NUTRITION STATUS AND ASSOCIATED DIETARY DIVERSITY FACTORS AMONG ADOLESCENTS LIVING WITH HIV IN ILALA MUNICIPAL COUNCIL, DAR ES SALAAM

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By

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A Dissertation Submitted in (Partial) Fulfillment of the Requirements for the Degree of Master of Public Health of

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CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled: **''Nutrition status and associated dietary diversity factors among adolescents living with HIV in Ilala Municipal Council, Dar es Salaam'',** in (partial) fulfillment of the requirements for the Degree of Master of Public Health of the Muhimbili University of Health and Allied Sciences.

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Date

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Date

DECLARATION AND COPYRIGHT

I, **Shakila Bashiru Majura**, declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature ……. **Date** ……

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DEDICATION

I dedicate this dissertation to my parents, who laid the foundation of my education. Their unwavering support, encouragement, and sacrifices have been instrumental in my journey.

ABSTRACT

Background: The global burden of HIV/AIDS significantly impacts vulnerable populations, particularly adolescents. Adolescents living with HIV continue to face significant nutritional challenges that compromise their treatment. These challenges are often due to low adherence to ART, influenced psychosocial factors such as fear of stigmatization, lack of social support and mental health issues such as depression and anxiety. In Tanzania, undernutrition emerges as the predominant challenge among adolescents with HIV, but comprehensive data on their nutritional status is limited.

Objective: To assess the nutritional status and associated dietary diversity factors among adolescents living with HIV in Ilala Municipal Council, Dar es Salaam.

Materials and Methods: A hospital based, cross-sectional descriptive study was conducted among adolescents living with HIV attending CTCs at Amana Regional Referral Hospital and Mnazi Mmoja Health Center. Sociodemographic, clinical and dietary diversity information were collected through face-to-face interviews using a structured questionnaire. Anthropometric measurements were conducted, and z-scores were computed based on the WHO 2007 Growth Reference Charts. Data analysis was done using Stata Version-17. Descriptive, chi-square tests, pearson's correlation, and multivariate regression analysis were applied. A p-value of <0.05 was considered statistically significant.

Results: A total of 132 HIV positive adolescents were recruited, majority of the participants were below 15 years of age. Malnutrition was prevalent, with 31.1% showing stunting, 25.8% underweight and 15.9% wasting. Significantly associated factors included food insecurity, low feeding frequency, advanced HIV stage and history of opportunistic infections. Dietary diversity was low, with 84.8% of the participants having inadequate dietary diversity. Key predators of poor dietary diversity were meal skipping (AOR = 12.2, P < 0.001, 95% CI: 3.5 - 41.7), and snacking (AOR = 5.0, P = 0.007, 95% CI: 1.6 – 16.4). Conversely, the majority of participants 62.1% reported better adherence to their ART regimen. Contributing factors were adequate food intake and dietary patterns, as well as use of medication reminders or schedules. Inadequate

food intake and missing medication doses due to side effects were associated with poor adherence.

Conclusion: This study reveals the critical nutritional and health challenges faced by HIV-positive adolescents, particularly malnutrition and poor dietary diversity. Factors such as food insecurity and low feeding frequency highlight the need for comprehensive strategies to improve their well-being. Enhancing dietary diversity is vital, as it affects physical health and supports ART adherence. The findings underscore the importance of addressing barriers related to nutrition and medication side effects to improve medication adherence.

Recommendation: Engage stakeholders such as nutritionists and healthcare providers to implement nutritional programs, provide dietary counseling, and involve family support to enhance adolescent's medication adherence.

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LIST OF ABBREVIATIONS

AIDS	Acquired immunodeficiency syndrome
ART	Antiretroviral therapy
CTC	Care and Treatment Clinic
DDS	Dietary diversity score
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization
HIV	Human immunodeficiency virus
LMICs	Low and middle-income countries
MDD-W	Minimum Dietary Diversity for Women
MoHCDEC	Ministry of Health, Community Development, Gender, Elderly, and Children
MIS	Malaria Indicator Survey
MUAC	Mid-upper arm circumference
NAR	Nutrient adequacy ratio
NBS	National bureau of statistics
NNS	National nutrition survey
PLWHA	People living with HIV/AIDS
PMTCT	Prevention of mother to child transmissions
TFNC	Tanzania Food and Nutrition Center
TDHS	Tanzania Demographic Health Survey
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNICEF	United Nations Children’s Fund
WHO	World Health Organization’s

DEFINITION OF TERMS

Nutritional Status: Refers to the overall health and well-being of an individual in terms of their nutrient intake, absorption, and utilization, which directly affects their growth, development, and overall health.

Dietary Diversity: Refers to the variety of foods and food groups consumed by an individual or population within a specified period.

Adolescent: This term typically refers to individuals between the ages of 10 and 19 years old, representing a transitional stage between childhood and adulthood.

Malnutrition: A condition resulting from an imbalance in nutrient intake, which can manifest as undernutrition (insufficient nutrient intake leading to stunting, wasting, or deficiencies) or over-nutrition (excessive nutrient intake resulting in obesity and diet-related non-communicable diseases).

Antiretroviral Therapy (ART): Refers to the treatment that involves using medications to suppress the replication of HIV virus in the body, reduce the viral load, and slow disease progression, typically involving a combination of drugs from various classes to maintain viral suppression and improve immune function.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

The global burden of HIV/AIDS remains a significant public health challenge, particularly affecting vulnerable populations such as adolescents. As of the end of 2022, an estimated of 39 million people were living with HIV globally, with 1.65million being adolescents aged between 10 to 19 years (WHO, 2022). More than 90% of these cases are in sub-Saharan, accounting for about 1.4 million (UNICEF-WHO-WB, 2022). These statistics underscore the global imperative to continue and strengthen efforts in HIV prevention, treatment, and support, particularly in regions heavily burdened by the disease (UNAIDS, 2022).

Despite advancements in accessing antiretroviral therapy (ART) and efforts to prevent mother-to-child transmission (PMTCT), over 1.5 million adolescents and young adults aged 10 to 24 years die to AIDS-related causes annually, equating to nearly 5000 deaths each day (WHO, 2022). The majority, about three-fourths, of these deaths occur in low and middle-income countries (LMICs). In 2022, approximately 140,000 adolescents aged 10-19 years worldwide were newly infected with HIV. About 100,000 children 0-9 years and adolescents 10-19years died from AIDS-related causes, with approximately 73 percent of these preventable deaths occurring among children 0-9 years old (UNAIDS, 2022). While the number of annual AIDS-related deaths among children under 10 years has declined by about 80 percent since its peak in 2002, the decrease among adolescents has only been 27 percent since the same year (UNAIDS, 2022). This highlights the persistent challenges adolescents face related to AIDS-related mortality. It underscores the urgent need for targeted interventions and support systems to address the specific needs and vulnerabilities of adolescents living with HIV/AIDS.

Adolescence is a critical period of growth and development marked by rapid physical, cognitive, and psychosocial changes as individuals navigate the transition from childhood to adulthood (WHO, 2010). However, for adolescents living with HIV, often face complications in achieving these developmental milestones due to the challenges associated with managing this chronic medical condition (WHO, 2010). Adolescents living with HIV often face unique challenges

related to their nutritional status. HIV infection can directly impact their nutritional status by affecting their metabolism, appetite, and ability to absorb nutrients. Additionally, HIV-related symptoms and complications, as well as side effects of antiretroviral therapy (ART), can further exacerbate malnutrition among this population (WHO, 2010). These challenges begin even before birth, as children born to seropositive mothers face higher mortality rates and an increased incidence of prematurity and intrauterine growth retardation (Taha et al., 1999). The severity of maternal HIV infection also impacts infant mortality rates, with those born to more advanced HIV-positive mothers facing heightened risks within the first 6 months of life (Zijenah et al., 2021). Additionally, adolescents living with HIV may experience stigma, discrimination, and social isolation, further hindering their access to nutritious food, adherence to treatment, and overall well-being (Faidas et al., 2024). Economic hardships, limited access to healthcare services, and inadequate support systems exacerbate these challenges, contributing to poor nutrition outcomes among this vulnerable population (Robinson et al., 2023).

Despite advancements in the global response to the HIV pandemic, the unique challenges faced by HIV-positive adolescents persist. Among these concerns, the impact of HIV on the nutritional status of adolescents emerges as a critical aspect requiring comprehensive examination (Kimberly et al., 2017). Addressing nutritional needs and challenges faced by adolescents living with HIV requires a comprehensive approach that goes beyond medical interventions. It is essential to address social, economic, and psychological factors to ensure a holistic solution (Ngwenya et al., 2024). Nutritional interventions should encompass strategies to enhance access to balanced diets, provide tailored nutritional counseling and support, and tackle underlying social determinants of health (WHO, 2022). By addressing these challenges, we can promote better nutrition status and overall health outcomes for adolescents living with HIV.

Malnutrition continues to be a significant global issue, with undernutrition being particularly prevalent in developing countries and affecting individuals of all age groups living with HIV. Adolescents infected with HIV face a heightened risk of undernutrition due to their rapid physical growth and development, combined with increased nutritional demands during puberty and the presence of HIV infection (Gebrie et al., 2023). Research indicates a notable prevalence of underweight among this population. Furthermore, micronutrient deficiencies pose significant

health risks on a global scale, with iron deficiency emerging as the most common among adolescents living with HIV worldwide (Gebrie et al., 2023).

The relationship between nutrition and HIV is complex and bidirectional. Malnutrition can exacerbate the effects of HIV and contribute to a more rapid progression to AIDS. Conversely, the progression of HIV can lead to malnutrition (Caroline et al., 2006). Additionally, the relationship between HIV/AIDS and food security operates in two directions, as HIV/AIDS can both contribute to and result from food insecurity and inadequate nutrition (Caroline et al., 2006). In adolescents, the progression of HIV/AIDS is often influenced by a weakened immune system, which can be exacerbated by insufficient dietary intake or malnutrition (Duggal et al., 2012).

The nutritional status of adolescents infected with the Human Immunodeficiency Virus (HIV) is predominantly characterized by undernutrition (Hussein et al., 2019). Undernutrition, in this context, is defined as the consequence of inadequate food intake, leading to conditions such as underweight, stunting, wasting, and deficiencies in essential micronutrients often associated with recurrent infectious diseases (FAO, 2003). These nutritional challenges not only compromise the immediate health of these adolescents but also have long-term implications for their growth, development, and overall quality of life (Clark et al., 2018). Poor nutrition has been linked to compromised immunity and accelerated disease progression in HIV-positive adolescents (Kathleen et al., 2007). These children are susceptible to growth failure and may face developmental and behavioral challenges.

In low- and middle-income countries (LMICs), undernutrition such as stunting, underweight, micronutrient deficiencies such as anemia, is prevalent among adolescents living with HIV (Bailey et al., 2015). Despite the significant and varied impacts, limited data exists regarding the nutritional status among adolescents with HIV in low-income countries, where the burdens of undernutrition and HIV are notably high. Previous research often combines data for adolescents with that of younger children, failing to provide an accurate representation of the specific nutritional challenges faced by adolescents. This lack of detailed data may lead to either overestimation or underestimation of the problem, as there are likely systematic differences in

the nutritional challenges between young children and adolescents living with HIV (Shiferaw et al., 2020).

In Tanzania as well, adolescents living with HIV are significantly affected by undernutrition, although this issue remains largely underreported and overlooked in health and nutrition initiatives. Consequently, there is a scarcity of data at the national level regarding the nutritional status of adolescent girls living with HIV, who are considered women of reproductive age starting from 15 years old (Chacha et al., 2023). Previous studies indicate that approximately 28.9% of children and adolescents aged 5 to 19 years were suffering from underweight, 36% from stunting, and 13% from underweight (Chacha et al., 2023). Despite concerted efforts to combat malnutrition, the prevalence of adolescent morbidity and mortality due to HIV/AIDS remains high in the country. Enhancing nutrition uptake and regular assessment is crucial for early detection of malnutrition (WHO, 2010).

In addressing undernutrition, WHO has recommended nutritional interventions such as promoting healthy eating habits, providing access to nutritious food options, offering nutritional counseling and education, as well as access to balanced diet rich in essential nutrients to support their overall health and well-being. The combined use of these interventions and ensuring access to adequate healthcare services, including HIV treatment and care, holds the potential to improve undernutrition and lower case fatality among HIV-positive adolescents (WHO, 2010). Antiretroviral therapy (ART) treatments can help improve immunity, reduce energy loss, and potentially enhance appetite for food, which can indirectly support nutritional status in this population (Sunguya et al., 2012).

Studies conducted in Tanzania and other settings has highlighted the importance of nutritional support in promoting optimal growth and addressing undernutrition among adolescents living with HIV (Sunguya et al., 2012). Understanding the effectiveness of various nutritional interventions, in improving the nutritional status of adolescents receiving ART is essential for developing targeted strategies to address undernutrition in this population effectively (Zegeye et al., 2022; Nakamura et al., 2023). Additionally, socio-economic and demographic factors play a pivotal role in contributing to malnutrition in many households. These factors encompass a

lack of financial resources for purchasing food, food insecurity, and poor housing conditions. In households affected by HIV, where children may lose one or both parents, vulnerabilities to food insecurity increase. This heightened vulnerability, combined with insufficient care and support, further aggravates the risk of developing malnutrition (Echendu et al., 2021).

Adolescents demand particular focus to fulfill their nutritional needs essential for their growth and maturation. It's imperative to incorporate nutritional evaluation and assistance into the regular healthcare provided to children living with HIV (FANTA, 2016). Dietary strategies need to address concerns regarding access to food, adequate quantity and quality of food, and the absorption and processing of nutrients (FANTA, 2016). Enhancements in dietary diversity and frequency, following the World Health Organization's recommendation of consuming a balanced diet that includes a variety of nutrient-rich foods to meet their nutritional needs, can significantly improve the health, well-being, and reduce mortality and morbidity rates associated with various forms of malnutrition among adolescents aged 10 to 19 years living with HIV (WHO, 2020). Nutritional assessment is a critical component of the management of every child infected with HIV (TFNC, 2016). Through this assessment, any nutritional deficiencies are identified, allowing for tailored nutritional support based on the adolescent's current nutritional status and potential risk factors for malnutrition (Sunguya et al., 2014).

