDER TEN YEAR'S OF AGE LIVING WITH HIV/AIDS IN TEMEKE MUNICIPALITY, DAR ES SALAAM, TANZANIA.

By

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CERTIFICATION

The undersigned certifies that she has read and recommends for acceptance the dissertation titled ***Nutrition Status of Children Under Ten Years of Age Living With HIV/AIDS in Temeke Municipality, Dar es Salaam, Tanzania*** as partial fulfillment of the requirements for the degree of Masters of Public Health of the Muhimbili University of Health and Allied Sciences.

Dr. G.H. Leyna
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Date--16th December 2019

DECLARATION

AND

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DEDICATION

I dedicate this work to the following:

My beloved husband Diomedes Kalisa, my precious daughter Linda, my parents Mr & Mrs Kashaija and my grandmother Paulina Mukulu.

ABSTRACT

Malnutrition is a common problem among children living with HIV/AIDS. Several studies have shown that there are high prevalence's of underweight and stunting among children living with HIV/AIDS. The objective of this cross-sectional study was to determine the prevalence of under-weight and stunting by sex among children under-ten years of age living with HIV/AIDS in Temeke Municipality, Dar es Salaam. I also attempted to ascertain whether nutrition knowledge of care-takers, foods reportedly consumed frequently and other factors were associated with nutrition status of these children.

Proportionate sampling was used on each clinic to obtain 230 HIV infected children less than 10 years of age. The children were conveniently selected together with their care-takers. Information on socio-demographic characteristics, nutrition knowledge and medical history were collected using a structured questionnaire. A short food frequency questionnaire was also administered. Anthropometric measurements were taken for children whose parent/caretaker consented.

There was no significant difference in the prevalence of underweight (25% boys vs. 34% girls; P=0.92) by sex among children 5-10 years of age. Similarly, the prevalence of under-weight (52.7% boys vs. 40% girls; p=0.29) and stunting (56.4% boys vs. 66.7% girls; p=0.6) among under-five children showed no significant difference between the sexes.

The proportion of caretakers who had appropriate knowledge on nutrition for HIV infected children was 61.7% and those with low or no knowledge was 38.3%. Nutrition knowledge was higher among caretakers who received nutritional counselling after their child tested HIV than among those who did not (P <0.001). The only factor which was found to be associated with nutrition status among under-fives was use of anti-retroviral therapy (ARV), where children not on ARV were three times more likely to be stunted compared to children on ARV (OR = 3.3; 95%CI: 1.21-8.84; P = 0.02). More than 90% of the children were able to get at least one carbohydrate food daily and at least one protein food more than four times a week. But, about 35% and 45% of the children were not consuming vegetables and fruits daily, respectively.

Government agencies, Non-Governmental Organizations and Community-Based Organizations are recommended to encourage provision of nutritious foods to children with HIV/AIDS when addressing the HIV/AIDS pandemic. Nutrition counselling and nutrition education should be the basic component in care and treatment centres. ARV should be made available to children accordingly. Further studies on meal frequencies to find out if required daily allowances (RDA's) are being met are recommended.

TABLE OF CONTENTS

CERTIFICATION ..... **ii**

DECLARATION AND COPYRIGHT ..... **iii**

ACKNOWLEDGEMENT ..... **iv**

DEDICATION ..... **vi**

ABSTRACT ..... **vii**

TABLE OF CONTENTS ..... **viii**

LIST OF TABLES ..... **xii**

LIST OF FIGURES ..... **xiii**

LIST OF ABREVIATION ..... **xiv**

CHAPTER ONE **1**

1.0 BACKGROUND INFORMATION **1**

1.1 Introduction 1

CHAPTER TWO **4**

2.0 LITERATURE REVIEW **4**

2.1.1 Introduction 4

2.1.2 HIV in Children 4

2.1.3 Impact of HIV on Children 5

2.1.4 Economic Consequences of HIV 6

2.1.5 HIV Testing as an Entry Point to Reduce MTCT 7

2.1.6 Nutrition 8

2.1.7 Importance of Nutrition for Children in Sub-Saharan Africa (SSA) 8

2.1. 8 Relationship of HIV/AIDS and Nutrition 9

2.1.9 The Importance of Good Nutrition in HIV Infected Children 10

2.1.10 Factors Associated with Poor Nutritional Status in HIV Positive Children 12

2.1.11 Prevalence of Malnutrition in Children Living with HIV/AIDS 13

2.1.12 Nutritional Requirements for HIV-Positive Children 14

2.1.12.1 Macronutrients 15

2.1.12.2 Micronutrients 16

2.1.13 Interaction between Nutrition and Antiretroviral Treatment 17

2.1.14. Nutrition Knowledge 18

2.2 Problem Statement 18

2.3 Rationale 20

2.4 Objective of the Study 21

2.4.1 Specific Objectives 21

2.4.2 Conceptual Framework 22

CHAPTER THREE 24

3.0 METHODS AND MATERIALS 24

3.1 Study Design and Study Area 24

3.2 Study Population 24

3.2.1 Inclusion Criteria 24

3.2.2 Exclusion Criteria 25

3.3 Data Collection 25

3.3.1 Sampling Procedure 25

3.3.2 Sample Size 25

3.3.3 Data Collection Tools 26

3.3.4 Nutritional Status Assessment of Children 26

3.3.5. Food Frequency Questionnaire 28

3.3.6 Data Management 28

3.3.7 Statistical Analysis 29

3.3.8 Ethical Considerations 29

3.3.9 Pre-testing of the Study Tool 30

3.3.10 Study Strengths and Limitations 30

CHAPTER FOUR 32

4.0 RESULTS 32

4.1 Social-demographic Characteristics of Children and Respondents. 32

4.2 Nutritional Status of the Children 33

4.2.1 Prevalence of Underweight among 5-10 years Children 33

4.2.2 Prevalence of Underweight among Under-five years children 36

4.2.3 Prevalence of Stunting among Under-five years children 36

4.3 Nutritional Knowledge of Caretakers 38

4.4 Food Consumption patterns 40

4.4.1 Children 5-10 years of age 40

4.4.2 Children Under-five Years of age 41

CHAPTER FIVE 42

5.0 DISCUSSION 42

5.1 The nutritional Status of the Children 42

5.2 Factors Influencing the Nutritional Status of the Children 43

5.3 Knowledge of Care-taker 45

5.4 Food Consumption patterns 46

CHAPTER SIX 48

6.0 CONCLUSSION AND RECOMENDATIONS 48

6.1 Conclusion 48

6.2 Recommendations 48

REFERENCES 49

APPENDICES 56

LIST OF TABLES

Table 1: Conventional Indices Showing Prevalence of Under-nutrition in Children.....27

Table 2: Relationship of Nutritional Status of 5-10 years old Children Living with HIV/AIDS and Social Demographic and Economic Characteristics of their Care takers.....34

Table 3 Relationship of Nutritional Status of Children 5-10 years of age Living with HIV/AIDS in Temeke Municipality and Medical and Nutritional Characteristics 35

Table 4: Relationship between Stunting of Children under five years living with HIV/AIDS in Temeke Municipality and Medical and Nutritional Characteristics ...37

Table 5: Crude and Adjusted Odds ratio of Stunting among Children under five years living with HIV/AIDS in Temeke Municipality in relation to Medical and Nutrition Characteristic 38

Table 6: Relationship between Nutrition Knowledge of Caretakers of Children under 10 years living with HIV/AIDS in Temeke Municipality and their Social demographic Characteristics 39

Table 7 Relationship between Nutrition Knowledge of Care-takers and Nutrition characteristics and Nutritional Status of Children under 10 years living with HIV/AIDS in Temeke Municipality 40

LIST OF FIGURES

Figure 1: The relationship between good nutrition and HIV/AIDS.....11

Figure 2: Conceptual Framework for the Causes of Malnutrition in HIV Positive Children.....22

LIST OF ABREVIATION

ACC/SCN	Administrative Committee on Coordination/Subcommittee on Nutrition (United Nations)
AIDS	Acquired Immune Deficiency Syndrome
ARV	Antiretroviral
ASSAF	Academy of Science of South Africa
CDC	Centre for Disease Control
CTC	Care and Treatment Clinic/Centre
FANTA	Food and Nutrition Technical Assistance Project
FAO	United Nations Food and Agriculture organisation
HIV	Human Immunodeficiency Virus
IU	International Unit
MDH	Muhimbili University, Dar es Salaam city, Harvad School of Public
PI	Principal Investigator
PLWHA	People Living with HIV and AIDS
PMTCT	Prevention of Mother to Child Transmission
RA	Research Assistant
RDA	Recommended Dietary Allowance
SANGN	South Africa National Guidelines for Nutrition
SPSS	Statistical Package for Social Sciences

SSA	Sub Saharan Africa
STI	Sexual Transmitted Infections
TACAIDS	Tanzania Commission for AIDS
TDHS	Tanzania Demographic Health Survey
TFNC	Tanzania Food and Nutrition Centre
THIS	Tanzania HIV/AIDS Indicator Survey
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS
URT	United Republic of Tanzania
VTC	Voluntary Counselling and Testing
WHO	World Health Organization

CHAPTER ONE

1.0 BACKGROUND INFORMATION

1.1 Introduction

The Human Immunodeficiency Virus (HIV) is an RNA retrovirus that takes over the CD-4 T cells of the immune system to make copies of it resulting in a slow constant damage to the immune system (MOH&SW/NACP, 2008). HIV infection leads to Acquired Immune Deficiency Syndrome (AIDS) which is a condition diagnosed when there are a group of related symptoms due to opportunistic infections or when the body's protective T-cells drop below a certain level. HIV infection is acquired through sexual intercourse with an infected partner, exposure to infected blood and blood products, and from an infected mother to her unborn child, in the uterus, during delivery or from breast milk (NACP, 2008). The modes of transmission of HIV vary from one region to another, in sub-Saharan Africa the main mode of transmission is through heterosexual sex and from mother to child (UNAIDS, 2008)

According to the Joint United Nations Programme on HIV/AIDS (UNAIDS, 2008) out of the 32.9 million people estimated globally to be living with HIV/AIDS, 22 million people live in sub-Saharan Africa. Moreover, 75% of the 2 million deaths due to AIDS in 2008 occurred in this region. AIDS has thus caused immense human suffering in this region. The most obvious effect of this pandemic has been illness and death. However, the impact of the epidemic has not been confined to the health sector and has affected households, schools, workplaces and economies severely.

The first case of HIV/AIDS in Tanzania was reported in1983 in the Kagera region, although it is believed that for sub-Saharan Africa as a whole the problem began to surface in the late 1970s. Since then HIV/AIDS has evolved from being a rare and new disease to a common household problem, which has affected most Tanzanian families. Young people and women have been the most affected groups due to economic, social-cultural and biological reasons. Hence, economic disparities and gender inequalities may have played a role in fuelling the epidemic in Tanzania (TACAIDS, 2003)

According to The Tanzania HIV and Malaria Indicator Survey (THMIS) of 2007/8, Tanzania had by the end of 2007, 1.4 million people living with HIV/AIDS of which 140,000 were children. The national adult prevalence of HIV is estimated at 5.7% with regional heterogeneity. The prevalence of HIV is reported to decline by 1.3% from the previous estimates of 7% in 2003/4. The observed decline has been attributed to reduced risk-sexual behaviours, increase in condom use as well as reduction in number of sexual partners among young people (ages 15-24) (UNAIDS, 2008).

Despite the promising trends in reduction of risk sexual behaviours, the number of children infected with HIV/AIDS is still increasing steadily. Around 2 million children in Sub-Saharan Africa were living with HIV at the end of 2007. They represent more than 85% of all children living with HIV worldwide (UNAIDS, 2008). It is estimated that more than 90% of children with HIV/AIDS acquired the

infection intrauterine, during delivery or while breastfeeding (Kanabus and Fredrikson, 2008).

Poor nutrition is a common complication of HIV infection as it weakens an already poor immune system. Poor nutrition causes more serious problems in children living with HIV/AIDS than in adults (ASSAf, 2007). These problems include a poor growth pattern where almost all children with HIV/AIDS have been observed to grow slower than uninfected children (SANGN, 2001). Nutrition is an input to and foundation for health and development. The interaction between infection and malnutrition is well-documented (WHO, 2009). Better nutrition means stronger immune systems, less illness and better health. Healthy children learn better and are stronger. Better nutrition is thus a prime entry point to ending poverty and a milestone to achieving better quality of life (WHO, 2009). Adequate nutrition, which is best achieved through consumption of a balanced diet, is vital for health and survival for all individuals regardless of HIV status. The current study intends to investigate the nutritional status and its associated factors among children under ten years of age living with HIV/AIDS in Dar es Salaam, Tanzania.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1.1 Introduction

Tanzania is among the countries severely affected by the HIV/AIDS pandemic. It is estimated that by the end of 2007 the national adult prevalence of HIV/AIDS was 5.7%. HIV/AIDS has been one of the severest clinical and public health problems ever faced by mankind. The epidemic has caused a substantial increase in mortality among adults of reproductive ages (Blacker, 2004) reducing the average life expectancy in Sub-Saharan Africa (SSA) to 47 years, when it could have been 62 years (AVERT, 2008). It is increasingly being recognised that the HIV/AIDS epidemic in sub-Saharan Africa is being driven by and contributes to factors that also create malnutrition in particular, poverty, emergencies and inequalities (WHO, 2005).

2.1.2 HIV in Children

Children under 15 years of age account for an estimated 2 million of the 33 million people living with HIV (UNAIDS, 2008). By the end of 2007, an estimated 420 000 children were newly infected with HIV, the vast majority of them through mother-to-child-transmission (MTCT). Children from sub-Saharan Africa account for 90% of these infections (UNAIDS, 2008). Most of these children acquire HIV from their mothers during pregnancy, birth or breastfeeding (WHO, 2008). The risk of MTCT of HIV is about 15%–30% if the mother does not breastfeed the child and can be as high as 45% under prolonged breastfeeding (UNAIDS, 2008). With successful interventions the risk of MTCT of HIV can be reduced to 2% (WHO, 2008). Thus,

MTCT of HIV is almost entirely preventable, where services are available. However the coverage levels are remarkably low in most resource-limited countries (WHO, 2009).

HIV/AIDS has reversed the improvements made in reducing child morbidity and mortality rates during the last several decades. The epidemic influences child survival both directly through mother-to-child transmission and indirectly through diverting resources and attention away from children to the care and treatment of a sick parent. In several sub-Saharan African countries, infant and child mortality rates have already risen substantially and are expected to increase further in the coming years (Newell *et al.*, 2004).

According to the HIV/AIDS/STI surveillance report number 20, HIV prevalence in children below 9 years in Tanzania was 2.2% in the year 2005. HIV influences the treatment of severe acute malnutrition (SAM). It is indicated that, the rate of disease progression is much more rapid in children compared to adults where majority of children have symptoms within 12 months of detection of HIV infection (WHO, 2007). High viral load, chronic diarrhoea and other opportunistic infections impair growth in children and there is 50% mortality by the age of 24 months (WHO, 2007).

2.1.3 Impact of HIV on Children

During the years of physical growth, the child is also developing psychologically and in ways that define intellectual, social, spiritual and emotional characteristics. The circumstances or conditions in which this growth takes place can limit or enhance development. Many women who know that they have tested positive for HIV may

have no choice but to breastfeed their babies when clean water and formula milk are unobtainable, even though they risk transmitting infection to their babies. Without access to health care or a nutritious diet, infected infants often die before they are two or three years old (FANTA, 2003). The associated effect of poverty, inadequate access to household food, infectious diseases and inadequate breastfeeding and complimentary feeding practice often lead to illness, growth flattering, nutrient deficiencies, delayed development, and death particularly during the first two years of life (FANTA, 2003).

2.1.4 Economic Consequences of HIV

HIV/AIDS is not only a health problem but also has multiple social and economic dimensions and implications. Numerous studies have described the adverse effects of HIV/AIDS through erosion of human, financial, physical and natural capital as well as effects of poor nutrition on the risk of vertical transmission, disease progression and mortality in HIV infected individuals (Fawzi and Dreyfuss, 2002). It is estimated that on average, HIV-related care can absorb one-third of a household's monthly income (Steinberg et al. 2002 in Poku, 2005). Parental HIV-related illness and death often lead to decreased household resources due to treatment costs and job loss. These result in shortage of food hence poor nutrition status and other care to the children (UNICEF, 2003). In South Africa households affected with HIV/AIDS have been shown to reduce the amount of money spent on food with almost half of the households reporting food insufficiency at times (Steinberg et al. 2002 in Poku, 2005).

It has been estimated that since 1985, over 7 million farmers have died of AIDS in the 27 most affected countries (USAID, 2003). This has contributed to increased food insecurity in many areas, as agricultural work is abandoned due to death and household illness (UNAIDS 2006). The reduction in farm labour, has led to less intensive farming, and poor knowledge transfer resulting in reduced food production as well as income. Many children have become orphans and are now raised by grandparents who are old and poor or left on their own. It becomes harder for these children to access adequate nutrition.

2.1.5 HIV Testing as an Entry Point to Reduce MTCT

Voluntary counselling and testing (VCT) is a process by which an individual undergoes confidentiality counselling to learn about his/her HIV status, exercise an informed choice in testing for HIV, and cope with the results (NACP, 2005). In 2006, the Centre for Disease Control (CDC) published *"Revised Recommendations for HIV Testing of Adults, Adolescents, and Pregnant Women in Health-Care Settings in order to reduce the number of children who are infected with HIV perinatally"* (CDC, 2007). To date VCT is one of the most important prevention interventions in promoting important behaviour change in both HIV negative and HIV positive individuals. HIV positive people are motivated to seek care earlier and are provided with referral to appropriate facilities for care, support and treatment including prevention of mother-to child-transmission (PMTCT) services (NACP, 2005). VCT is a critical component of PMTCT programmes and has been a recommended practice in all HIV/AIDS prevention and care programmes with high level of scientific evidence (Perez *et al.*, 2006). Provision of voluntary, confidential

testing and infant feeding counselling for pregnant women adds opportunities for increased access to treatment, care, support and prevention (UNAIDS, 2003).