1.2 Problem statement

Adolescents living with HIV continue to face significant nutritional challenges that compromise the effectiveness of their treatments. These challenges include malnutrition and poor dietary diversity. The persistence of these challenges, despite improvements in HIV treatment access can be attributed to food insecurity and low adherence to ART, exarcebated by psychosocial factors such as fear of stigmatization, limited social support, and mental health issues such as depression and anxiety (Sauli et al., 2019). These factors contribute to compromised immune function and poor health outcomes for adolescents living with HIV.

Undernutrition is a predominant nutritional challenge faced by adolescents living with HIV in Tanzania. These adolescents face a heightened risk of undernutrition, primarily due to the increased nutritional demands during puberty and the effects of HIV, which can hinder physical growth and development (Gebrie et al., 2023). Nutritional deficiencies, such as iron deficiency and other micronutrient deficits, are prevalent in this population, with significant implications for both short-term and long-term health outcomes (Gebrie et al., 2023). Research indicates that, 36% of these adolescents experience stunting, 28.9% are underweight, and 13% suffer from wasting. Additionally, severe anemia affects 88.1% of HIV-positive adolescents (Chacha et al., 2023).

Despite these challenges, there is scarcity of data regarding the nutritional status among adolescents living with HIV in Tanzania (Shiferaw et al., 2020). Much of the existing research combines data for adolescents with that of younger children, failing to account for the unique challenges that adolescents face during this critical developmental period (Shiferaw et al., 2020). This lack of data hinders the ability to design targeted interventions, as the nutritional needs and challenges of adolescents differ significantly from those of younger children.

There is a need for further research focusing specifically on adolescents living with HIV in Tanzania, to better understand and address their specific nutritional needs and challenges within the context of HIV. This study focused on assessing the nutritional well-being and associated dietary diversity factors among adolescents living with HIV in the Ilala Municipal Council, Dar es salaam.

1.3 Rationale of the study

The study findings focused on equipping parent and caregivers with tools for early detection of malnutrition indicators, including wasting, stunting and underweight. By raising awareness of these indicators, the study enabled caregivers to take proactive measures to address nutritional issues. This included practices such as promoting dietary variety, encouraging consistent physical activity, offering emotional support, maintaining open communication, ensuring adherence to medication, fostering social connections, and consulting healthcare professionals for guidance.

The study findings aimed to offer healthcare providers in the Ilala Municipal Council a comprehensive understanding of adolescent's nutritional needs within the context of HIV/AIDS. By improving insights into these needs, the study sought to enhance to counseling and educational efforts, ensuring that parents and caregivers receive accurate and thorough information regarding nutrition.

The study findings aimed to provide evidence-based insights to healthcare providers for improving nutrition among adolescents living with HIV/AIDS. By integrating these findings, health care providers can enhance their practice and develop effective interventions. This includes increasing dietary diversity through tailored recommendations and counseling, implementing school-based nutrition education, ensuring access to nutritional supplements, and addressing socio-economic and demographic factors affecting nutritional status.

1.4 Research questions

1.4.1 Main research question

What is the nutritional status and associated dietary diversity factors among adolescents living with HIV in Ilala Municipal Council, Dar es Salaam?

1.4.2 Specific research questions

1. What is the prevalence of malnutrition among adolescents living with HIV in Ilala Municipal Council?
2. What is the dietary diversity among adolescents living with HIV in Ilala Municipal Council?
3. What is the level of adherence to Antiretroviral Therapy (ART)) in relation to nutritional intake among adolescents living with HIV in Ilala Municipal Council?

1.5 Research objectives

1.5.1 Broad objective

To assess the nutritional status and associated dietary diversity factors among adolescents living with HIV in Ilala Municipal Council, Dar es Salaam.

1.5.2 Specific objectives

1. To determine the prevalence of malnutrition among adolescents living with HIV in Ilala Municipal Council.
2. To assess the dietary diversity among adolescents living with HIV in Ilala Municipal Council.
3. To assess the level of adherence to ART in relation to nutritional intake among adolescents living with HIV in Ilala Municipal Council.

1.6 Conceptual framework

The figure below illustrates the factors influencing the nutritional status of adolescents living with HIV**,** by showing the interrelationship between dependent variable and independent variables.

The “nutrition status” served as the dependent variable, reflecting the overall health and well-being of adolescents living with HIV. The independent variables such as, “dietary diversity, adherence to antiretroviral therapy (ART), and sociodemographic factors” play a crucial role in influencing the nutritional status of adolescents living with HIV.

Higher dietary diversity is typically associated with better nutrition status, as it ensures a wider range of essential nutrients are consumed. Proper adherence to ART can improve health outcomes in adolescents with HIV, which in turn can positively affect their nutrition status by supporting overall well being and immune function. Sociodemographic factors can act as confounders or effect modifiers. For instance, socioeconomic status can influence access to diverse food and healthcare, thereby affecting both dietary diversity and adherence to ART, and consequently, nutrition status.

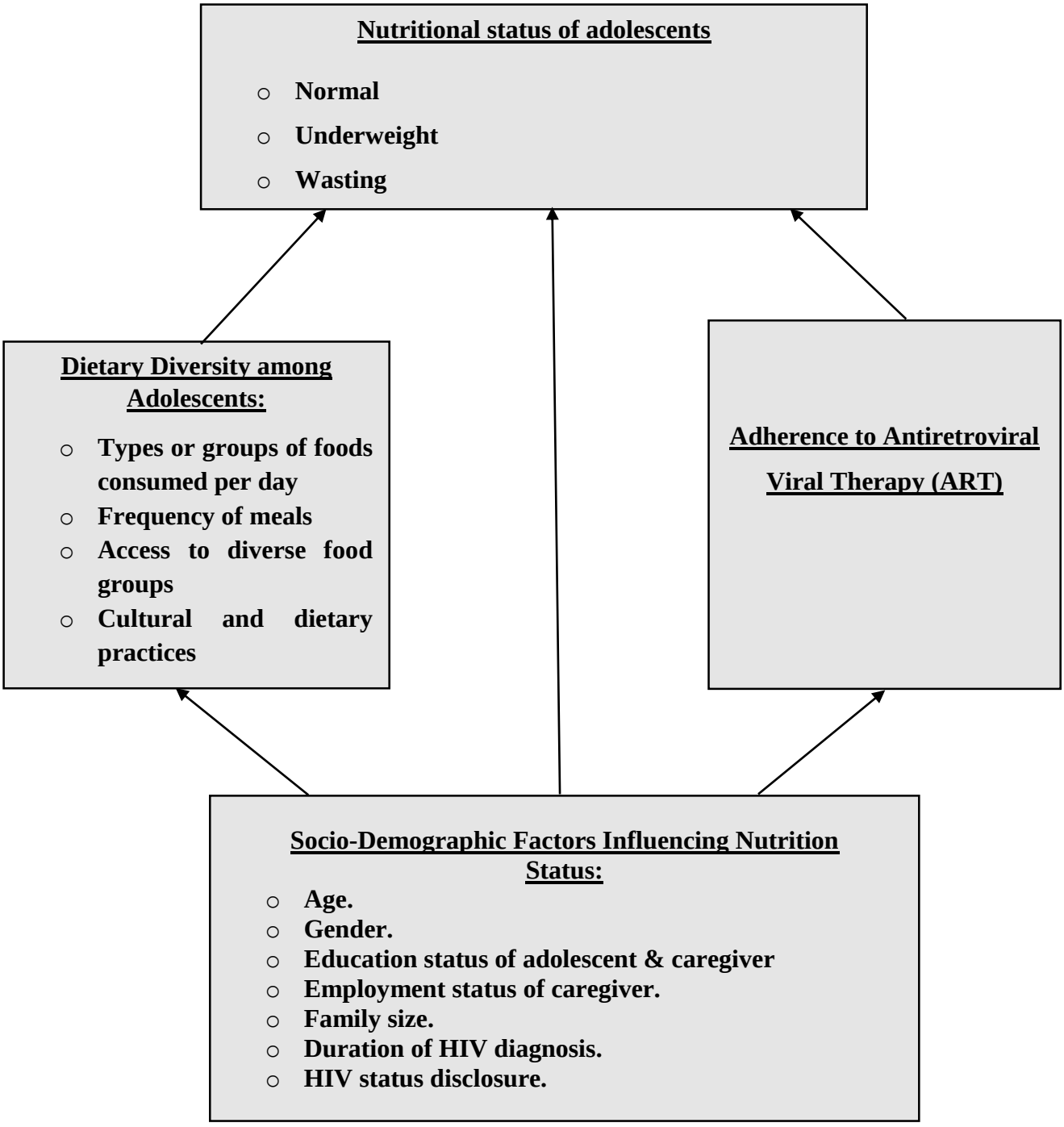


Figure 1: Conceptual framework

(Developed by the author)

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Nutritional Requirements of Adolescents

Nutritional status during adolescence significantly influences an individual's health and well-being throughout their lifespan. Adolescents experience unique nutritional requirements due to several key factors. Firstly, rapid growth and development during adolescence, especially during the pubertal growth spurt, necessitate increased nutrient intake to support physical growth and development (Spear et al., 2002). Secondly, adolescents have higher energy needs compared to other age groups due to increased physical activity levels and metabolic demands associated with growth and development (Story et al., 2005). Thirdly, psychosocial factors, such as peer influence and dietary habits, can impact adolescents' nutrient intake and nutritional status (Neurmark-Sztainer et al., 2003). Lastly, hormonal changes during adolescence, including changes in metabolism and body composition, contribute to altered nutrient requirements. Overall, meeting the nutritional needs of adolescents is crucial for promoting optimal growth, development, and overall health during this critical life stage (King et al., 1993; Lathan et al., 1997).

2.2 Nutritional Status in Adolescents

Nutritional status refers to the overall health and well-being of an individual in relation to their dietary intake and utilization of nutrients (WHO, 2010). It encompasses various aspects such as dietary patterns, nutrient intake, body composition, and metabolic function to determine their nutrition health (Gibson et al., 1990). Adolescents undergo significant physical, cognitive, and psychosocial changes during this period, and their nutritional needs are influenced by factors such as growth spurts, hormonal changes, and lifestyle habits (Gibson et al., 2010). The common categories of nutritional status assessment are dietary surveys, biochemical tests, anthropometric measurements and clinical assessments (WHO, 2010). The measurements obtained from various nutritional status assessment methods are typically consolidated to create indices, aiding in the interpretation and categorization of these measurements. These indices are evaluated by

comparing them with reference values, limits, and predetermined thresholds derived from standard distributions (WHO, 2010).

2.3 Factors Influencing Nutritional Status in Adolescents

The causes of malnutrition in adolescents are complex and have multifactorial causes, in the sense that there are various ways in which nutritional status can be affected. Food availability and accessibility remain critical determinants, as insufficient food intake can lead to malnutrition (FAO, 2018). Economic factors, such as low income and limited access to markets, may contribute to insufficient food production and accessibility, impacting adolescents' ability to maintain a balanced diet (FAO, 2018). Additionally, adolescents' nutritional status may be influenced by factors such as workload and responsibilities. Most African women are the ones responsible for both domestic chores and agricultural activities. This has resulted to most of the women to have not enough time for preparing meals for their children (Black et al., 2013). Therefore, ensuring frequent and nutritious meals for adolescents is crucial to meeting their increased nutrient requirements during this critical period of growth and development. Addressing socioeconomic factors and providing support for caregivers can help improve adolescents' access to nutritious foods and promote better nutritional status overall (UNICEF, 2020).

2.4 Adolescents Malnutrition

Adolescent malnutrition refers to inadequate or imbalanced nutrition during the critical stage of adolescence, typically between the ages of 10 to 19 years. This period is marked by significant physical, cognitive, and psychosocial development, making proper nutrition essential for overall health and well-being (Patton et al., 2016). Malnutrition during adolescence can manifest in various forms, including undernutrition (stunting, wasting, and underweight), micronutrient deficiencies, and overweight/obesity (WHO, 2014). Several factors contribute to adolescent malnutrition. These may include socio-economic factors such as poverty, limited access to nutritious food, and food insecurity (FAO, 2018). Adolescents may also face barriers to healthy eating due to cultural norms, lack of nutrition education, and unhealthy dietary practices (Story et al., 2002). Additionally, psychosocial factors such as peer pressure, body image concerns,

and mental health issues can influence eating behaviors and contribute to malnutrition (Neumark-Sztainer et al., 2012). There is a prevailing belief that a child whose mother has died of AIDS, or an AIDS-related illness is also destined to die from the same cause. Consequently, these children are at an increased risk of unnecessary death due to malnutrition and common childhood illnesses such as diarrhea and respiratory infections (Mukoyogo et al., 1991).

Malnutrition can be classified using various indicators, including anthropometric measurements as well as clinical signs and symptoms of nutritional deficiencies.

2.4.1 Weight-for-Age (Underweight)

Underweight serves as an indicator that reflects the body relative to chronological age, considering both weight and height of the child. Its composite nature, however, introduces complexity in interpretation, as it fails to differentiate between a short child with adequate body weight and a tall but thin child. The use of Weight-for-age Z-score and underweight data has limitations, particularly in distinguishing between stunting and wasting. Nevertheless, similar to stunting, being underweight provides insights into the long-term health and nutritional experiences of individuals or populations (WHO, 2020).

In Tanzania, approximately 28.9% of children and adolescents aged 5-19 years are classified as moderately or severely underweight. Reports indicate that the prevalence of underweight were higher in boys than in girls and were commonly in rural areas than in urban areas (MoHCDEC, & TDHS-MIS, 2022). These findings emphasize the need for nuanced interpretations of underweight indicators and highlight regional variations that warrant targeted interventions and further investigation.