2.1.6 Nutrition

The World Health Organization (WHO) defines nutrition as *"intake of food, considered in relation to the body's dietary needs..."* while good nutrition *"is an adequate, well balanced diet combined with regular physical activity"* (WHO, 2008). There are five groups of food, namely; Carbohydrate, Protein, Fats, Vitamins and minerals, sugar and water, though water is not regarded as a food group. Any deficiency or excess of one or more of these groups may lead to malnutrition. Malnutrition can be defined as both under-nutrition and over-nutrition. Under-nutrition occurs when the body is lacking certain nutrients and over-nutrition is where the body is ingesting too many nutrients.

2.1.7 Importance of Nutrition for Children in Sub-Saharan Africa (SSA)

Malnutrition is decreasing in every region of the world except Sub-Saharan Africa, where there are a lot of health and food security problems (WORLD LINKAGES, 2003). Poor nutrition leads to reduced immunity, increased susceptibility to disease, impaired physical and mental development, and reduced productivity (Ibid). Child malnutrition is one of the most important causes of infant and child mortality contributing to more than half of all under five childhood deaths in developing countries (FANTA, 2003; Pelletier *et al.*, 1995). High prevalence rates of stunting, wasting and under-nutrition continue to be reported in different parts of Sub-Saharan Africa (WORLD LINKAGES, 2003). The fourth report on global nutrition in 2000

showed that approximately 27% of children under 5 years of age in developing countries were underweight (ACC/SCN, 2000). These estimates have increased by 8.2 million over the last decade (ACC/SCN 2000). Under-nutrition in Tanzania is estimated to have caused over 43% of children under-five years of age to be stunted, 22% to be underweight and 2% to suffer from severe wasting (URT, 2005).

2.1. 8 Relationship of HIV/AIDS and Nutrition

Malnutrition rates are increasing in the African region (WHO, 2005). Food shortages and malnutrition combined with HIV/AIDS have brought some countries to the brink of crisis (Ibid). There are multiple relations between HIV/AIDS and nutritional status. Individuals with poor nutrient status are known to be more susceptible to infections, in HIV infected individual poor nutrient status worsens an already compromised immune system increasing vulnerability to opportunistic infections, which in turn leads to deterioration in nutrient status (ASSAf, 2007). Malnutrition therefore acts as both a cause and a result of HIV disease progression. Inadequate dietary intake leads to malnutrition and lowered immune system function: it reduces the body's ability to fight infections and therefore contributes to increased incidence, severity and length of infections (ASSAf, 2007). Symptoms that accompany infections, such as loss of appetite, diarrhoea and fever, lead to reduced food intake, mal-absorption, nutrient losses and altered metabolism which lead to weight loss, growth faltering, and further weakening of the immune system (FANTA, 2003).

HIV associated weight loss and wasting may be due to negative energy balance which may be due to an inability of HIV-infected individuals to increase food intake

sufficiently to balance the increased resting energy expenditure and or decreased absorption of ingested food components due to gastrointestinal disease or virus-related disruption of the intestinal mucosa (ASSAf, 2007). HIV infection, associated with negative energy balance result in the loss of body protein stores as well as adipose tissue (Macallan et al, 1995). In HIV infections, resting energy expenditure is expected to be elevated due to increased cytokines linked to on-going viral replicative activity as well as increased protein turnover and de novo hepatic lipogenesis (ASSAf, 2007).

Research shows that the chance of infection with the HIV virus might be reduced in individuals who have good nutritional status, including micronutrients and especially, vitamin A (ACC/SCN, 1998). Again a diet rich in protein, energy and micronutrients contributes to resistance to opportunistic infections in AIDS patients (Friis, 1998). At the same time, the onset of the disease and even death might be delayed in well-nourished HIV positive individuals (ACC/SCN, 1998). Thus, higher nutrient intakes are required when the patient suffers from secondary diseases.

2.1.9 The Importance of Good Nutrition in HIV Infected Children

Because of the immaturity of the immune system in children, it causes the relationship between immunity and nutrition to be more complicated than in adults. It is hypothesised that nutritional deficiencies may play a role in the pathogenesis of HIV infection; partly because of the role of some micronutrients as anti-oxidants (FAO, 2002). Nutritional care and support are thus important from the early stages of HIV infection to prevent the development of nutritional deficiencies. A healthy and

balanced diet will help to maintain body weight and fitness. Eating well helps to maintain and improve the performance of the immune system the body's protection against opportunistic infection and therefore helps a person to stay healthy (FAO, 2002). Good nutrition helps in:

- Improving the function of the immune system and the body's ability to fight infection,
- Extending the period from infection to the development of the AIDS disease,
- Improving response to treatment; reducing time and money spent on health care,
- Keeping HIV-infected children active, and allowing them to grow normally.

Good nutrition cannot cure AIDS or prevent HIV infection, but it can help to maintain and improve the nutritional status of a person with HIV/AIDS and delay the progression from HIV to AIDS-related diseases. It can therefore improve the quality of life of people living with HIV/AIDS (Piwoz and Preble, 2000).

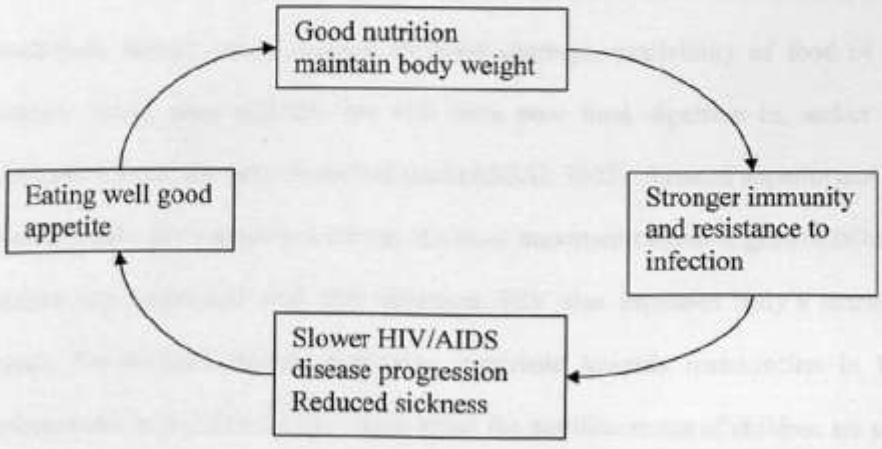


Figure 1: The relationship between good nutrition and HIV/AIDS. Adopted from Piwoz and Preble, 2000.

2.1.10 Factors Associated with Poor Nutritional Status in HIV Positive Children

HIV-related malnutrition has several causes, including decrease in food intake; the effects of opportunistic infections (of which their processes can be associated with increased breakdown of body constituents not compensated for by increased re-synthesis) (ASSAf, 2007); and metabolic inefficiencies due to cytokine activity which leads to increased energy expenditure and contributes significantly to weight loss (Macallan, 1995). Though no scientific explanation has been given, many studies have found that people with HIV tend to burn around 10% more calories while resting, compared to those who are uninfected (AVERT, 2008). People with advanced infection or AIDS (particularly children) may expend far more energy (Batterham, 2005). Again due to opportunistic infections a child may fail to eat well because of nausea and vomiting, oral thrush which may make eating and swallowing difficult and painful (SANGN, 2001).

The nutritional related factors which cause malnutrition in HIV/AIDS children are inadequate diatary intake (caused by Food shortage, availability of food of poor nutrient value, poor appetite) but also from poor food digestion in, and/or poor absorption from, the gastrointestinal tract (ASSAf, 2007). Loss of appetite and poor diatary intake are regarded as among the most important causes of growth failure or weight loss associated with HIV infection. HIV also increases body's nutritional needs. Psychosocial factors may also contribute towards malnutrition in HIV-infected children. Other factors which affect the nutrition status of children are social demographic and social economic characteristics. Low levels of education of the caretakers, large household sizes, and low level of income found to be affecting the

nutrition status of children significantly ((Kikafunda and Namusoke, 2006). A study done by (Kabubo-Mariara *et al*, 2008) found that maternal education is a more important determinant of children's nutritional status and household assets are also important determinants of children's nutritional status.

2.1.11 Prevalence of Malnutrition in Children Living with HIV/AIDS

Malnutrition in its many forms persists in all countries of the world, but it is worse in developing countries where an estimated 174 million children under five years of age are malnourished, as indicated by low weight for age (Kikafunda and Namusoke, 2006). The World Health Organization reports that malnutrition and HIV/AIDS are the underlying causes of death for 50% and 30%, respectively, of children under-five years in Africa (WHO, 2007). Also a number of studies conducted amongst HIV infected children in South Africa have found prevalence of underweight of 25-30%, and 55- 60% for stunting. These were much higher than the average percentages in a national survey conducted on children below 6 years of age, which indicated that 10% were underweight and 23% stunted (Liana *et al.* 2004).