2.4.2 Height-for-age (Stunting)

Stunting signifies the inability to attain full linear growth potential due to suboptimal health or nutritional status, often linked with challenging economic circumstances and exposure to adverse conditions like illness and inadequate feeding practices (WHO, 2020). Progress in reducing stunting levels indicates an enhancement in overall socioeconomic conditions. Typically, stunting becomes more prominent around the age of three, and in children younger than three, it represents an ongoing struggle to gain weight or experience stunted growth (WHO, 2020). In Tanzania about 36% of children and of adolescents aged 5-19 years living with HIV

are stunted (low height-for-their age) a reflection of chronic malnutrition. Stunting was higher among boys than girls and the percentage of stunting increased with age compared to the younger counterparts. A higher percentage of stunted were recorded in rural settings. (MoHCDEC & TDHS-MIS, 2022).

2.4.3 Weight –for-height (Wasting/ Overweight)

Wasting indicates a deficiency in tissue and fat mass compared to what is expected for a child of similar height or length. It results from inadequate nutrition in the period leading up to the survey, as well as from insufficient food intake or recent illnesses causing weight loss and the onset of malnutrition (WHO, 2020). Severe wasting is strongly associated with a heightened risk of mortality, and the prevalence of wasting can vary significantly with the season. In areas without food shortages, wasting prevalence typically remains below 5%, even in impoverished countries. Inadequate or delayed weight gain and height growth, as well as weight loss (especially loss of lean body tissue), serve as crucial indicators of nutritional risk among individuals with HIV, particularly adolescents (UNICEF, 2020).

Overweight refers to an excess accumulation of body fat that may impair health. Body mass index (BMI), calculated by dividing weight in kilograms by the square of height in meters (kg/m^2), is commonly used to assess this condition, particularly in adolescents who are compared to growth charts specific to their age and sex (CDC, 2020).Various factors contribute to overweight in adolescents, such as genetic predisposition, poor dietary choices, sedentary lifestyle, socioeconomic status, and environmental influences. Overweight adolescents face an elevated risk of developing numerous health issues, including type 2 diabetes, cardiovascular disease, high blood pressure, joint problems, and psychological challenges like low self-esteem and depression (WHO, 2020).

2.5 Global Prevalence and Impact of Adolescents Malnutrition

Adolescent’s malnutrition, encompassing underweight, wasting, stunting, and overweight is a significant public health concern, particularly in low- and middle-income countries. The global prevalence of malnutrition including overweight/obesity affected over 340 million school-aged children (SAC) and adolescents aged between 5 to 19 years in 2016 (FAO, 2018). Within sub-

Saharan Africa, where approximately 23% of the population falls within the 10 to 19 ages, more than half of adolescents suffer from micronutrient deficiencies like anemia. This is largely attributed to challenges related to food insecurity and a lack of dietary variety (UNICEF, 2020).

These statistics underscore the widespread nature of malnutrition and its impact on child health and well-being. Studies have consistently shown that malnutrition among adolescents aged 10-19 years is highly prevalent in various regions, particularly in sub-Saharan Africa, Asia, and other developing countries. The consequences of malnutrition extend beyond immediate health issues, impacting childhood mortality, growth disorders, and long-term health outcomes (Black et al., 2013). Malnutrition has been linked to increased susceptibility to infectious diseases, impaired cognitive development, and long-term health complications (Patton et al., 2016). Furthermore, the bidirectional relationship between malnutrition and other health conditions, such as HIV/AIDS, has been a subject of investigation. Research has highlighted the complex interplay between malnutrition and infectious diseases, emphasizing the compounding impact of these health challenges on child health and well-being (Zegeye et al., 2022; Simms et al., 2014).

2.6 Coexistence of HIV Infection and Adolescent Malnutrition

The coexistence of HIV infection and malnutrition presents a complex and multifaceted challenge, particularly in the context of adolescent's malnutrition. Studies have shown that malnutrition is highly prevalent among HIV-positive adolescents, exacerbating the effects of the disease and impacting the overall health and well-being of this vulnerable population (Gebrie et al., 2023). Adolescents with HIV face increased susceptibility to malnutrition due to various factors. The virus itself can compromise the immune system, making this age group more vulnerable to infections and affecting their nutritional status. Additionally, the social and economic circumstances often associated with HIV, such as poverty and inadequate access to healthcare, contribute to the nutritional challenges faced by these children (Ngwenya et al., 2024). Malnutrition, in turn, exacerbates the effects of HIV infection. The compromised nutritional status weakens the immune system further, accelerating disease progression and increasing the susceptibility to opportunistic infections (Shiferaw et al., 2020). This bidirectional relationship forms a vicious cycle, where HIV and malnutrition reinforce each

other, creating a significant barrier to the overall health improvement of affected children (Yusufu et al., 2023). Previous research studies, have extensively documented this intricate relationship. These studies emphasize the critical need for targeted interventions addressing both HIV and malnutrition simultaneously. Nutritional interventions, including therapeutic feeding programs and nutrient supplementation, become imperative to promote optimal growth, development, and overall well-being among HIV-positive adolescents (Magadi et al., 2011; Zegeye et al., 2022).

2.7 Impact of Malnutrition on Health Outcomes in HIV-Infected Adolescents

Malnutrition significantly worsens the health challenges faced by HIV-infected adolescents, creating a harmful cycle. Malnutrition weakens the immune system, making them more susceptible to infections and worsening the impact of HIV. It accelerates the progression of HIV/AIDS, leading to a faster decline in health and increased complications (Gebrie et al., 2023). The lack of essential nutrients hampers physical and cognitive development, causing stunted growth and cognitive impairments with long-term consequences (Shiferaw et al., 2020). Malnourished adolescents are more prone to opportunistic infections, further compromising their health. Additionally, malnutrition can undermine the effectiveness of antiretroviral therapy, emphasizing the need to address nutritional needs alongside medical interventions (Zegeye et al., 2022).

2.8 Nutritional Interventions and the Role of Antiretroviral Therapy (ART)

Nutritional interventions, coupled with antiretroviral therapy (ART), constitute a pivotal strategy in fostering optimal growth and well-being among HIV-infected children. While ART is fundamental in managing the viral infection, studies have shown that ART alone may not be sufficient to address the nutritional needs of HIV-positive children, emphasizing the critical need for additional nutritional interventions to promote optimal growth and overall health outcomes in this vulnerable population (Zegeye et al., 2022; Jacobs et al., 2018)

Antiretroviral therapy is central for controlling HIV progression, while nutritional interventions complement it by combating malnutrition, supporting immune function, and fostering overall

physical and cognitive development (Shiferaw et al., 2020). These interventions are crucial to mitigate the high prevalence of malnutrition among HIV-infected children, ensuring optimal growth and countering the negative impacts on health (Magadi et al., 2011). Addressing micronutrient deficiencies caused by HIV infection is a key goal of nutritional interventions, providing essential vitamins and minerals for the child's well-being (Fawzi et al., 2004). Integrating nutritional support with ART offers a holistic approach, not only tackling the viral infection but also promoting comprehensive health improvements, mitigating the long-term consequences of malnutrition (Duggan et al., 2019).

2.9 Dietary diversity among HIV infected adolescents

A varied and diverse range of foods has demonstrated effectiveness in improving the nutritional status among adolescents, providing essential energy and micronutrients. Achieving optimal diet quality (DQ) is crucial, with dietary diversity serving as a widely-used method to assess the variety and nutrient adequacy of diets (Arimond et al., 2004). Dietary diversity, quantified by the number of food groups consumed, is instrumental in ensuring a well-rounded intake of nutrients crucial for adequate growth during the early years of a child's life. It serves as a significant predictor of growth and is closely tied to the fundamental pillars of food security: accessibility, availability, and utilization (Arimond et al., 2004). Proper definition and adherence to dietary diversity, as outlined by the WHO, are essential to enhance the nutritional status of individuals. Various studies emphasize the importance of following dietary diversity to boost the immune system, particularly in immune-compromised individuals or those living with HIV/AIDS, aiming to prevent disease progression (Jones et al., 2014; FANTA, 2010). The dietary diversity score, derived from a 24-hour recall of a child's food intake, classifies food items into 12 categories based on FAO guidelines. These categories include cereals, vegetables, fruits, meat, eggs, fish and other seafood, legumes, nuts and seeds, dairy products, oils and fats, sweets, spices, condiments, beverages, tubers, and roots. Consuming a diverse diet has shown to increase energy and micronutrient intake in developing countries (FAO, 2013; Kennedy et al., 2007). The study by Sealey-Potts et al. (2014) revealed positive correlations between Dietary Diversity Score and Food Variety Score in Tobago preschoolers, aligning with similar findings in children, adolescents, and adults across different studies (Moursi et al., 2008; Oldewage-

Theron et al., 2008; Nguyen et al., 2013; Rathnayake et al., 2012). Notably, a significant and positive correlation between Nutrient Adequacy Ratio (NAR) of most nutrients and Dietary Diversity Score was observed in this study, reinforcing the utility of dietary diversity as a simple approach to estimate nutrient adequacy in various populations.

The study by Ukegbu et al. (2016) on dietary diversity among under-five children in rural areas of Nigeria, utilizing a 24-hour recall, revealed that most households failed to reach the recommended 12 types of foods outlined by FAO. Instead, they primarily relied on 5 to 8 types, attributing this limitation to food insecurity. This pattern is not unique to Nigeria, as other sub-Saharan countries, such as Ethiopia and Ghana also face challenges of food insecurity resulting in low dietary diversity scores among children. (Herrador et al., 2015; Bandoh et al., 2017).

2.10 Adherence to ART in relation to nutritional intake

Research conducted in Ethiopia by Negassie et al. (2013) revealed that malnutrition, characterized by insufficient access to adequate food and a dietary pattern consisting of fewer than three meals per day, was strongly linked to non-adherence to antiretroviral therapy (ART). The studies by (Dong et al., 2017; Van-Graan et al., 2015; Somarriba et al., 2010) revealed that nutrition plays a crucial role in boosting the immune system for people living with HIV. However, it emphasized that nutritional demands can vary among individuals. Therefore, dietary recommendations should be personalized and tailored to meet the specific nutritional needs of each person. Based on the literature, proper adherence to antiretroviral therapy (ART) for patients living with HIV is crucial, particularly in resource-limited settings. Nutrition and dietary intake emerge as pivotal components for boosting immunity in study population.

2.11 Socio-Demographic factors influencing the nutrition status

The nutritional status of HIV-positive adolescents is notably influenced by socioeconomic factors and demographic characteristics. Numerous studies have demonstrated that adolescents from lower socioeconomic backgrounds are more prone to being undernourished, experiencing wasting, being underweight, and exhibiting stunted growth. This correlation is unsurprising, as adolescents from economically disadvantaged families often face limited access to nutritious foods and quality healthcare services. The study by Echendu et al. (2021) showed that orphans,

especially those who lost one or both parents, experience higher rates of undernutrition, particularly wasting, due to increased food insecurity and economic challenges associated with parental loss. Similar findings are documented across various studies in different countries. In Uganda, Kikafunda et al. (2005) reported a higher prevalence of stunting among orphans compared to non-orphans. Studies in Ethiopia, Botswana, Nigeria, and the Democratic Republic of Congo also highlight the association between single-parent households and elevated levels of underweight or stunting in children. Additionally, the study in Tanzania by Sichona et al. (2001) found that children in households with currently married mothers experienced less stunting compared to those with divorced, widowed, or never-married mothers. These findings underscore the impact of socio-demographic factors, particularly parental status, on undernutrition in HIV-infected children.

Research findings from Mishra et al. (2007) highlighted that, those with single mothers are more likely to experience underweight and wasting compared to their counterparts from married households. Similarly, Tette et al. (2016) found a correlation between malnutrition in children and mothers who are unmarried or cohabiting from lower family incomes. These studies underscore the importance of stable family unions in promoting better nutritional outcomes for children. The implication is that nutritional support programs should include training for single parents, along with empowerment initiatives for widows and unmarried single mothers.

Others studies by Ndukwa et al. (2013) and Owoaje et al. (2014) demonstrated associations between family size and stunting, as well as a higher risk of malnutrition in households with more than four children. Furthermore, a consistent observation across sub-Saharan Africa, noted by Keino et al. (2014) and Kismul et al. (2017) revealed that, males tend to be more stunted than females with factors contributing to this pattern being multifactorial and involving socioeconomic, environmental, and biodemographic factors. The WHO recommends that children and adolescents living with HIV should consume a balanced diet that includes a variety of nutrient-rich foods to meet their nutritional needs. However, the study population revealed suboptimal feeding frequency in over half of the participants, possibly due to factors like lack of awareness or financial constraints hindering parents/caregivers from meeting the recommended frequency, possibly due to poverty (WHO, 2003).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study area

The study was conducted in Ilala Municipal Council, one of the five municipalities within the Dar es Salaam region, consisting of an approximate population of 1,220,611 as projected from the 2012 census. Over the years, the population growth rate in Ilala Municipal Council has increased from 4.6% in 2002 to 5.6% in 2012 (Ilala Municipal Council Socio-Economic Profile, 2019). This municipality comprises 26 wards, 159 streets, and 142 healthcare facilities. The health services in Ilala Municipal Council encompass curative, preventive, and promotive healthcare, as well as rehabilitative services offered by both public and private healthcare facilities. These services include 8 hospitals, 12 health centers, and 136 dispensaries which comprise government, private, and military facilities (Ilala Municipal Council Socio-Economic Profile, 2019).

The Ilala Municipal was purposefully chosen due to its significant representation of hospitals that serve a large number of HIV patients (both adults and children) attending Care and Treatment Centers (CTCs) in Dar es Salaam. This council was selected for its high number of HIV patient care and treatment activities, making it a relevant and suitable location for conducting the study on nutritional status and associated factors among adolescents living with HIV.

The study was conducted in two health facilities namely: Amana Regional Referral Hospital (ARRH) and Mnazi Mmoja Health Center. Both hospitals are dedicated to children's care and treatment services, with a focus on addressing malnutrition. The hospitals consist of four departments, Pediatric (clinic, counsellor, and reception), Laboratory, Pharmacy and Administration to ensure effective and efficient healthcare delivery. They offer outpatient clinics, follow-up services, free medical treatment, and nutrition counseling tailored to HIV-positive children and adolescents. (Ilala Municipal Council Socio-Economic Profile, 2019)

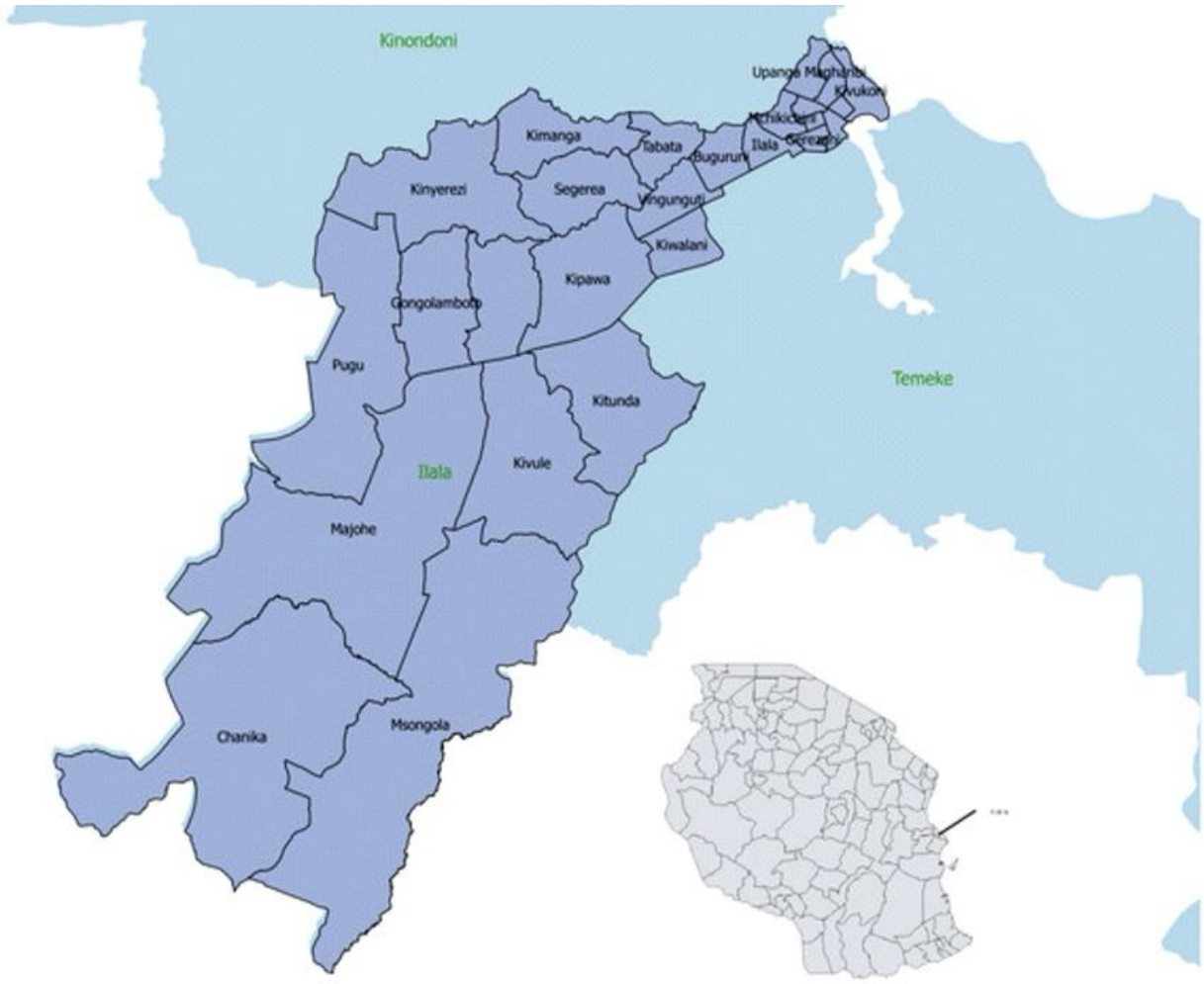


Figure 2: Showing the map of Ilala Municipal Council and its wards in Dar es Salaam City.

(Cited from Wikipedia.com)

3.2 Study population

The study population for this research were adolescents aged 10 to 19 years living with HIV who were accessing HIV care and treatment services at Amana Regional Referral Hospital (ARRH) and Mnazi Mmoja Health Center in the Ilala Municipal Council of Dar es Salaam.

3.2 Eligibility criteria

3.2.1 Inclusion criteria

All HIV infected adolescents, both male and female aged between 10 and 19 years who were accessing HIV care and treatment services at Amana Regional Referral Hospital and Mnazi Mmoja Health Center and receiving antiretroviral therapy (ART) were included in the study.

3.2.2 Exclusion criteria

HIV-infected adolescents with severe health conditions or comorbidities that might have interfered with nutritional status assessment, as well as pregnant female adolescents, since pregnancy could independently influence nutritional status, were excluded from the study.

3.3 Study design

Hospital based, Cross-sectional descriptive study was conducted to assess the nutritional status and associated dietary diversity factors among adolescents living with HIV in Ilala Municipal Council, Dar es Salaam.

3.4 Sample size and sampling technique

3.4.1 Sample size

The sample size was established using the formula for sample size estimation for survey as regarding this is finite population a formula derived from Epi Info™

$$n = \frac{Nz^2pq}{d^2(N-1) + z^2pq}$$

Where:

N=size of the population of adolescents attending CTC at Amana Regional Referral hospital and Mnazi Mmoja Health Center.

z= standard normal deviate set at 1.96 for 95% confidence interval

p=Proportion of undernutrition among adolescents living with HIV. (similar study was done on the epidemiological profile of malnutrition status among adolescents living with HIV in Tanzania, the prevalence of undernutrition was found to be 72% (Chacha et al., 2023).

q = 1-p and

d = margin error, set at 5% (0.05)

P = 0.72

The sample size required was:

So, N =242, d=5%, p=0.72, q=0.28, z=1.96. Plugin to the formula; n= 136.

Therefore, the minimum sample size was 136. This sample size was used for collecting data in two health facilities, namely Amana Regional Referral Hospital and Mnazi Mmoja Health Center.

3.4.2 Sampling technique

Systematic random sampling technique was used to select a desired sample of adolescents living with HIV who were attending at both Amana Regional Referral Hospital and Mnazi Mmoja Health Center. With a total population of **242** adolescents attending these facilities, and a desired sample size of **136**, a sampling interval (k) was calculated by dividing the total population size by the desired sample size. This resulted in a sampling interval of **2.**

Subsequently, participants were selected systematically, with every 2nd participant on the list being included in the sample until the desired sample size was achieved. A truly random starting point was chosen to maintain the randomness of the sampling process. Following the completion of the sampling procedure, the selected sample of 136 adolescents was verified to confirm that the desired sample size had been attained. This sampling approach facilitated the selection of a representative sample from the population of adolescents accessing HIV care and treatment services at both Amana Regional Referral Hospital and Mnazi Mmoja Hospital.

3.5 Study variables

1. **Dependent variable**
    a. Nutritional status of adolescents living with HIV.
2. **Independent variables**
    a. Adherence to Antiretroviral Therapy (ART).
    b. Dietary Diversity among adolescents such as types of foods consumed per day, frequency of meals, access to diverse food groups, cultural and dietary practices.

c. Socio-Demographic factors influencing nutrition status such as age, gender, duration of HIV diagnosis, education level of caregivers, family size, housing conditions, Socioeconomic status ie, access to health care, household income, and employment status of caregivers.

3.6 Data collection method

Data were collected by two research assistants using a face to face, interviewer-administered, structured questionnaire. Information was collected directly from the primary caregivers for adolescents aged 10-14 years, while adolescents aged 15-19 years provided information themselves during their ART follow-ups visits to health facilities. The questionnaire covered socio-demographic information, dietary diversity assessment (24 hours' dietary recall), and adherence to ART in relation to nutritional intake, to assess the nutritional status and dietary diversity factors of adolescents living with HIV. The questionnaire was carefully designed to collect pertinent information related to the nutritional assessment of HIV-positive adolescents in the specified age group.

The research assistants received training on how to take anthropometric measurements and dietary assessment. Additionally, they received training on the proper administration of the study questionnaire. This training equipped them with the necessary skills to effectively and accurately carry out data collection procedures, ensuring consistency and reliability of the study.

Informed consent was obtained from the primary caregivers of adolescents aged 10 to 14 years before administering the questionnaire. For adolescents aged 15 to 19 years, assent was obtained in addition to caregiver consent. This process ensured that both the caregivers and the adolescents were fully informed about the study's purpose, procedures, and their rights as participants. To protect the privacy and confidentiality of the participants, the questionnaire did not include personal identifiers, and the data collected was securely stored on a password-protected computer.

3.6.1 Anthropometric assessment

The assessment entailed using a digital weighing scale (Seca 770, Germany) to measure participants' weight and a stadiometer (Seca, Germany) to measure their height. Z-scores for

height-for-age, weight-for-height, and weight-for-age computed and contrasted with the growth standards set by the WHO in 2007. This comparison helped to determine the prevalence of stunting, wasting, and underweight. Participants whose z-scores for height-for-age, weight-for-age, and weight-for-height are below -2 standard deviations of the WHO (2007) reference population were classified as stunted, underweight, and wasted accordingly.

3.6.2 Dietary diversity assessment

A 24-hour recall method was used to collect data on dietary intake based on the variety of foods consumed within the past 24 hours. The participants were asked to recall all the foods and drinks they consumed throughout the day, starting from the first food eaten in the morning until the last food consumed at night, both at home and outside the home.

The Food and Agriculture Organization's (FAO) Minimum Dietary Diversity for Women (MDD-W) was adapted to determine the adolescents' dietary diversity. The dietary diversity was assessed using 10 food groups: cereals, white roots, tubers and plantation; legumes; nuts and seeds; dairy products; meat, poultry and fish; eggs; dark green leafy vegetables; vitamin A rich fruits and vegetables; other vegetables; other fruits. Foods consumed in the past 24 hours were used to calculate the dietary diversity score. All "Yes" responses were scored one (1) and "No" responses were scored zero (0). The food groups consumed were summed into a score ranging from 0 to 10. (FAO, 2016).

The total dietary diversity score was classified into two categories; adequate (5-10) and inadequate (1-4). A score of 5 or greater (≥5) indicated that the participant consumed from 5 or more food groups, while a score of 4 or less (≤4) indicated that the participant consumed from 4 or fewer food groups.

3.6.3 ART adherence assessment

A structured questionnaire was used to collect self-reported data on medication adherence and daily nutritional intake. Participants' responses regarding medication intake were categorized into two groups: adherent and non-adherent.

3.7 Data management and analysis

Data analysis was carried out using STATA version 17 software.

Table 1: Specific objectives and data analysis method

OBJECTIVE	DATA ANALYSIS PLAN
Objective 1	-Chi-square tests were used to determine if there is significant association between categorical variables (e.g., nutritional status and other categorical factors like gender, caregiver type, etc.) -Multivariate regression analysis was used to examine how socio-demographic characteristics, treatment history, and disease status collectively influence nutritional status (malnutrition prevalence).
Objective 2	-Descriptive statistics were used to analyze the Dietary Diversity Score (DDS) and dietary diversity. -Chi-square tests was performed to assess if there is significant association between categorical variables (e.g., dietary diversity scores and other categorical factors like sociodemographic factors, food intake practices, etc). -Binary logistic regression was used to predict inadequate dietary diversity.
Objective 3	-Pearson correlation analysis was used to measure the strength and direction of the relationship between two variables i.e adherence to ART and nutritional intake.

3.8 Ethical clearance and approval

The approval was requested and secured from the Institutional Review Board (IRB) at Muhimbili University of Health and Allied Sciences (MUHAS). The permits for conducting research within within the respective department were obtained from Amana Regional Referral Hospital (ARRH) and Mnazi Mmoja Health Center Management. Written informed consent was obtained the primary caregivers of adolescents aged 10 to 14 years before administering the questionnaire. For adolescents aged 15 to 19 years, assent was obtained in addition to categiver consent. These measures ensured that the study adhered to ethical guidelines, promoting integrity and responsible research conduct throughout the entire process.

CHAPTER FOUR

4.0 RESULTS

4.1 Sociodemographic characteristics of HIV-positive adolescents attending CTC at Mnazi Mmoja Health Center and Amana Regional Referral Hospital

During the study period, 136 adolescents were on ART follow-up across two health facilities. Four adolescents were excluded due to the incomplete questionnaires (n=4), leaving 132 adolescents in the study, comprising 64 (48.5%) boys and 68 (51.5%) girls. The majority 56.1% were below 15 years of age. All adolescents were in-school, more than three-fourths 78.0% were primary school students and the remaining 22.0% secondary school students. Slightly, more than half 53.0% were living with their biological parents. The majority of caregivers 71.2% had formal education, while 28.8% had no formal education.

Most adolescents 73.5% came from families with greater than five members, the remaining 26.5% were from smaller families less than five members.

Regarding their medical records, half of the adolescents had been on ART for at least five years. About a quarter 23.5% had a low CD4 count ≤500 cells/μL, at the time of the study, while majority (76.5%) had a CD4 count greater than 500 cells/μL. Most participants 80.3% reported no history of opportunistic infections, with only a few (19.7%) having experienced them.

According to WHO clinical staging of HIV (2007), the majority 78.8% were at the first clinical stage of the illness. Additionally, about 77.3% had normal hemoglobin levels. **(Table. 2).**

Table 2: Sociodemographic characteristics of HIV-positive adolescents (n=132)

Variables	Frequency (n)	Percentages (%)
Age (years)		
10–14	74	56.1
15–19	58	43.9
Sex		
Girls	68	51.5
Boys	64	48.5
Type of caregiver		
Parents	70	53.0
Others	62	47.0
Education status of the adolescent		
Primary	103	78.0
Secondary	29	22.0
Education status of a caregiver		
No formal education	38	28.8
Primary	65	49.2
Secondary & Tertiary	29	22.0
Family size		
<5	35	26.5
≥5	97	73.5
HIV status disclosure		
Not disclosed	37	28.0
Disclosed	95	72.0
Duration on ART		
≤5 years	66	50.0
>5 years	66	50.0
CD4 count (cells/µL)		
≤500	31	23.5
>500	101	76.5
History of opportunistic infection		
No	106	80.3
Yes	26	19.7
WHO HIV-staging		
Stage-I	104	78.8
Stage-II or above	28	21.2
Hemoglobin level		
Normal	102	77.3
Anaemia	30	22.7

4.1.1 The prevalence of most commonly encountered opportunistic infections by sex among HIV-positive adolescents attending CTC at Mnazi Mmoja Health Center and Amana Regional Referral Hospital.