Many children in the world with severe forms of malnutrition may have HIV/AIDS. However, AIDS is often not diagnosed because the symptoms of childhood AIDS are similar to the symptoms of malnutrition. For instance, a study conducted in Dar Es Salaam, Tanzania, revealed that over 25% of the 200 children with severe malnutrition who were tested for HIV infection, were infected with HIV, compared to 1.5 percent of those who were well nourished (Biberfeld *et al*,1994). According to WHO, children in areas with high transmission of HIV with severe underweight are

three times more likely to be HIV-infected (WHO, 2007). In such areas, HIV prevalence among children suffering from severe acute malnutrition (SAM) ranges from 15-40%. Although this trend has not been observed in Europe, they have shown that infected children grow more slowly than uninfected children where, by age 10, infected children were on average 7.5 cm shorter and 7 kg lighter than uninfected children (Newell *et al.*, 2003).

A study of children under ten years of age conducted in Rakai district in Uganda assessed the nutrition status of HIV/AIDS orphaned children, living with grand parents and showed that, the prevalence of malnutrition among the orphans was twice that found in the general population (47 % in the AIDS orphans compared to 23 % in the general Population) (Kikafunda and Namusoke, 2006). Similar findings have also been observed by Rowland (Rowland *et al*, 2000) where out of the 52 surveyed children aged 1-10 years, 46% were stunted, 34.6% were underweight and 7.7% wasted. This trend was also evident from the Nutrition surveillance in Zimbabwe where underweight and stunting were higher among orphans of HIV/AIDS than among non-orphans, 22% versus 17%, and 34% versus 26%, respectively (UNICEF, 2003).

2.1.12 Nutritional Requirements for HIV-Positive Children

Good nutritional status is very important from the time a child is infected with HIV. Nutrition education to the caretaker at this early stage provides a chance to feed a child well according to the requirements. From (WHO, 2003) Technical consultation

Report on Nutrient requirements for people living with HIV/AIDS, the nutritional requirements for people living with HIV/AIDS) are as follows:-

2.1.12.1 Macronutrients

Energy

Energy requirements need to be increased by 10% to maintain body weight and growth in asymptomatic HIV children. During symptomatic HIV, and subsequently during AIDS, energy requirements, need to be increased by 50% to 100% over normal requirements in children experiencing weight loss.

Protein

There are insufficient data at present to support an increase in protein intake for children above normal requirements for health i.e. 12% to 15% of total energy intake. But the nutritional guidance suggesting increased protein intake during HIV infection, are not based on rigorously conducted studies (WHO, 2003).

Fat

Children living with HIV/AIDS do not need to increase their fat intake due to their HIV status. However, for those who are on ARVs as well as those who experience certain infections such as diarrhoea may need to change the quantity of fat intake in some cases (FANTA 2004).

2.1.12.2 Micronutrients

Micronutrient deficiencies are common in person with HIV infection and AIDS in both developed and developing countries (Buys *et al*, 2002). They occur as a consequence of a number of factors including reduced intake as a result of the anorexia associated with AIDS, opportunistic infections and excessive losses in the stools in patients with diarrhoea, mal-absorption and parasitic infections (Winter, 1996). Some studies show that supplements of micronutrients, for example, B-complex, and vitamins C and E can improve immune status and prevent childhood diarrhoea. Community based studies conducted in various developing countries have demonstrated that periodic supplementation with vitamin A (in most instances 6-months) or fortification reduces all cause child mortality by at least 23% in children aged 6-60 months (ASSAf, 2007). Another study by (Rahman,2009) found that children who received vitamin "A" supplementation were 1.655 times more likely to be healthy weighted as compared to the children who have not received vitamin "A' supplements.

HIV-infected 6-59-month-old children living in resource-limited settings should receive periodic (every 4-6 months) vitamin A supplements (100 000 IU for infants 6 to 12 months and 200 000 IU for children >12 months). This level is consistent with current WHO recommendations for the prevention of vitamin A deficiency in children (WHO, 2003). Households with HIV-positive children, like all households, should use iodized salt (FANTA 2004). HIV-infected children should consume diets that ensure micronutrient intakes at recommended dietary allowance (RDA) levels.

2.1.13 Interaction between Nutrition and Antiretroviral Treatment

As AIDS treatment becomes increasingly available in the poorest parts of the world, critical questions are emerging about how well the drugs (ARV,s) work in people who are short of food (AVERT, 2008). HIV and nutrition are intimately linked. HIV infection can lead to malnutrition, while poor diet can in turn speed the disease's progress. Antiretroviral drugs (ARVs) help to delay the progression of HIV to AIDS and allow people living with HIV to live relatively normal and healthy lives (Kanabus and Fredrikson, 2008).

The life-saving benefits of antiretroviral therapy are clearly recognized. Current antiretroviral drug treatments control HIV infection and prevent severe wasting as well as other AIDS-related conditions. Emaciated people tend to regain weight once they begin treatment and stunted children start to grow faster. To achieve the full benefits of such treatment, adequate dietary intake is essential. Good nutrition is essential to maintain a person's immune system, to sustain healthy levels of physical activity, and for optimal quality of life; adequate nutrition is also necessary to ensure optimal benefits from the use of antiretroviral treatment, which is essential to prolong the lives of HIV-infected people and prevent transmission of HIV from mother to child (WHO, 2005).

In resource-poor countries, treatment in children is made more difficult because many children with HIV are severely malnourished. Very little is known about how best to treat such children, and in particular whether it is best to start antiretroviral treatment before or after nutritional rehabilitation (Heikens, 2008).

2.1.14. Nutrition Knowledge

Nutrition knowledge on HIV is very important to a care-taker from the time when a child test HIV positive, which is normally provided as nutrition counselling. The study conducted by (Abbi *et al*, 1988) to determine the effects of mother's nutritional knowledge on children's nutrition, found that the children's nutritional status improved with increased maternal knowledge of nutrition. Nutrition knowledge depends much on the level of education. The study conducted in Bangladesh by (Rahman and Nasrin, 2009) revealed that higher educated mothers have higher probability of having healthy weighted children as compared to the mothers with no education. Nutrition counselling service for HIV patients/care-takers helps to provides specialised advice to patients and their caregivers, and assists them in reducing the severity and the consequences of HIV nutrition-related symptoms, also to prevent weight loss and improve nutrition/health-related quality of life (Kruseman *et al*, 1996).

2.2 Problem Statement

HIV/AIDS is a public health problem that lowers the immune system of the body and affects the nutritional status of infected individuals from early infection. These nutritional deficiencies have been shown to enhance disease progression, increase morbidity and mortality and even influence vertical transmission of the virus. HIV/AIDS is more serious in children because they possess immature, inexperienced immune systems and very small protein reserves. In addition, children are at an age where they are undergoing rapid physical and mental development where more nutrients for their growth and cognitive development are needed. Any nutrient

deficiency during this stage if sufficiently severe will also impair resistance to infections (Scrimshaw and SanGiovanni, 1997).

HIV infected children have a high risk of suffering from nutritional deficiencies due to the effects of the infection. Often a combination of insufficient macro- and micronutrient intake is experienced as a result of anorexia, nausea, vomiting, diarrhoea and mal-absorption. This is associated with impaired storage and altered metabolism of nutrients as well as elevated energy expenditure during secondary bacteria and/or systemic opportunistic infections often leading to wasting and micronutrient malnutrition (Semba and Tang, 1999)

Several studies have been conducted to examine the role of good nutrition in mitigating the effect of HIV/AIDS. These studies have revealed that for HIV positive children, safe feeding practices and improved dietary intake are critical to regaining weight lost during opportunistic infections. Also periodic vitamin A supplementation in HIV positive children reduces illness and death and improves growth.

Various efforts have been ongoing attempting to improve nutrition education especially at care and treatment centres (CTC) in some parts of the country. However, the situation is not convincing. This is mainly attributed to low coverage of nutrition information and education. Other factors that have been mentioned that contribute to the problem of malnutrition in HIV infected children include; poor knowledge on the relationship of HIV/AIDS and nutrition, poverty which determines

the level of food security in the household, level of education of the caretaker and family size .

Despite the fact that malnutrition among the general population is high in Tanzania, and various factors which contribute to it being known, few studies have been done to show the magnitude of the problem. Poor growth is associated with an increased risk of mortality in HIV-infected children; nutritional status therefore needs to be assessed at regular intervals as part of the management of HIV infection in children to prevent stunted growth and development. This study aims at assessing the nutritional status of children under-ten years of age living with HIV/AIDS in Dar es Salaam and to examine factors which are associated with poor nutritional status of these children.

2.3 Rationale

The study is expected to find out the proportional of children who are underweight and who are stunted. The findings will enable us to know the magnitude of the problem. Expected findings from this study will enable the policy maker to plan for preventive strategies. It will also help in designing the interventions for improving nutrition status of these children hence prevents stunted growth and development. This may in the future be associated with a decreased risk of mortality in HIV-infected children. It will help to avoid the cost which may be incurred in taking care of these HIV-infected children when they are sick as a result of malnutrition.

The study will also add knowledge on the existing one; and increase awareness of the parents/guardians and the whole community so that they will participate well in taking care of their children by feeding them properly. Undertaking of this study is of great importance as it is aimed at offsetting the problems of HIV/AIDS which are at increasing rate and putting many children in the risk of growth failure that affects the workforce of the coming generation.

2.4 Objective of the Study

To investigate the nutrition status of children less than ten year's of age living with HIV/AIDS in Dar es Salaam, Tanzania and associated factors.

2.4.1 Specific Objectives

1. To determine the prevalence of stunting by sex in children less than 10 years of age living with HIV/AIDS.
2. To determine the prevalence of underweight by sex in children less than 10 years of age living with HIV/AIDS.
3. To asses nutrition knowledge of parents or guardians living with children less than 10 years of age living with HIV/AIDS
4. To describe the main foods frequently consumed by children less than 10 years of age living with HIV/AIDS.
5. To ascertain factors associated with nutritional status of children less than 10 years of age living with HIV/AIDS

2.4.2 Conceptual Framework

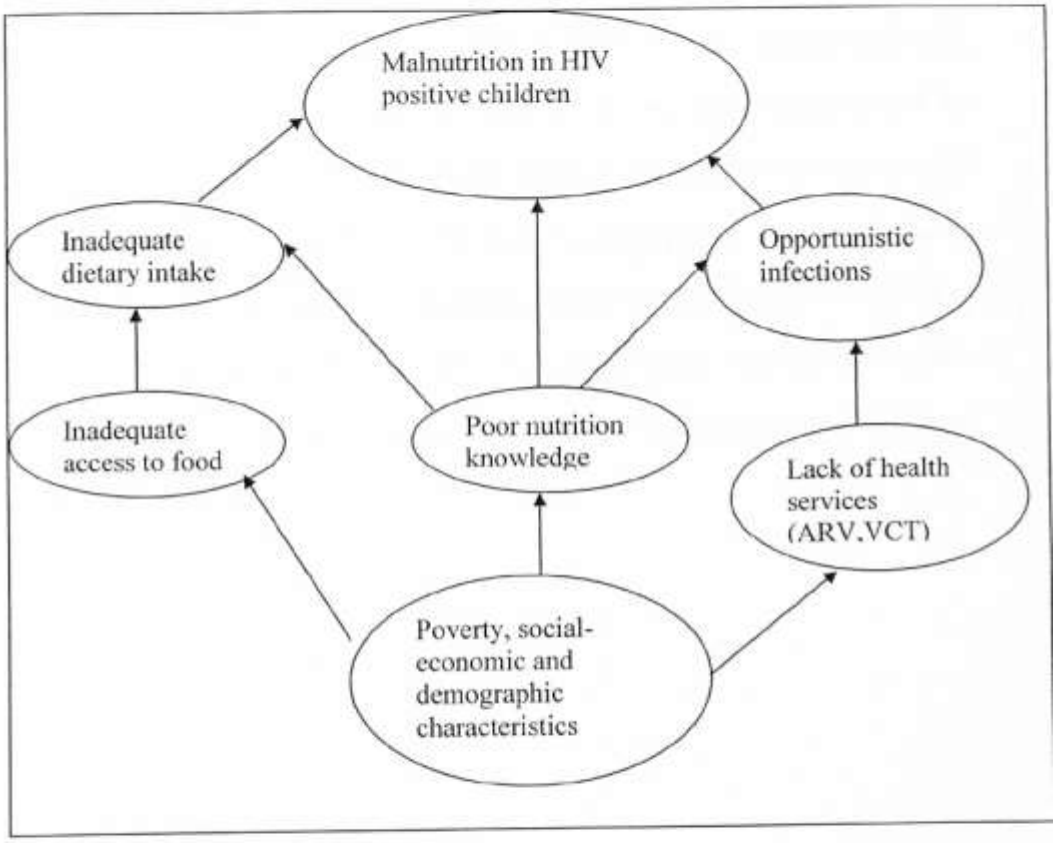


Figure 2: Conceptual Framework for the Causes of Malnutrition in HIV Positive Children.

Malnutrition has long been recognized as a consequence of poverty. It is widely accepted that higher rates of malnutrition will be found in areas with chronic widespread poverty (ADB, 2001). The devastating impact of HIV pandemic has been exacerbated by the pervasive poverty that has become a global phenomenon (Nelson, 2004).

HIV and nutrition are intimately linked. HIV infection can lead to malnutrition by increasing the chances of opportunistic infections which interferes with body's nutrients uptake, while poor diet can in turn speed the disease's progress (AVERT, 2008). Malnutrition is the result of marginal dietary intake compounded by infections. In turn, marginal dietary intake is caused by household food insecurity due to AIDS epidemic as agricultural work is neglected or abandoned due to household illness (AVERT, 2008). Insufficient health services and low utilization of heath services which depend on the knowledge of care takers exacerbates the effects of opportunistic infections eventually leading to severe malnutrition of HIV infected children (ADD, 2005).

CHAPTER THREE

3.0 METHODS AND MATERIALS

3.1 Study Design and Study Area

A cross-sectional study was conducted from June to August 2009 in Temeke, Dar es Salaam, Tanzania. Temeke is the southernmost municipality of the three municipalities (others being Kinondoni and Ilala) in the city of Dar es Salaam, Tanzania. The city of Dar es Salaam borders the Indian Ocean to the East and Coast region to the North, South and West. The population of Temeke was 768,451 according to the 2002 National Census (URT, 2003). The municipality covers an area of 786.5 km². Temeke municipality is administratively divided into 3 divisions and 24 wards. Temeke was chosen because it has people of different social economic status and a majority are believed to be of low income. Moreover, it has a large semi-urban area.

3.2 Study Population

The study population was all children living with HIV/AIDS aged 1-10 years attending care and treatment centres (CTC) in Temeke municipality.

3.2.1 Inclusion Criteria

- Children aged between 1-10 years.
- Children with positive HIV sero-status.
- Children whose parent/guardian agreed to participate in the study.

3.2.2 Exclusion Criteria

- Children below 1 year or older than 10 years.
- Children who were seriously ill.
- Children whose parent/guardian didn't consent to participation in the study.

3.3 Data Collection

3.3.1 Sampling Procedure

Two care and treatment centres were identified namely; Temeke hospital and Mbagala Rangi tatu clinic. Proportionate sampling was used at each clinic to obtain the required sample size and children were selected conveniently with their respective care-taker. Anyone who attended the clinic on that day was included in the study according to the availability of the care taker and children who were seriously ill were not included in the study.

3.3.2 Sample Size

Sample size was determined based on the formula for a single proportion,

$$n = \frac{z^2 p (100-p)}{\varepsilon^2}$$

Where; n = the required minimum sample size

p = Prevalence of malnutrition among children living with HIV/AIDS in Dar es Salaam (25%)

ε = margin of error (6%)

z = standard normal deviate corresponding to 95% confidence level

$$n = 1.96^2 \times 25 \times (100-25) = 200$$

36

The sample size was 200 + 15% which was approximately 230.

3.3.3 Data Collection Tools

Face to face interviews with structured questionnaire comprising of both closed and open ended questions was administered to the parents/guardians of the children. Information collected included: demographic characteristics of the child (age, sex); demographic characteristics of the parent (relationship with child, residence, education, occupation, income and marital status); nutrition knowledge of the parent/guardian and child's medical history in past three months. A short food frequency questionnaire was also administered.

3.3.4 Nutritional Status Assessment of Children

Height was measured to the nearest 0.1cm using a Length/height board with the child standing in supine position and weight was measured to the nearest 0.1kg using electronic scales with child wearing minimal clothing and no shoes. Children who were unable to stand, their length were measured with legs stretched and their weight estimated by first weighing mother and child then subtracting the weight of the mother alone (Cogill, 2003). The difference between the two measures was the child's weight. The prevalence of under-nutrition in children is commonly reported

using conventional indices divided into stunting, underweight, and wasting. **Table 1** summarizes these indices.

Table 1: Conventional Indices Showing Prevalence of Under-nutrition in Children

INDICES	DESCRIPTION	TYPE OF INDICATOR
Stunting	Low height-for-age	Indicator of chronic under nutrition, prolonged deprivation, and or disease
Wasting	Low weight-for-height	Indicator of acute under nutrition, more recent food deprivation
Underweight	Low weight-for-age	Indicates both acute/chronic under nutrition but does not distinguish them

In this thesis, height-for-age and weight-for-age were used to describe under-nutrition in children. Wasting was not used in this thesis as it only indicates recent food deprivation which may be a result of acute illness. Instead, underweight was preferred as it indicates both acute and chronic food deprivation although it is not able to distinguish them. These anthropometric indices were analyzed using SMART-ena software and categorization was made based on Z-score. Those who were –2SD below the mean of the reference population were regarded as under nourished according to WHO recommendations (WHO, 1995). Body mass index (BMI) for age was used to classify children from 5-10 years as underweight, normal or above. Different analysis was used for children under-five years and for 5-10 years because stunting can be assessed among under-fives children only and there are different methods for analysing their anthropometric data.