The study showed that, about (19.7%) adolescents had a history of opportunistic infections with nearly equal distribution among boys (20.3%) and girls (19.1%). The most commonly encountered opportunistic infections were pneumocystis pneumonia (34.6%), tuberculosis (26.9%), chronic diarrhea (15.4%), herpes zoster (15.4%) and candidiasis (7.7%). Pneumocystis pneumonia was the most common opportunistic infection among both boys and girls, followed by tuberculosis. Boys had a higher percentage of cases for chronic diarrhea (23.1%) compared to girls (7.7%), while herpes zoster and candidiasis were equal for both sexes. **(Figure. 2).**

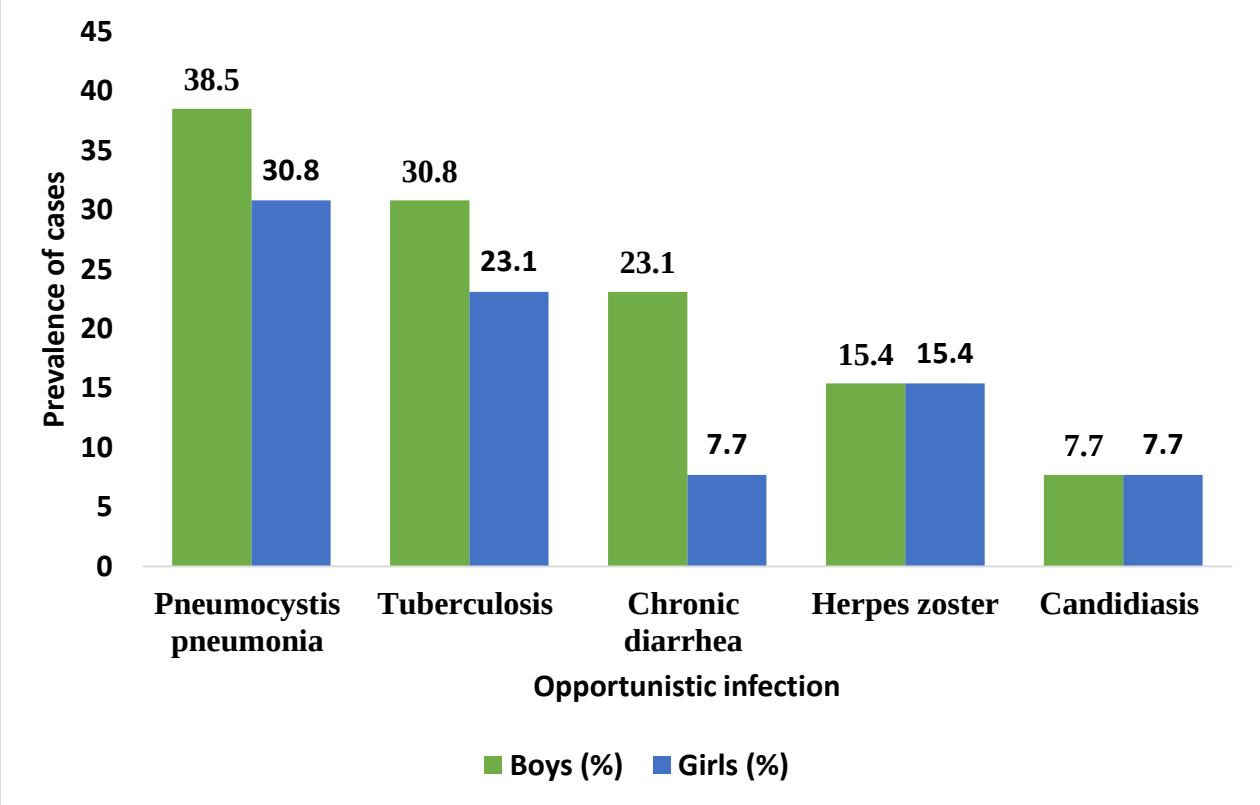


Figure 3: Prevalence of most commonly encountered opportunistic infections by sex among HIV-positive adolescents.

4.2 Prevalence of malnutrition among HIV-positive adolescents attending CTC at Mnazi Mmoja Health Center and Amana Regional Referral Hospital

HIV-positive adolescents exhibited significant levels of malnutrition, with 31.1% classified as stunted, 25.8% as underweight and 15.9% as wasted. Among those attending CTCs, a notable proportion showed moderate to severe stunting.

Table. 3, demonstrates significant variations in malnutrition prevalence across different socio-demographic characteristics, treatment history, and disease status. These findings are supported by Chi-square test, with all p-values being below 0.001, indicating strong statistical significance. Adolescents aged 15 years and above showed a higher prevalence of moderate to severe stunting and underweight compared to those aged below 15 years. Conversely, moderate to severe wasting was slightly more prevalent among younger adolescents compared to their older counterparts.

Across all types of malnutrition, the prevalence was higher among adolescents who were under the care of caregivers other than parents. Education levels also influenced malnutrition, with higher prevalence observed among adolescents with primary education compared to those with secondary education. Additionally, adolescents with caregivers who had no formal education experienced a higher prevalence of malnutrition than those with caregivers who had formal education.

Regarding family size, adolescents from larger families experienced a higher prevalence of malnutrition compared to those from smaller families. The duration on ART also played a role, with those on ART for less than 5 years experienced a higher prevalence of malnutrition than those on ART for more than 5 years. Adolescents with a history of opportunistic infections and those with lower CD4 counts (≤500 cells/μL) had a higher prevalence of malnutrition, compared to those without a history of opportunistic infections and with higher CD4 counts (>500 cells/μL).

In terms of HIV staging, adolescents in HIV clinical stage II or above had a higher prevalence of malnutrition compared to those in stage I. Hemoglobin status revealed that adolescents with anemia had a higher prevalence of malnutrition compared to those with normal hemoglobin levels

Table 3: Prevalence of malnutrition among HIV-positive adolescents attending CTC at Mnazi Mmoja Health Center and Amana Regional Referral Hospital (n=132).

	Stunting (n=41) 31.1%	**p-value**	**Underweight (n=34) 25.8%**	**p-value**	**Wasting (n=21) 15.9%**	**p-value**	**Normal (n=36) 27.3%**
Age (years)							
10–14	16 (21.6%)	<0.001	14 (19.0%)	<0.001	12 (16.2%)	<0.001	32 (43.2%)
15–19	25 (43.1%)		20 (34.5%)		9 (15.5%)		4 (6.9%)
Sex							
Boys	22 (34.3%)		19 (29.7%)		11 (17.2%)	<0.001	12 (18.8%)
Girls	19 (27.9%)		15 (22.1%)		10 (14.7%)		24 (35.3%)
Type of caregiver							
Parents	16 (22.9%)	<0.001	14 (20.0%)	<0.001	8 (11.4%)	<0.001	32 (45.7%)
Others	25 (40.3%)		20 (32.3%)		13 (20.9%)		4 (6.5%)
Education status of the adolescent							
Primary	36 (34.9%)	<0.001	30 (29.1%)	<0.001	17 (16.5%)	<0.001	20 (19.4%)
Secondary	5 (17.2%)		4 (13.8%)		4 (13.8%)		16 (55.2%)
Education status of a caregiver							
No formal education	18 (47.4%)	<0.001	10 (26.3%)	<0.001	8 (21.1%)	<0.001	2 (5.3%)
Primary	12 (18.5%)		15 (23.1%)		11 (16.9%)		27 (41.5%)
Secondary & tertiary	11 (38.0%)		9 (31.0%)		2 (7.0%)		7 (24.0%)
Family size							
<5	9 (25.7%)	<0.001	8 (22.9%)	<0.001	4 (11.4%)	<0.001	14 (40.0%)
≥5	32 (33.0%)		26 (26.8%)		17 (17.5%)		22 (22.7%)
Duration on ART							
≤5 years	27 (40.9%)	<0.001	22 (33.3%)	<0.001	14 (21.2%)	<0.001	3 (4.5%)
>5 years	14 (21.2%)		12 (18.2%)		7 (10.6%)		33 (50.0%)
CD4 count (cells/µL)							
≤500	9 (29.0%)	<0.001	4 (12.9%)	<0.001	5 (16.1%)	<0.001	13 (41.9%)
>500	32 (31.7%)		30 (29.7%)		16 (15.8%)		23 (22.8%)
History of opportunistic infection							
No	29 (27.4%)	<0.001	28 (26.4%)	<0.001	16 (15.1%)	<0.001	33 (31.1%)
Yes	12 (46.2%)		6 (23.1%)		5 (19.2%)		3 (11.5%)
WHO HIV-staging							
Stage-I	33 (31.7%)	<0.001	31 (29.8%)	<0.001	11 (10.6%)	<0.001	29 (27.9%)
Stage-II or above	8 (28.6%)		3 (10.7%)		10 (35.7%)		7 (25.0%)
Hemoglobin status							
Normal	28 (27.5%)	<0.001	27 (26.5%)	<0.001	18 (17.6%)	<0.001	29 (28.4%)
Anemic	13 (43:3%)		7 (23.3%)		3 (10.0%)		7 (23.3%)

The variations in the prevalence of malnutrition across gender are shown in the figure below. Among boys, the prevalence of stunting 34.3%, underweight 29.7%, and wasting 17.2% were notably higher compared to girls. Conversely, a slightly higher percentage of girls 35.3% fell into the normal nutritional status category compared to boys 18.8%.

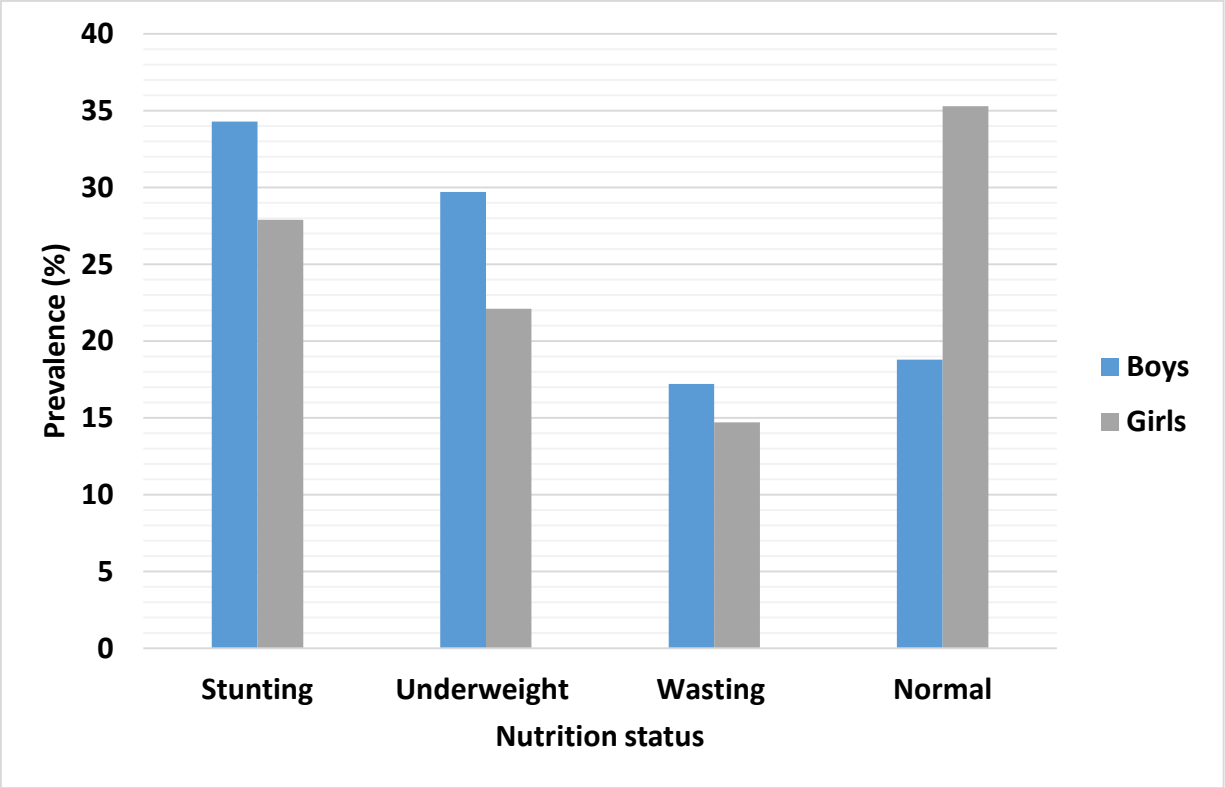


Figure 4: Prevalence of malnutrition by sex among HIV-positive adolescents

4.2.1 Determinants of undernutrition among HIV-positive adolescents attending CTC at Mnazi Mmoja Health Center and Amana Regional Referral Hospital.

Table 4, presents the findings of multivariate regression analysis on the factors associated with undernutrition among HIV-positive adolescents attending CTCs. After adjusting for covariates and confounders, an increase in the age of HIV-positive adolescents (per year) was more likely to be associated with poor linear growth (β = -0.25, p= 0.015). Adolescents whose caregivers had at least primary education had a lower likelihood of being stunted (β= 0.87, p= 0.035) compared to those with uneducated caregivers. Household food insecurity was also associated

with poor linear growth among adolescents (β= -0.01, p= 0.027). Additionally, low feeding frequency was associated with poor linear growth among HIV-positive adolescents (β= 0.11, p= 0.016). Furthermore, advanced HIV clinical stage was more likely to be associated with poor linear growth among HIV-positive adolescents (β= -0.12, p= 0.001).

Wasting was more associated with age, and HIV clinical stage. Younger adolescents were more likely to experience wasting (β= 0.20, p= 0.009). Additionally, an increase in the adolescents' HIV clinical stage from early to advanced was more likely to be associated with severe wasting (β= -0.25, p= 0.001). However, low feeding practices and food insecurity affected by large family size was not significantly associated with wasting among adolescents of this population.