3.3.5. Food Frequency Questionnaire

A short Food Frequency Questionnaire (FFQ) was developed based on locally available foods to assess dietary consumption of the children. The questionnaire mainly enquired about foods from the carbohydrate (stiff porridge (ugali), cassava, rice, irish potatoes), protein (animal products such as meat, fish, poultry eggs, dry sardines, fresh sardines, milk, beans and other legumes), vegetables (green leafy vegetables for example spinach, amaranths, sweet potatoes leaves "matembele", "mnafu", pumpkin leaves and cassava leaves "kisamvu") and fruits (including mangoes, pineapple, oranges, and avocados). Parents/guardians of the children were asked on average how often in the past month the child consumed each food item. Six response alternatives - everyday, 3-4 times a week, once or twice a week, and twice or more a month, once a month and less than once a month/rarely/never were given as options.

3.3.6 Data Management

Daily checking of questionnaires was done while in the field and illogical or missing information dealt with before leaving the field area. Meetings with research assistants were conducted daily to discuss any problems that have arisen during data collection. Data entry and analyses was done using the statistical package for social sciences version 14.0 (SPSS). Also ena-SMART was used for the analysis of under-five anthropometric measurements.

3.3.7 Statistical Analysis

Data was summarized using frequencies and percentage for nominal variables and means (± standard deviation) for continuous variables. Between groups differences were compared using Pearson's χ^2 tests or Fishers exact test when appropriate. To identify independent factors associated with under-nutrition, logistic regression models were run adjusted for potential confounders. Food items were grouped in carbohydrate, protein, vegetables and fruits food groups. For carbohydrate group, vegetables and fruits the assumption was made that the child met minimal requirement if and only if the child is capable of consuming at least one food item from those groups daily. For protein the assumption was that, a child will meet minimal requirement if he/she consumed at least one food item more than or equal to four times a week. The significance level was two tailed at 0.05.

3.3.8 Ethical Considerations

Ethical clearance was sought from the Muhimbili University of Health and Allied Sciences Research and Publication Ethical Committee. Permission from Temeke District administrative authorities was sought. Introduction letters were sent to all health facilities where data was collected from. Written informed consent was sought from all children's care-takers and or parents before inclusion into the study. Respondents were informed about the objectives of the study and that their participation was voluntary. Children's care-takers and or parents were told to feel free to withdraw at any time during the course of the study. Names of children and their parents/guardians was not recorded for confidential reasons, instead numbers were used to ensure confidentiality.

3.3.9 Pre-testing of the Study Tool

The pilot testing of the questionnaires was carried out at Mwananyamala CTC which was not among those selected for the actual study. The children were selected conveniently with their respective care takers. Anthropometric measurements of the selected children were taken and care takers were interviewed. Following the pre-tested questionnaires it was found that all questions were well understood by the respondents.

3.3.10 Study Strengths and Limitations

The study has several strengths, namely: due to the large age range of the children it was easy to capture the effect of HIV on nutrition status, the sample was taken from HIV care and treatment centres (CTC) thus all the children were HIV positive. However, there are some limitations. Only two CTC were conveniently selected for the study. These centres may not be representative of the many centres available. Respondents may decide not to provide full and factual information about their children and themselves hoping that they will receive financial support from the researcher for their children. This may bring information bias thus over estimating of the results, however objectives of the study were well explained to the caretakers and we believe this reduced the bias to a minimum. Convenient sampling was used in this study. Our results may not be representative of the HIV positive population of children in this age group; however the sample size was large enough. Food frequency questionnaire may not be able to show clearly if a child has met the RDA's but rather provide a clue into the habitual eating patterns of these children.

Additionally, the grouped frequencies of the various food groups may have resulted in misclassification of the children in consumption patterns. .

CHAPTER FOUR

4.0 RESULTS

4.1 Social-demographic Characteristics of Children and Respondents.

A total of 230 children living with HIV/AIDS in Temeke municipality were identified through the selected centres, of these children 52.2% were males and 47.8% females. Fifty percent of the children were above five years of age and the other 50% were under-five years of age (12-33 months were 13%, 34-42 months were 23.6% and 43 -59 months were 13.4%).

Out of the 230 respondents, 185 (80.4 %) were female and 45 (19.6%) were male. About (86.5%) of the respondents were aged between 18 and 45 years, 11.3% were above 45 years and only (2.2%) were below 18 years. Married couples were 53%, single were 21.7% while 25.3% were widowed and divorced. About 60% of respondents were the child's' mother, 19.6% were guardians and 9.6% were fathers.

More than half of respondent (55%) had primary education, 21.5% had informal education and 23.5% had secondary education and above. Almost half of respondents (46%) were engaged in business, 23.9% were unemployed, 13 % were private sector employees, (7.4%) were government employees and 9.7% were farmers. Ninety percent of the respondents reported an average monthly income of less than Tsh.199, 000/=; 10% were earning Tsh. 200,000/= +.

About thirty three percent of children's father were engaged in business, 23% in private sector, 9.7% were government employees, 6% farmers and those who were

unemployed were only 3%. A quarter of the children's father were either dead or the respondent did not have any information about them. Children's father who were earning below Tsh. 199,000/= per month were 53%, those who were earning 200,000/= + per month were only 20.9%. About 30.4% of the households had more than 6 people, 51.3% had 4-6 people and the smallest household size (<4 people) was reported by 18.3% **(Appendix 1).**

4.2 Nutritional Status of the Children

4.2.1 Prevalence of Underweight Among 5-10 years Children

Out of 115 children, 33 children (found to be below -2SD Z-score on the BMI for age chart). The general prevalence of under-nutrition among children aged 5-10 years was 28.7%. Among female children was higher (34.0%) compared to that of boys (25.0%) though the difference was not significant (P=0.292). The prevalence of underweight among children whom their fathers were farmers was 50%, similar to that of unemployed fathers. For children whose fathers were government employees the prevalence of underweight was 30% as compared to 28.6% of those children whose fathers were private employees. The prevalence of underweight among children whose fathers were businessmen was found to be10.8%. Again the prevalence of underweight was a bit high in those children who were abandoned by fathers 42.9% even though there was no significant (P = 0.048) **(Table 2 and 3).**

Table 2: Relationship of Nutritional Status of 5-10 years old Children Living with HIV/AIDS in Temeke Municipality and Social Demographic and Economic Characteristics of their Care takers

Variable	Category	Nutrition Status of Children 5-10 years old		
		Under weight **n (%)**	Normal and above **n (%)**	P-Value
Sex of the Respondent				
	Male	9 (36.0)	16 (64.0)	
	Female	24 (26.7)	66 (73.3)	0.36
Age of the Respondent				
	Below 18 yrs	-	3 (100.0)	
	18 to 45 yrs	29 (29.3)	70 (70.7)	
	Above 45 yrs	4 (30.8)	9 (69.2)	0.54
Marital Status of the Respondent				
	Single	6 (27.3)	16 (72.7)	
	Married	16 (25.8)	46 (74.2)	
	Widow/divorced	11 (35.5)	20 (64.5)	0.62
Level of Education of the Care Taker				
	Informal	9 (25.7)	26 (74.3)	
	Primary	16 (29.6)	38 (70.4)	
	Secondary	8 (30.8)	18 (69.2)	0.89
Occupation of the Care Taker				
	Unemployed	4 (14.8)	23 (85.2)	
	Farmer	1 (10.0)	9 (90.0)	
	Government Employee	4 (44.4)	5 (55.6)	
	Private Sector Employee	4 (23.5)	13 (76.5)	
	Business	20 (38.5)	32 (61.5)	0.09
Level of Income of the Care taker				
	Below 199,000/=	28(28.3)	71(71.7)	
	200,000/ +	5(31.3)	11(68.8)	0.81
Occupation of the Child's Father				
	Unemployed	2 (50.0)	2 (50.0)	
	Farmer	4 (50.0)	4 (50.0)	
	Government Employee	3 (30.0)	7 (70.0)	

	Private Sector Employee	8 (28.6)	20 (71.4)	
	Business	4 (10.8)	33 (89.2)	
	Abandoned by Fathers	12 (42.9)	16 (57.1)	0.04
Level of Income of Child's father				
	Below 199,000/=	15(25)	45(75)	
	200,000/ +	6(22.2)	21(77.8)	0.78
Household Size				
	Below 3	7 (41.2)	10 (58.8)	
	4 to 6	14 (22.6)	48 (77.4)	
	Above 6	12 (33.3)	24 (66.7)	0.25
Relationship of the Respondent and Child				
	Father	5 (45.5)	6 (54.5)	
	Mother	17 (25.8)	49 (74.2)	
	Care Taker/Guardian	9 (32.1)	19 (67.9)	
	Others	2 (20)	8 (80)	0.61

Table3: Relationship of Nutritional Status of Children 5-10 years of age Living with HIV/AIDS in Temeke Municipality and Medical and Nutritional Characteristics

Variable	Category	Nutrition Status of Children 5-10 years old		
		Under weight **n (%)**	Normal and above **n (%)**	P-Value
Dietary Supplements				
	Yes	12 (27.9)	31 (72.1)	
	No	21 (29.2)	51 (70.8)	0.89
ARV Therapy				
	Yes	22 (25.3)	65 (74.7)	
	No	11 (39.3)	17 (60.7)	0.15
History of illness				
	Yes	17 (33.3)	34 (66.7)	
	No	12 (21.8)	43 (78.2)	0.24
Nutritional Counselling				
	Yes	27 (28.1)	69 (71.9)	
	No	61 (31.6)	13 (68.4)	0.76

4.2.2 Prevalence of Underweight Among under-five years Children

The overall prevalence of underweight among children under five years of age in the study was 46.1%. The prevalence of underweight among boys was 52.7% (95% CI: 39.5-65.9) and among girls was 40.0% (95% CI: 27.6-52.4).However the difference was not significant (P=0.6). There was no significant association between underweight status of children under five years and socio-demographic and economic characteristics of the caretaker as well as medical and nutritional characteristics of the child **(Appendix 3 and 4).**

4.2.3 Prevalence of Stunting among Under-five years Children

The overall prevalence of stunting was 61.7%. The prevalence of stunting among boys was 56.4% (95% CI: 43.3 - 65.9) and among girls was 66.7% (95% CI: 54.7 - 78.6), but there were no significant difference in stunting between the two sexes (p=0.11).There was no significant association between stunting status of children under five years and socio-demographic and economic characteristics of the caretaker **(Appendix 6).** There was a significant difference in levels of stunting between children using ARV and those who were not on ARV. Stunting was significantly higher among children who were not on ART compared to those who were on ART (82.4% vs. 56.1%; P= 0.042). The prevalence of stunting among children who had fallen sick in the past three months was 59% as compared to 50.9% of those who didn't fall sick in the past three months (P=0.048). The prevalence of stunting was significantly higher (69.1%) among children not using dietary

supplements as compared to those who were using dietary supplements (p = 0.016) (**Table 4**).

Table 4: Relationship between Stunting of Children under five years Living with HIV/AIDS in Temeke Municipality and Medical and Nutritional Characteristics

Variable	Category	Nutrition Status of Children under five years		
		Stunting **n (%)**	Normal and above **n (%)**	P-Value
Dietary Supplements				
	Yes	22 (46.8)	25 (53.2)	0.016
	No	47 (69.1)	21 (30.9)	
ARV Therapy				
	Yes	55 (56.1)	43 (43.9)	
	No	14 (82.4)	3 (17.6)	0.042
History of illness				
	Yes	40 (59.0)	18 (31.0)	
	No	29 (50.9)	28 (49.1)	0.048
Nutritional Counselling				
	Yes	57 (58.2)	41 (41.8)	
	No	12 (70.6)	5 (29.4)	0.334

Table 4 shows multivariable logistic regression models of stunting. Children who were not on ARV were 3.3 times more likely to be stunted as compared to those who were on ARV therapy (OR = 3.3; 95%CI: 1.21-8.84; P = 0.02). Children who had no history of illness in the past three months were 0.96 likely to be stunted as compared to those who have a history of illness in the past three months (OR = 0.96; 95%CI: 0.43-2.16 ; P =0.92) however the difference was not significant.

Table 5: Crude and Adjusted Odds ratio of Stunting among Children under five years living with HIV/AIDS in Temeke Municipality in relation to Medical and Nutrition Characteristic

Variable	Category	Crude OR	95% C.I	P-Value	AOR*	95% C.I	P-Value
Dietary supplements	Yes	1			1.00		
	No	3.6	1.67-6.43	0.001	0.63	0.28-1.42	0.26
ARV use	Yes	1			1.00		
	No	4.0	2.67-7.40	0.000	3.3	1.21-8.84	0.02
History of illness	Yes	1			1.00		
	No	5.4	2.67-11.10	0.000	0.96	0.43-2.16	0.92

* Adjusted odds ratio for age and sex of children, social demographic and social economic characteristics of care-taker and child's father and nutrition and medical characteristics of a child (ARV use, nutrition counselling and supplements)

4.3 Nutritional Knowledge of Caretakers

The proportion of caretakers who had nutrition knowledge was 61.7% and those with low or no knowledge was 38.3%. Nutritional knowledge was lower among male care takers (37.8%) than in female care takers (38.4%) though the difference was not statistically significant (P = 0.941). Low level of knowledge was highest 50.4% among elderly care takers (above 45yrs) and lowest (20%) among those who were below 18 years, but the difference was not statistically significant (P = 0.313). Low level of knowledge was significantly higher (56.3%) among those with informal education than those with secondary education and above (23.6%; P = 0.004). There was a significant association between nutrition knowledge and receiving nutritional

counselling after a child tested HIV where, receiving nutrition counselling was associated with higher nutrition knowledge than not receiving (66.7% vs. 33%; P <0.001) (**Table 6 and 7**) .

Table 6: Relationship between Nutrition Knowledge of Caretakers of Children under 10 years living with HIV/AIDS in Temeke Municipality and their Social demographic Characteristics

Variable	Category	Nutrition Knowledge		
		No knowledge **n (%)**	Knowledgeable **n (%)**	P-Value
Sex of the Respondent				
	Male	17 (37.8)	28 (62.2)	
	Female	71 (38.4)	114 (61.6)	0.94
Age of the Respondent				
	Below 18 yrs	1 (20.0)	4 (80.0)	
	18 to 45 yrs	74 (37.2)	125 (62.8)	
	Above 45 yrs	13 (50.4)	13 (50.0)	0.31
Level of Education of the Care Taker				
	Informal	27 (56.3)	21 (43.8)	
	Primary	48 (37.8)	79 (62.2)	
	Secondary	13 (23.6)	42 (76.4)	0.001
Occupation of the Care Taker				
	Unemployed	23 (41.8)	32 (58.2)	
	Farmer	10 (45.8)	12 (54.5)	
	Government Employee	4 (23.5)	13 (76.5)	
	Private Sector Employee	7 (23.3)	23 (76.7)	
	Business	44 (41.5)	62 (58.5)	0.23

Table 7: Relationship between Nutrition Knowledge of Care-takers and Nutrition characteristics and Nutritional Status of Children under 10 years living with HIV/AIDS in Temeke Municipality

Variable	Category	No knowledge **n (%)**	Knowledgeable **n (%)**	P-Value
Stunting (under-five)				
	Yes	30 (43.5)	39 (56.5)	
	No	18 (39.1)	28 (60.9)	0.64
Under weight(under-five)				
	Yes	23 (44.2)	29 (55.8)	
	No	25 (39.7)	38 (60.3)	0.62
Underweight in (5-10 yrs)				
	Yes	15 (45.5)	18 (54.5)	
	No	25 (30.5)	57 (69.5)	0.13
Nutrition counselling				
	Yes	64 (33.0)	130 (67.0)	
	No	24 (66.7)	12 (33.3)	0.001

4.4 Food Consumption patterns

4.4.1 Children 5-10 years of age

The main frequently consumed foods from the carbohydrate group were ugali, rice and cassava. More than 93% of children aged between 5-10 years were consuming at least one food item from the carbohydrate group daily, and only 6.1% were consuming these foods less than 4 times per week or less than that. In protein group the main foods which were consumed found to be beef, fish, drydagaa, beans and milk. 94.8% of these children were consuming at least one food item from protein group more than four times a week and the rest were consuming less than that. Vegetables which were frequently consumed were carrot, amaranths, sweet potatoes leaves, spinach, and pumpkin leaves. 65.2% of these children were consuming at least one type of vegetable daily and the rest were consuming less than that. Fruits

which were frequently consumed were oranges, avocado, pawpaw, pineapple, mangoes. 56.5% were consuming at least one type of fruits daily and the rest were consuming less than that (**Appendix 7**).