Food insecurity, feeding frequency, and HIV clinical stage were associated with poor weight gain for age after controlling for covariates and confounders. HIV-positive adolescents residing in households with food insecurity were more likely to be underweight (β= -0.17, p= 0.003). Low feeding frequency was also associated with poor weight gain for age among HIV-positive adolescents (β =0.12, p= 0.029). Additionally, an advanced HIV clinical stage (β = -0.14, p= 0.001) was associated with poor weight gain for age among adolescents in this population.

Table 4: Multivariate regression analysis of factors associated with undernutrition among HIV-positive adolescents.

Variable	Stunting (HAZ-score)		Underweight (WAZ-score)		Wasting (WHZ-score)	
	Beta (β)	**P-value**	**Beta (β)**	**P-value**	**Beta (β)**	**P-value**
Age (years)	-0.25	0.015	-0.06	0.180	0.20	0.009
Gender	-0.06	0.076	0.31	0.484	0.06	0.411
Caregiver education						
None						
Primary	0.87	0.035	-0.01	0.942	0.02	0.808
>Primary	0.36	0.395	0.07	0.196	0.07	0.451
Food insecurity	-0.01	0.027	-0.17	0.003	0.06	0.541
Feeding frequency	0.11	0.016	0.12	0.029	0.05	0.601
ART adherence	0.03	0.423				
History of opportunistic infection	-0.06	0.096	-0.07	0.111		
HIV stage	-0.12	0.001	-0.14	0.001	-0.25	0.001

WHZ- Weight-for-height z-score; WAZ- Weight-for-age z-score; HAZ- Height-for-age z-score.

4.3 Dietary Diversity among HIV-positive adolescents attending CTC at Mnazi Mmoja Health Center and Amana Regional Referral Hospital.

In this study, HIV-positive adolescents had a mean dietary diversity score of 3.8 ± 0.8, with the majority (84.8%) categorized as having inadequate dietary diversity.

The associations between sociodemographic, BMI and hemoglobin status and dietary diversity showed that majority of the participants had inadequate dietary diversity. However, none was

statistically significant (P >0.05). A significant association was established between meal skipping (P = 0.033), snacking (P=0.001), frequency of meals per day (P=0.018) and inadequate dietary diversity. The majority of participants who skipped meals 93.1%, who snacked 89.2% and those who had meal frequency 2 times per day 91.8%, had inadequate dietary diversity. **(Table. 5)**

The proportions of participants consuming various food groups are shown in **(Figure. 4)**. The food groups consumed on the previous day included: cereals, white roots, tubers and plantains; legumes; nuts and seeds; dairy products; meat, poultry and fish; eggs; dark green leafy vegetables; vitamin A rich fruits and vegetables; other vegetables; other fruits.

A majority of the participants regularly consumed cereals, white roots, tubers and plantains (91.7%) mainly white rice, stiff porridge, potatoes, cassava and breads. Additionally, 87.1% consumed legumes daily, with beans and peas being the most commonly during lunch and dinner. About 73.5% reported consuming nuts and seeds. Dark green leafy vegetables mainly spinach and other vegetables were consumed by 55.3% and 54.5% of the adolescents respectively during lunch. Less than 5 in 10 participants consumed meat, fish and poultry 36.4%, and less than 3 in 10 participants consumed dairy products 29.5%. Few participants consumed eggs 9.8%, other fruits (7.6%) and vitamin A rich fruits and vegetables 4.5%. Furthermore, only 15.2% of the participants had high dietary diversity.

Table 5: Dietary Diversity among HIV-positive adolescents (n=132).

Variables	Mean (SD)	n (%)	Dietary Diversity		X^2	*p-Value*
			Adequate	Inadequate		
DDS	3.8 ± 0.8					
Boys	3.8 ± 0.8					
Girls	3.7 ± 0.9					
Adequate (≥5)		**20 (15.2)**				
Inadequate (≤4)		**112 (84.8)**				
Age					4.6	0.200
10 -14		74	14 (18.9)	60 (81.1)		
15-19		58	6 (10.3)	52 (89.7)		
Gender					3.25	0.345
Girls		68	14 (20.6)	54 (79.4)		
Boys		64	6 (9.4)	58 (90.6)		
Education level of adolescents					10.73	0.290
Primary		103	10 (9.7)	93 (90.3)		
Secondary		29	10 (34.5)	19 (65.5)		
Education level of caregiver					1.44	0.230
Non-formal		38	8 (21.0)	30 (79.0)		
Formal		94	12 (12.8)	82 (87.2)		
Type of caregiver					2.78	0.330
Parents		70	11 (15.7)	59 (84.3)		
Others		62	9 (14.5)	53 (85.5)		
Household size					2.19	0.140
≤5		35	8 (22.9)	27 (77.1)		
>5		97	12 (12.4)	85 (87.6)		
Frequency of meals per day					8.03	0.018
2		49	4 (8.2)	45 (91.8)		
3		63	9 (14.3)	54 (85.7)		
4		20	7 (35.0)	13 (65.0)		
Meals skipping					5.5	0.033
Yes		58	4 (6.9)	54 (93.1)		
No		74	16 (21.6)	58 (78.4)		
Snacking					6.66	0.010
Yes		102	11 (10.8)	91 (89.2)		
No		30	8 (26.7)	21 (73.3)		
BMI status					0.4	0.520
Underweight		34	4 (11.8)	30 (88.2)		
Normal-weight		98	16 (16.3)	82 (83.7)		
Hemoglobin status					0.2	0.614
Normal		102	9 (8.8)	93 (91.2)		
Anaemia		30	11 (36.7)	19 (63.3)		

Food groups consumed by HIV-positive adolescents attending CTC at Mnazi Mmoja Health center and Amana Regional Referral Hospital.

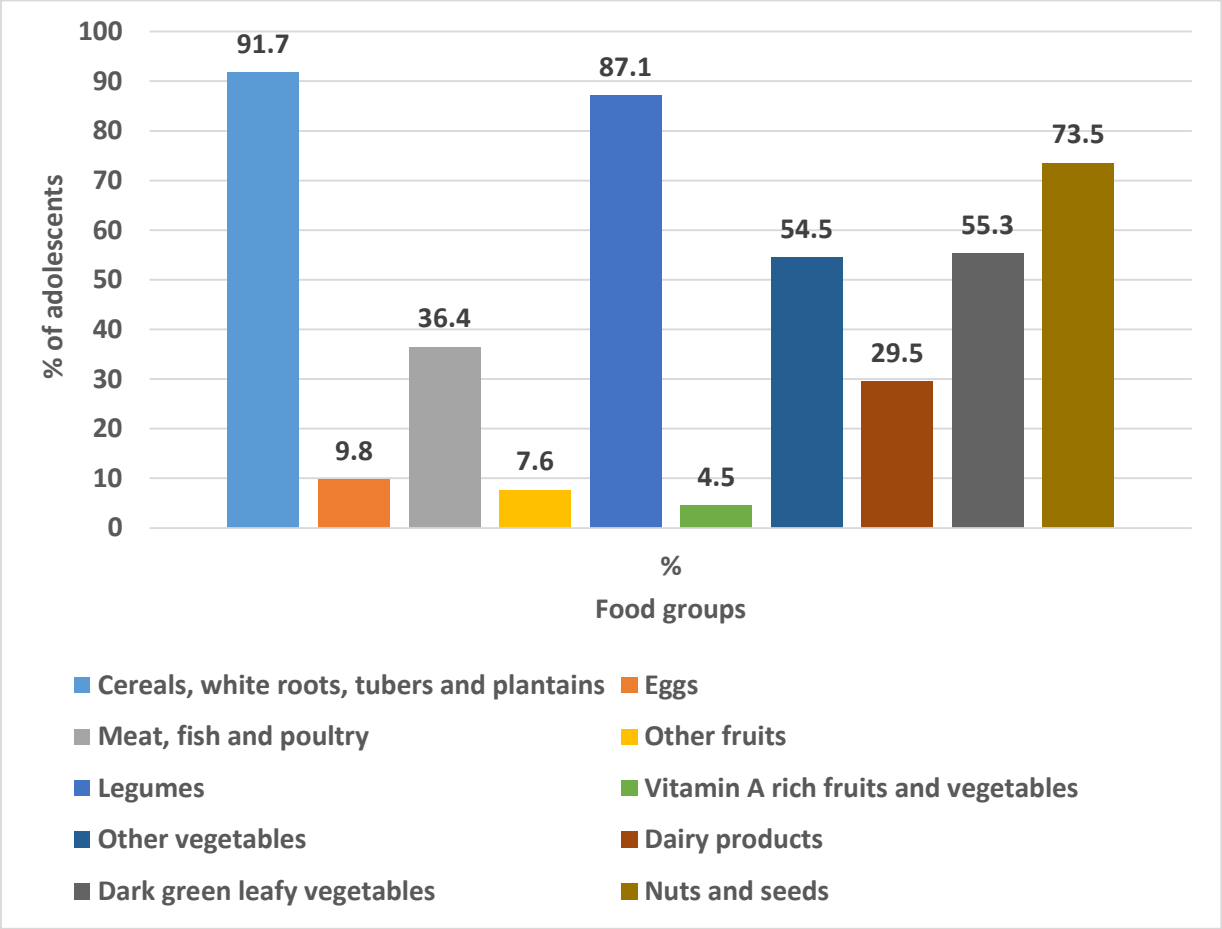


Figure 5: Proportions of participants consuming from the different food groups.

4.3.1 Predictors of inadequate dietary diversity among HIV-positive adolescents attending CTC at Mnazi Mmoja Hospital and Amana Regional Referral Hospital.

Table. 6, presents the adjusted odds ratios (AORs) for predictors of inadequate dietary diversity among adolescents living with HIV, with adjustments made for age and gender. The analysis revealed significant associations between dietary practices and inadequate dietary diversity.

The likelihood of inadequate dietary diversity was significantly higher among adolescents who skipped meals. The adjusted odds ratio (AOR) for meal skipping was 12.2 (P < 0.001, 95% CI: 3.5 - 41.7), indicating that those who skipped meals were over 12 times more likely to experience inadequate dietary diversity compared to those who did not skip meals.

Additionally, snacking also showed a significant association with inadequate dietary diversity. Adolescents who engaged in snacking had an adjusted odds ratio (AOR) of 5.0 (P = 0.007, 95% CI: 1.6 – 16.4), suggesting that those who snacked were five times more likely to have inadequate dietary diversity than those who did not snack.

Table 6: Binary logistic regression on the predictors of inadequate dietary diversity among HIV-positive adolescents.

Variables	**Inadequate dietary diversity**					
	Unadjusted			**Adjusted**		
	β	OR (95% CI)	P-value	β	OR (95% CI)	P-value
Meal skipping						
Yes	1.1	3.72 (1.1 - 7.8)	0.033	2.5	12.2 (3.6 - 41.7)	<0.001
No		1			1	
Snacking						
Yes	1.8	3.15 (2.3 - 16.7)	0.010	1.6	5.0 (1.6 - 16.4)	0.007
No		1			1	

4.4 ART adherence in relation to nutritional intake among HIV-positive adolescents attending CTC at Mnazi Mmoja Health center and Amana Regional Referral Hospital.

During the study period, total of 132 HIV positive adolescents were analyzed for medication adherence behavior. Of these, 82 participants (62.1%) were classified as adherent, indicating consistent adherence to prescribed medication regimens. Conversely, 50 participants (37.9%) were classified as non-adherent.

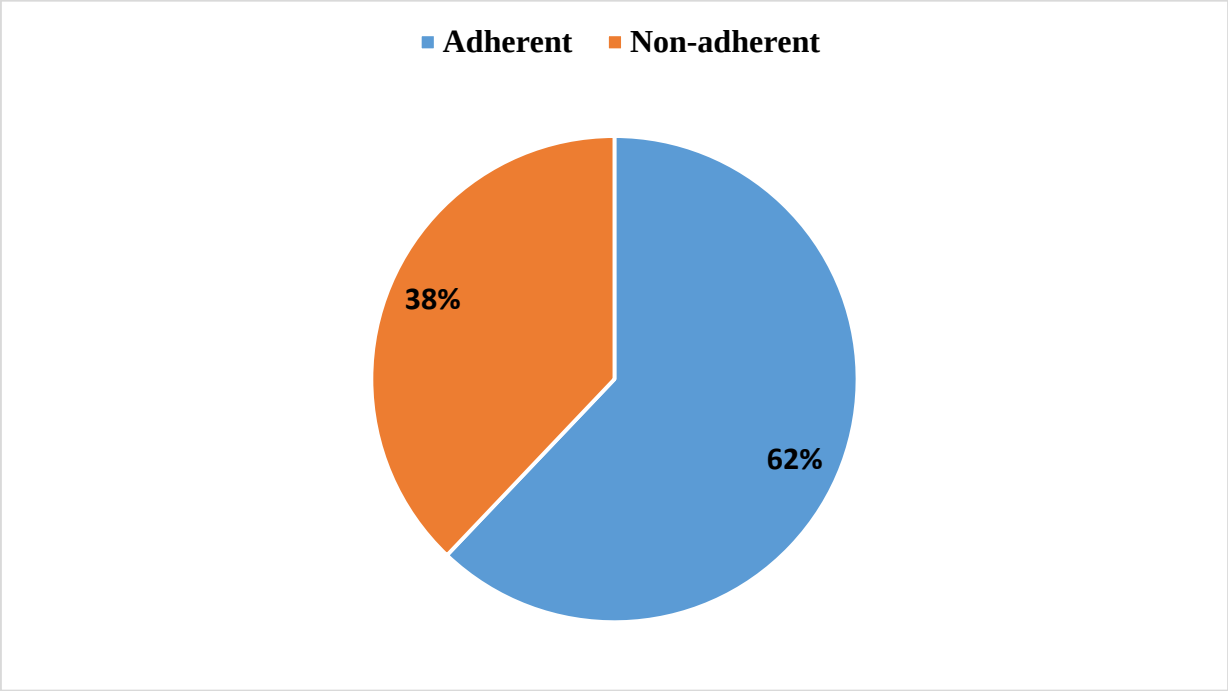


Figure 6: ART adherence among HIV-positive adolescents.