4.4.2 Children Under-five Years of age

Among under-five the main frequently consumed foods from carbohydrate group were ugali, rice and cassava. About 93.9% of under-five years children were consuming at least one food item from the carbohydrate group daily, and only 6.1% were consuming these foods less than 4 times per week or less than that. In protein group the main foods which were consumed found to be beef, fish, drydagaa, beans and milk. 95.7% of these children were consuming at least one food item from protein group more than four times a week and the rest 4.3% were consuming less than that. Vegetables which were frequently consumed were carrot, amaranths, sweet potatoes leaves, spinach, and pumpkin leaves. 69.6% of these children were consuming at least one type of vegetable daily and the rest were consuming less than that. Fruits which were frequently consumed were oranges, avocado, pawpaw, pineapple, mangoes. 54.8% were consuming at least one type of fruits daily and the rest were consuming less than that **(Appendix 8)**

CHAPTER FIVE

5.0 DISCUSSION

5.1 The nutritional Status of the Children

The main objective of this study was to assess the prevalence of under-weight and stunting among children aged 1 to 10 years living with HIV in Temeke Municipality in Dares Salaam and their associated factors. The study found that the prevalence of stunting and under weight among these children was high. These findings conform to what other studies have observed (SANGN, 2001). Newell *et al* (2003) explained that, poor nutrition causes more serious problems in children living with HIV/AIDS. These problems include poor growth pattern where almost all children with HIV/AIDS have been observed to grow slower than uninfected children. HIV-related malnutrition has several causes, including decrease in food intake; the effects of opportunistic infections and metabolic inefficiencies due to cytokine activity which leads to increased energy expenditure and contributes significantly to weight loss (Macallan, 1995; ASSAf, 2007).

The prevalence of under weight among children aged five to ten years was 28.7% whilst the prevalence of under weight and stunting among children under-five years of age was 46.1% and 61.7% respectively. These estimates are much higher than the reported prevalence of under-nutrition in the general population of Tanzania. It is estimated that for children under five years of age, the prevalence is over 43% for stunting, 22% underweight and 2% for severe wasting (URT, 2005). The high prevalence of under-nutrition among HIV positive children has also been observed by several studies (Biberfeld *et al*, 1994). For instance, amongst HIV infected

children in South Africa the prevalence for underweight and stunting was 25-30% and 55- 60% respectively. These findings were higher than the average percentages in a national survey conducted on children below 6 years of age, which indicated that 10% were underweight and 23% stunted (Liana *et al*, 2004). High prevalence of under-weight and stunting not only affects physical growth but also intellectual, social, spiritual and emotional development. It also increases the risk of mortality among these children.

5.2 Factors Influencing the Nutritional Status of the Children

The nutritional status of children is an outcome of many interrelated factors. This study anticipated different factors that may influence the nutrition status of children living with HIV/AIDS, though not all factors showed a significant predicting effect. Nutritional status of the children was significantly influenced by ARV use. Antiretroviral drugs (ARVs) help to delay the progression of HIV to AIDS and allow people living with HIV to live relatively normal and healthy lives (Kanabus and Fredrikson, 2008) Antiretroviral drug treatments help to control HIV infection and prevent severe wasting, and other AIDS-related conditions. Emaciated people tend to regain weight once they begin treatment, and stunted children start to grow faster (WHO, 2005). The results revealed that children not on ARV treatment were more likely to be stunted than those who were on ARV treatment (OR=6.0; 95%CI: 1.9 – 18.5; P =0.002). In order to ensure optimal benefit of ARV adequate nutrition is necessary, as ARV works better under good nutrition. Antiretroviral distribution should be emphasized to the children living with HIV as per directives in order to improve their quality of life and help them to grow normally. But adherence of ARV

can also have a great impact on the nutrition status of a child. If adherence is very good, it will allow their immune system to start to recover, so that illness is reduced and health is regained. Hence it is possible that in children who were on ARV even the adherence was good that is why it showed positive effect. Poor adherence to ARV treatment allows a person's levels of HIV to stay high and their immune system to stay weak. It means that they face an increased risk of severe illness, more time in hospital and early death. Poor adherence can also cause the virus to become resistant to ARVs.

The Micronutrient deficiencies occur as a consequence of number of factors include reduced intake as a result of the anorexia associated with AIDS and opportunistic infections, and excessive losses in the stools in patients with diarrhoea, mal-absorption and parasitic infections (Winter, 1996). In the studied CTCs the only dietary supplement being provided to the children was Vitamin A. After adjusting for potential confounders the study did not observe a significant association between taking dietary supplements and nutritional status of the children. This is in contrast to what Rahman and Nasrin reported in Bangladesh (Rahman and Nasrin. 2009); where children who received vitamin A supplementation were 1.7 times more likely to have a healthy weight as compared to children who did not receive vitamin A supplements.

Other studies conducted in various developing countries have shown that periodic supplementation with vitamin A or food fortification with vitamin A reduces all-cause child mortality by at least 23% in children aged 6-60 months (ASSAf, 2007).

In spite of these benefits of vitamin A, this study did not see any significant difference in nutrition status between children using vitamin A and those who were not using. This may be due to the reason that, care –takers did not properly administer vitamin A tablets provided at the CTC centres. Another reason is that the sample size was not large enough to detect this difference hence missed the power.

Symptoms that accompany infections, such as loss of appetite, diarrhoea and fever, lead to reduced food intake, mal-absorption, nutrient losses and altered metabolism which lead to weight loss, growth faltering, and further weakening of the immune system (FANTA, 2003). I hypothesized that children with several episodes of sickness will be more likely to have poor nutrition status. We observed that in unadjusted logistic regression children who did not report illness in the past 3 months were more likely to be stunted than those who reported an illness. However, this did not remain significant after adjusting for potential confounders. This may be due to children who have not fallen sick in the past three months having not yet started ARV therapy which helps to regain weight, and stunted children tend to grow faster once they begin ARV therapy.

5.3 Knowledge of Care-taker

The study conducted by (Abbi *et al.*, 1988) showed that children's' nutritional status improved with increased nutrition knowledge of caretakers. This is in contrast with my study which shows that there was no significance difference in nutrition status (under-weight and stunting) between care-takers with low nutrition knowledge and those with high nutrition knowledge. This may be due to other contributing factors

like economic status, thus a care taker may be having nutrition knowledge but economically poor which may result into poor dietary intake of the children. The study found that nutritional knowledge was poor among those caretakers with informal education than those with secondary education (Table 10). Educated people are more likely to be well informed on nutrition issues as well as child care and feeding as compared to illiterate people. The study by (Rahman and Nasrin, 2009) revealed that higher educated mothers have higher probability of having healthy children as compared to non educated mothers.

The study observed that caregivers who received nutrition counselling had better nutrition knowledge than those who did not. Nutrition counselling is very important from when a child test HIV positive. The major objective of nutrition counselling service is to provide specialised advice to patients and their care-takers, and assist them in reducing the severity and the consequences of HIV nutrition-related symptoms. According to (Kruseman *et al*, 1996) the aim of nutrition counselling is to prevent weight loss and improve nutrition/health-related quality of life.

5.4 Food Consumption patterns

The study revealed that main foods frequently consumed by under-ten children were; carbohydrate (*'ugali'*, rice and cassava). In protein group food items were beef, fish, dry *'dagaa'*, beans and milk. Vegetables which were frequently consumed were carrot, amaranths, sweet potatoes leaves, spinach, and pumpkin leaves while fruits were oranges, avocado, pawpaw, pineapple, mangoes. The study showed that there were no problems in the frequencies of food consumption in carbohydrate and

protein food groups. But about 35% of children were not consuming vegetables daily, and 45% were not consuming fruits daily. This can be a contributing factor to malnutrition as most vitamins are not stored in the body, thus consumption of vitamin providing foods should be on daily basis. The higher prevalence of malnutrition may also be due to increased nutritional demand due to HIV/AIDS, considering that these children need more nutrients for growth. According to (WHO, 2003), energy requirements during asymptomatic phase need to be increase by 10%, and during symptomatic HIV and subsequently during AIDS, energy should to be increased by 50% to 100% over normal requirements in children experiencing weight loss. In order to meet these requirements there should be an increase in the number of meals consumed per day, especially high energy snacks in between the main meals.

Another reason for high prevalence's of malnutrition may be due to poor preparation of some foods, especially vitamins and fruits which may result in the loss of nutrients. Vitamins and minerals are very important because apart from other functions they play an important role in the functioning of the immune system. For example intake of vitamins A, B, multivitamins, zinc and selenium, in HIV infected children, reduces morbidity and mortality (ASSAF, 2007.)

CHAPTER SIX

6.0 CONCLUSSION AND RECOMENDATION

6.1 Conclusion

The study found out that malnutrition was a significant problem among children living with HIV/AIDS. Malnutrition in these children was significantly associated with ARV use. ARV use was seen as a means of improving nutrition status of the children as they help to reduce the incidence of opportunistic infections and other AIDS-related conditions. Reduction of opportunistic infections helps to reduce the increased demand of nutrients during infection; hence helps the children to grow normally and the possibility of malnutrition of a child will be reduced if other factors like good nutrition are taken care of. Nutrition counselling was seen to be important as children whom their care-takers received nutrition counselling were found to be knowledgeable on nutrition. The study found that there were problem in the frequency of consumption of fruits and vegetables among these children.

6.2 Recommendations

Nutrition counselling and nutrition education should be among the basic components of care and treatment of HIV infected children in CTCs. ARV should be made available to children accordingly and adherence should be ensured. Further studies on meal frequencies aiming at finding out if required daily allowances (RDA's) are being met as recommended. Also government agencies, Non Governmental Organisations (NGOs) and Community Based Organisations (CBOs) are recommended to encourage provision of nutritious foods to HIV/AIDS children when addressing the HIV/AIDS pandemic.

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