4.4.1 Food intake and Adherence related behavior of HIV-positive adolescents attending CTC at Mnazi Mmoja Health center and Amana Regional Referral Hospital.

A higher percentage of non-adherent participants reported often or always having difficulty eating due to medication side effects 40.0% compared to adherent participants 20.7%. Additionally, non-adherent participants showed a higher percentage of low fruit and vegetable intake (44% for 0-1 servings per day) and low protein intake (50% for less than 3 times per week) compared to adherent participants. Moreover, non-adherent participants also reported a more significant decrease in food appetite 48.8% compared to 24.4% of adherent participants.

Additionally, a higher percentage of non-adherent participants reported missing more than 4 doses 40% compared to adherent participants 6.1%. Side effects of medication was reported as the main reason for missed doses by 64.0% of non-adherent participants compared to 18.3% of adherent participants. Additionally, 48.8% of adherent participants reported more frequent use of a medication reminders as the main strategy to remember take their medication, compared to 20.0% of non-adherent participants. **(Table. 7)**

Table 7: Food intake and adherence-related behavior of HIV-positive adolescents (n=132).

Variable	Adherent (n=82)	Non-adherent (n=50)
Difficulty eating due to medication		
Never	29 (35.4%)	10 (20.0%)
Rarely	21 (25.6%)	8 (16.0%)
Sometimes	15 (18.3%)	12 (24.0%)
Often/Always	17 (20.7%)	20 (40.0%)
Servings of fruits and vegetables per day		
0-1	10 (12.2%)	22 (44.0%)
2-3	17(20.7%)	13 (26.0%)
4-5	25 (30.5%)	10 (20.0%)
More than 5	30 (36.6%)	5 (10.0%)
Protein intake times per week		
Less than 3	10 (12.2%)	25 (50.0%)
3-5	20 (24.4%)	15 (30.0%)
6-7	30 (36.6%)	7 (14.0)
More than 7	22 (26.8%)	3 (6.0%)
Changes in food appetite		
Increased	30 (36.6%)	11 (22.0%)
Decreased	20 (24.4%)	24 (48.0%)
No change	32 (39.0%)	15 (30.0%)
Missed medication		
None	50 (61.0%)	6 (10.0%)
1-2	18 (21.9%)	14 (30.0)
3-4	9 (10.9%)	9 (20.0%)
More than 4	5 (6.1%)	21 (40.0%)
Reasons for missed doses		
Side effects	15 (18.3%)	32 (64.0%)
Difficulty swallowing	10 (12.2%)	9 (18.0%)

Forgetfulness	17 (20.7%)	7 (14.0%)
Others	40 (48.8%)	2 (4.0%)
Strategies to remember medication		
Reminders	40 (48.8%)	10 (20.0%)
Medication schedules	25 (30.5%)	15 (30.0%)
Pill boxes	10 (12.2%)	15 (30.0%)
Others	7 (8.5%)	10 (20.0%)

4.4.2 Pearson's correlation between food intake, Adherence-related behavior and ART adherence of HIV-positive adolescents attending CTC at Mnazi Mmoja Health Center and Amana Regional Referral Hospital.

Table. 8, shows the Pearson's correlation between food intake, adherence-related behavior and ART adherence. A weak, negative correlation was observed between difficulty eating due to medication and adherence to ART, indicating that a greater difficulty in eating due to medication was associated with lower adherence to ART. Conversely, weak, positive correlations were found between ART adherence and both the number of servings of fruits and vegetables per day, as well as frequency of protein per week. These results suggest that higher consumption of fruits, vegetables, and protein was associated with better adherence to ART.

A moderate, positive correlation was observed between missing medication and poor ART adherence, suggesting that adolescents who frequently missed their medication tended to have lower adherence. Conversely, there was a very weak, negative correlation between the reasons for missed doses and ART adherence, indicating that more reasons for missed doses were slightly associated with lower adherence to ART. Additionally, a weak, positive correlation was found between the use of strategies to remember medication and better ART adherence. This suggests that adolescents who employed more strategies to remember their medication were more likely to adhere to their ART regimen.

Table 8: Pearson's correlation between food intake, Adherence-related behavior and ART adherence of HIV-positive adolescents.

Independent variables (Food intake, Adherence-related behavior)	**Dependent variable (ART adherence)**	
	Pearson's Correlation (r)	**Sig. (2 – tailed)**
Difficulty eating due to medication	-0.25	0.045
Servings of fruits and vegetables per day	0.30	0.001
Protein intake times per week	0.35	<0.001
Changes in food appetite	0.02	0.560*
Missed medication	0.50	<0.001
Reasons for missed doses	-0.18	0.050
Strategies to remember medication	0.25	0.001

CHAPTER FIVE

5.0 DISCUSSION

The findings of this study highlighted significant concerns regarding prevalence of malnutrition with, 31.1% of HIV-positive adolescents being stunted. These results are slightly lower than those reported by Chacha et al. (2023) who found prevalence of stunting at 36.0%, among adolescents living HIV in Tanzania. Similarly, a study conducted in Uganda among adolescents enrolled in HIV-care programs reported a stunting prevalence of 36.0% (Lwanga et al., 2015), while another study in Ethiopia on adolescents living with HIV receiving care reported a stunting prevalence of 37.4% (Birra et al., 2020). Furthermore, a meta-analysis on under-nutrition among HIV-infected adolescents in sub-Saharan Africa found that the prevalence of stunting ranged between 23.0% to 37.0%, underweight from 21.0% to 34.0%, and wasting from 7.0% to 18.0% (Nigussie et al., 2022). These findings suggest that stunting, which affects more than one-third of this population is indicative of chronic malnutrition and prolonged nutritional deficiencies. This condition can have severe long-term consequences, including impaired cognitive development, reduced physical growth, and a higher susceptibility to illnesses.

Comparing the prevalence of stunting between HIV-positive and HIV-negative adolescents, studies conducted among HIV-negative adolescents in rural Tanzania reported a much lower prevalence of stunting at 18% (Ismail et al., 2020). A nutrition survey conducted among HIV-negative school-aged children and adolescents in mainland Tanzania found a 25% prevalence of stunting (Sauli et al., 2021). Further, studies from urban areas reported stunting prevalence below 10% (Coldeiro et al., 2021). This suggests that the burden of stunting among HIV-positive adolescents is substantially higher than among HIV-negative adolescents in Tanzania.

In the current study, the prevalence of underweight was 25.8%. A study conducted in Tanzania in 2023 reported a slightly higher prevalence of underweight at 28.9% among adolescents living with HIV (Chacha et al., 2023). Similarly, a study in South-West Nigeria among ART-receiving orphaned children aged 6–18 years found a slightly higher prevalence of underweight at 27% (Fagbamigbe et al., 2019). In Uganda, 18% of HIV-positive adolescents were found to suffer from underweight (Lwanga et al., 2015). Additionally, a retrospective study in Southern

Ethiopia among HIV-positive children under 18 years found that underweight children were four times more likely to experience treatment failure (Sidemo et al., 2019). This high prevalence of underweight among HIV-positive adolescents is concerning, as underweight status is a critical predator of treatment failure and mortality, which may be due to factors such as inadequate nutritional intake, increased metabolic demands due to HIV infection, co-infections, and poor adherence to antiretroviral therapy.

The findings related to dietary diversity showed that adolescents had low dietary diversity scores, with a significant majority 84.8% falling into the inadequate dietary diversity category. Meal skipping and snacking were identified as key predictors of inadequate dietary diversity. This is expected, as meal skipping reduces the opportunity to consume a variety of food groups. Adolescents are often reported to skip meals and snack on unhealthy foods as part of their dietary practices (Kelishadi et al., 2017). These findings are notably higher compared to a study conducted in the Tanga region of Tanzania, which found that 62.3% HIV-positive children had inadequate dietary diversity (Sunguya et al., 2014). The mainly contributing factors were food insecurity and poor feeding practices. Studies conducted in Malawi, Ethiopia and Uganda, also reported lower prevalence of inadequate dietary diversity at 69%, 43.3% and 56%, respectively.

In comparison, among HIV-positive and HIV-negative adolescents, a study in Uganda found a lower prevalence of inadequate dietary diversity 45.3% among HIV-negative adolescents. Factors contributing to this included low socio-economic status, living with a single parent or guardian, and dependency on household meals (Isabirye et al., 2020).This highlights the compounded risks faced by HIV-positive adolescents such as increased nutritional needs, socio-economic burdens, and psychosocial factors.

The majority of participants consumed food primarily from cereals, white roots, tubers, and plantains 91.7%; legumes 87.1%; and nuts and seeds 73.5%. Similarly, a study conducted in Ghana on HIV-infected pregnant adolescents reported higher consumption of cereals 99.3%; legumes 88.4%; and nuts and seeds 75.6% (Gyimah et al., 2021). Excessive consumption of starchy staples has also been reported among rural adolescents living with HIV in Nigeria 100% (Otekunrin et al., 2022) and India 95% (Ganpule-Ro et at., 2021). In Malaysia, a similar trend

is observed with 93% of adolescents consuming starchy staples as a primary part of their diet (Abdul et al., 2016). The high intake of starchy staples observed in this study reflects carbohydrate levels exceeding the recommended dietary allowance. This discrepancy may be due to factors such as meal skipping, large family size, and low socioeconomic status.

The adherence to ART among HIV-positive adolescents in this study was good, with 62.1% of participants showing good adherence to their medication. The study revealed a notable correlation between nutritional intake and ART adherence, indicating that adolescents with adequate food intake were more likely to adhere to ART. Similarly, a study conducted in Dar es salaam, Tanzania among HIV-positive adolescents on ART also reported similar findings, with 63% of participants demonstrating good adherence to their medication regimes (Amour et al., 2022). A study conducted in Ethiopia reported that 61.7% of HIV-positive adolescents showed good adherence to ART, highlighting that insufficient access to adequate food and dietary patterns were strongly linked to non-adherence to ART (Negassie et al., 2013). This aligns with findings from another study in Addis Ababa, which reported that nutritional factors may have an effect on ART adherence (Abiy et al., 2007). Additionally, several articles recommend detailed studies on the effect of nutritional factors and dietary patterns on ART adherence, as these factors may significantly influence adherence (Cantrell et al., 2008; Rawat et al., 2010). These findings underscores the critical role of adequate nutrition in supporting ART adherence, emphasizing the importance of nutrition in boosting the immune system for people living with HIV.

In this study, adolescents who had inadequate dietary intake had poor adherence to ART. However, this finding contrasts with a cross-sectional study in Dire Dawa, Ethiopia, which reported that nutritional status had no impact on ART adherence. The study found that individuals with good nutritional status missed doses more frequently than those with poor nutritional status (Tiyou et al., 2008). Additionally, a randomized clinical trial conducted among wasted HIV infected patients in Blantyre, Malawi, who received supplementary food for 14 weeks, reported no differences in ART adherence compared to those who did not receive supplementary food (Manary et al., 2010). This lack of difference may be attributed to the

relatively short duration of the supplementation period, which might not have been sufficient to impact ART adherence.

Side effects were identified as the primary reason for missed doses in this study, reported by 64% of non-adherent participants. This is slightly higher than the 58% reported in a study done in Kenya, where side effects were also reported as a common barrier to adherence among HIV-positive adolescents (Wekesa et al., 2016). This suggests that addressing medication side effects is crucial for improving adherence. The study also highlighted several strategies to enhance ART adherence among HIV-positive adolescents. Notably, 48.8% of adherent participants used a medication reminders to remember their doses, compared to 20% of non-adherent participants.The use of medication reminders was significantly more common among adherent participants. This finding is supported by other research done in Tanzania, which demonstrated that adolescents using medication reminders had an adherence of 72%, compared to 55% among those who did not use (Mavhandu-Mudzus et al., 2013). This underscores the effectiveness of structured medication reminders as strategies for improving adherence, highlighting the importance of these tools in enhancing ART adherence.

5.1 Study limitations and mitigations

a. The study relied on self-reported data from participants regarding their dietary habits, which may introduce recall bias, as participants might provide socially desirable responses or incorrectly recall their dietary intake.

- To address this, confidentiality of their responses was emphasized to reduce the likelihood of socially desirable answers.

b. The study encountered challenges in obtaining a sample size due to the reluctance of some participants to engage in the study, possibly due to stigma or concerns about privacy.

- To address this, strategies such as extending the recruitment period and strengthening collaboration with healthcare providers were implemented, alongside efforts to reassure participants about confidentiality.

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

This study highlights significant challenges faced by HIV-positive adolescents regarding nutrition and health, particularly the high prevalence of malnutrition, including stunting and underweight. These findings highlight the urgent need for targeted nutritional interventions within this population. Key predictors of undernutrition, such as food insecurity and low feeding frequency, reveal systemic issues that necessitate comprehensive strategies to improve the overall well-being of these adolescents.

The findings regarding dietary diversity indicate critical gaps that, if addressed, could substantially enhance nutritional outcomes. Interventions aimed at increasing dietary diversity should take into account factors such as meal patterns, family dynamics, and socioeconomic conditions. Improving dietary diversity is essential not only for physical health but also for supporting adherence to antiretroviral therapy (ART).

Moreover, the study emphasizes the importance of medication adherence, particularly in relation to dietary habits and the use of reminders. Healthcare providers working with HIV-positive adolescents should prioritize addressing barriers to adherence, such as side effects and inadequate nutrition to promote health outcomes.

6.2 Recommendations

6.2.1 Implementation of nutritional supplementation and education to address malnutrition among HIV-positive adolescents.

Healthcare providers should distribute fortified foods and micronutrients supplements to ensure adolescents receive essential nutrients required for their growth and health. Conduct regular monitoring and assessment of their nutritional status to tailor supplements in order to meet individual needs, ensuring that each adolescent receives adequate and appropriate nutritional support.

Nutritionists should participate in providing comprehensive education on balanced diets and meal planning to both adolescents and their caregivers. This should include informative workshops, and written materials emphasizing the importance of dietary diversity and practical strategies for incorporating nutritious foods into their diets.

6.2.2 Dietary counseling and support for meal planning to enhance dietary diversity among HIV-positive adolescents.

Nutritionists should offer personalized dietary counseling that emphasizes the importance of consuming a varied and nutritious diets. This counseling should educate families on how to incorporate different food groups to meet their nutritional requirements. In addition, nutritionists should assist families with comprehensive meal planning and offer resources for healthy eating, particularly targeting larger families and those from low socioeconomic backgrounds. This support can include educational materials, workshops, and community initiatives designed to empower families to make informed food choices and enhance their overall dietary habits.

6.2.3 To improve ART Adherence among adolescents living with HIV.

Healthcare providers should educate family members on their crucial role supporting adolescent's adherence to medication. They should encourage them to provide regular reminders, assist in organizing medication schedules, and create a supportive environment that enhances the adolescent's commitment to treatment. Additionally, healthcare providers should offer guidance on addressing any challenges or barriers that may arise, ensuring that families are well-equipped to effectively support their adolescents.

Furthermore, healthcare providers should improve communication with adolescents to effectively manage medication side effects. This can be achieved by implementing strategies such as establishing support networks, which may include counseling services and peer support groups. These resources can help adolescents navigate and cope with medication-related challenges.

REFERENCES

Arimond, M. and Ruel, M.T., 2004. Dietary diversity is associated with child nutritional status: evidence from 11 demographic and health surveys. The Journal of Nutrition.

Bailey, R.L., West Jr, K.P. and Black, R.E., 2015. The epidemiology of global micronutrient deficiencies. Annals of Nutrition and Metabolism.

Bandoh, D.A. and Kenu, E., 2017. Dietary diversity and nutritional adequacy of under-fives in a fishing community in the central region of Ghana. BMC Nutrition.

Black, R.E., Victora, C.G., Walker, S.P., Bhutta, Z.A., Christian, P., de Onis, M. et al., 2013. Maternal and child undernutrition and overweight in low-income and middle-income countries. The Lancet.

Centers for Disease Control and Prevention (CDC), 2020. Childhood overweight and obesity. Available from: https://www.cdc.gov/obesity/childhood/index.html.

Caroline, B., Shannon, S., Kate, G., Natalie, K.L., Kristin, W. and Paul, P., 2006. Nutrition and food security for people living with HIV. Baltimore: Catholic Relief Services.

Chacha, S., Hui, J., Yuxin, T., Wang, Z., Ali, S., Mbonile, N., Msumari, M., Msuya, N., Malimu, E., Revocatus, B., Maokola, W., Mtali, G., Simon, V. and Dang, S., 2023. Epidemiological profile of malnutrition status and spatial distribution of children and adolescents living with HIV/AIDS in Tanzania. Tropical Medicine and International Health.

Clark, W.A. and Cress, E.M., 2018. Nutritional issues and positive living in human immunodeficiency virus/AIDS. Nursing Clinics.

Dong, K.R. and Imai, C.M., 2017. The relationship between food insecurity and adherence to HIV antiretroviral therapy: A systematic review. Journal of the International AIDS Society.

Duggal, S., Chugh, T.D. and Duggal, A.K., 2012. HIV and malnutrition: effects on the immune system. Clinical and Developmental Immunology.

Duggan, C. and Santosham, M., 2019. Nutrition and child survival in the developing world. Nutrition Reviews.

Echendu, S.T., Ebelechuku, F., et al., 2021. Socio-demographic determinants of undernutrition in HIV-infected under-five children. European Journal of Clinical Medicine.

Faidas, M., Stockton, M.A., Mphonda, S.M., et al., 2024. Stigma and discrimination faced by adolescents living with HIV and experiencing depression in Malawi. BMC Global Public Health.

Food and Agricultural Organization (FAO), 2003. Committee on World Food Security. 29th Session, Food Security & HIV/AIDS: an Update. FAO, Rome.

Food and Agriculture Organization of the United Nations, 2013. Dietary Diversity. Available at: http://www.fao.org/nutrition/education/food-dietary-guidelines/background/en/.

Food and Agriculture Organization of the United Nations (FAO), 2018. The state of food security and nutrition in the world. Available from: http://www.fao.org/3/I9553EN/i9553en.pdf.

Food and Agriculture Organization (FAO), 2013. Guidelines for measuring household and individual dietary diversity. Rome: Food and Agriculture Organization. Available from: http://www.fao.org/3/i1983e/i1983e00.pdf.

Food and Nutrition Technical Assistance (FANTA), 2010. Dietary diversity as a measure of the micronutrient adequacy of women's diets: results from metropolitan Cebu, Philippines site. Washington, DC: FHI 360. Available from: https://www.fantaproject.org/ sites/default/files/ resources/WDDP_Philippines_Dec2010.pdf.

Food and Nutrition Technical Assistance (FANTA), 2016. Potential uses of food aid to support HIV/AIDS mitigation activities in sub-Saharan Africa project. Washington, DC: Academy for Educational Development.

Fawzi, W.W., Msamanga, G.I., Wei, R., Spiegelman, D., Antelman, G., Villamor, E. et al., 2004. A randomized trial of multivitamin supplements and HIV disease progression and mortality. New England Journal of Medicine.

Gebrie, M., Perry, L., Xu, X., et al., 2023. Nutritional status and its determinants among adolescents with HIV on anti-retroviral treatment in low- and middle-income countries: a systematic review and meta-analysis. BMC Nutrition.

Gibson, R.S., 1990. Principles of Nutritional Assessment. New York: Oxford University Press.

Herrador, Z., Sordo, L., Gadisa, E., Buño, A., Gómez-Rioja, R., Iturzaeta, J.M. et al., 2015. Micronutrient deficiencies and related factors in school-aged children in Ethiopia: a cross-sectional study in Libo Kemkem and Fogera districts, Amhara Regional State. PLoS One.

Hussein, I.H., Youssef, L., Mladenovic, A., Leone, A., Jurjus, A. and Uhley, V., 2019. HIV-infected children and nutrition: the friend and the foe. In: Nutrition and HIV/AIDS: Implications for Treatment, Prevention and Cure. IntechOpen.

Jacobs, S., Moxley, K., Womersley, J., Spies, G., Hemmings, S. and Seedat, S., 2018. HPA-axis genes as potential risk variants for neurocognitive decline in trauma-exposed, HIV-positive females. Neuropsychiatric Disease and Treatment, 14, pp. 2497-2504.

Jones, A.D., Ickes, S.B., Smith, L.E., Mbuya, M.N., Chasekwa, B., Heidkamp, R.A. et al., 2014. World Health Organization infant and young child feeding indicators and their associations with child anthropometry: a synthesis of recent findings. Maternal and Child Nutrition, 10(1), pp. 1-17.

Joint United Nations Programme on HIV/AIDS (UNAIDS), 2020. Antiretroviral Therapy. Available at: https://www.unaids.org/en/topic/treatment.

Kathleen, M. and Sylvia, E., 2007. Krause’s Food and Nutrition Therapy. Saunders/Elsevier.

Keino, S., Plasqui, G., Ettyang, G. and van den Borne, B., 2014. Determinants of stunting and overweight among young children and adolescents in sub-Saharan Africa. Food and Nutrition Bulletin.

Kesmul, H., Acharya, P., Mapatano, M.A. and Hatloy, A., 2017. Determinants of childhood stunting in the Democratic Republic of Congo: Further analysis of Demographic and Health Survey 2013-14. BMC Public Health.

Kimberley, R. and Cindy, M., 2017. Medical Nutrition Therapy for HIV and AIDS. In: Krause's Food and Nutrition Care Process. 14th ed. Elsevier Inc.

Kikafunda, J.K., Karamagi, C.A. and Muwanika, R., 2005. Nutritional status of HIV/AIDS orphaned children in Uganda. East African Medical Journal, 82(2), pp. 87-93.

King, F.C. and Burgess, A., 1993. Nutrition for Developing Countries. 2nd ed. New York: Oxford University Press Inc.

Kennedy, G., Pedro, M.R., Seghieri, C., Nantel, G. and Brouwer, I.D., 2007. Dietary diversity score is a useful indicator of micronutrient intake in non-breastfeeding Filipino children. The Journal of Nutrition, 137(2), pp. 472-477.

Lathan, M.C., 1997. Human Nutrition in the Developing World. Rome: Food and Agricultural Organization of the United Nations.

Magadi, M., 2011. Cross-national analysis of the risk factors of child malnutrition among children made vulnerable by HIV/AIDS in sub-Saharan Africa: evidence from the DHS. Tropical Medicine & International Health, 16(5), pp. 570-578.

Ministry of Health, Community Development, Gender, Elderly and Children, 2022. Tanzania demographic and health survey and malaria indicator survey 2022. Dar es Salaam, Tanzania. Available from: https://dhsprogram.com/pubs/pdf/FR369/FR369.pdf.

Mishra, V., Stupp, P. and Kothari, M., 2007. Nutritional status and its socio-demographic determinants among HIV-uninfected children in Kenya. East African Journal of Public Health, 4(1), pp. 22-28.

Moursi, M.M., Arimond, M., Dewey, K.G., Treche, S., Ruel, M.T. and Delpeuch, F., 2008. Dietary diversity is a good predictor of the micronutrient density of the diet of 6 to 23-month-old children in Madagascar. The Journal of Nutrition.

Mukoyogo, C.M. and Williams, G., 1991. AIDS orphans: A community perspective from Tanzania. London: ActionAid.

Nakamura, T. and Imamura, H., 2023. Perspective chapter: early diagnosis of malnutrition. IntechOpen.

Negassa, B., Mersha, A., Belay, E.M. and Woldeyohannes, D., 2013. Adherence to antiretroviral therapy among HIV-infected adolescents in resource-limited settings: A systematic review and meta-analysis. AIDS Research and Therapy.

Negassie, B., Tadesse, A.W. and Ayele, G., 2013. Factors associated with adherence to antiretroviral therapy among HIV-infected children in Gondar, Ethiopia: a cross-sectional study. BMC Public Health.

Neumark-Sztainer, D., Wall, M., Larson, N.I., Eisenberg, M.E. and Loth, K., 2012. Dieting and disordered eating behaviors from adolescence to young adulthood: findings from a 10-year longitudinal study. Journal of the American Dietetic Association.

Neumark-Sztainer, D., Wall, M., Perry, C. and Story, M., 2003. Correlates of fruit and vegetable intake among adolescents: findings from Project EAT. Preventive Medicine.

Nguyen, P.H., Avula, R., Ruel, M.T., Saha, K.K., Ali, D., Tran, L.M. et al., 2013. Maternal and child dietary diversity are associated in Bangladesh, Vietnam, and Ethiopia. The Journal of Nutrition.

Ngwenya, N., Smith, T., Shahmanesh, M., et al., 2024. Social categorisation and social identification: the mediating role of social isolation and loneliness in adolescents living with HIV. International Journal of Behavioral Medicine.

Ndukwu, C.I., Egbuonu, I., Ulasi, T.O. and Ebenebe, J.C., 2013. Determinants of undernutrition among primary school children residing in slum areas of a Nigerian city. Nigerian Journal of Clinical Practice, 16, pp. 178-183.

Oldewage-Theron, W.H., Dicks, E.G., Napier, C.E. and Rutengwe, R., 2008. Situation analysis of an informal settlement in the Vaal Triangle. Development Southern Africa.

Owoaje, E., Onifade, O. and Desmennu, A., 2014. Family and socioeconomic risk factors for undernutrition among children aged 6 to 23 months in Ibadan, Nigeria. Pan African Medical Journal.

Patton, G.C., Sawyer, S.M., Santelli, J.S., Ross, D.A., Afifi, R., Allen, N.B. et al., 2016. Our future: a Lancet commission on adolescent health and wellbeing. The Lancet.

Rathnayake, K.M., Madushani, P. and Silva, K., 2012. Use of dietary diversity score as a proxy indicator of nutrient adequacy of rural elderly people in Sri Lanka. BMC Research Notes.

Robinson, A., Cooney, A., Fassbender, C., et al., 2023. Examining the relationship between HIV-related stigma and the health and wellbeing of children and adolescents living with HIV: a systematic review. AIDS and Behavior.

Sauli, J., Mchau, G., Ainan, S., Chacky, F., Machafuko, P., Noor, R., Masumo, R. and Leyna, G., 2022. Diet and nutrition status among school-age children and adolescents in Tanzania.

Sealey-Potts, C. and Potts, A.C., 2014. An assessment of dietary diversity and nutritional status of preschool children in Tobago. Journal of Nutrition and Metabolism.

Sichona, F., Mbuya, M.N. and Mathur, K., 2001. Nutritional status and its determinants among children in Tanzania. Tropical Medicine and International Health, 6(6), pp. 449-458.

Shiferaw, H. and Gebremedhin, S., 2020. Undernutrition among HIV-positive adolescents on antiretroviral therapy in Southern Ethiopia. Adolescent Health, Medicine and Therapy.

Simms, V., Gidudu, J., Zingoni, C., Alibhai, A., Szumilin, E., Spiegal, P. et al., 2014. The impact of nutritional status on mortality and treatment outcomes among HIV-infected adults and children receiving antiretroviral therapy: a systematic review and meta-analysis. AIDS.

Songo, F., Poudel, K.C., Mlunde, L.B., Urassa, D.P., Yasuoka, J. and Jimba, M., 2014. Poor nutrition status and associated feeding practices among HIV-positive children in a food secure region in Tanzania: a call for tailored nutrition training. PLoS One.

Somarriba, G., Lopez-Mitnik, G., Ludwig, D.A., Williams, P.L., van Dyke, R.B., Hazra, R. et al., 2010. The effects of protease inhibitor-based antiretroviral therapy on growth and nutrition among HIV-infected children.

Spear, B.A., 2002. Adolescent growth and development. Journal of the American Dietetic Association, 102(3), pp.S23-9. doi:10.1016/S0002-8223(02)90418-9.

Story, M., Neumark-Sztainer, D. and French, S., 2002. Individual and environmental influences on adolescent eating behaviors. Journal of the American Dietetic Association.

Story, M. and Stang, J., 2005. Nutrition needs of adolescents. In: Guidelines for Adolescent Nutrition Services. University of Minnesota, Center for Leadership, Education, and Training in Maternal and Child Nutrition.

Sunguya, B.F., Poudel, K.C., Otsuka, K., et al., 2012. Undernutrition among HIV-positive children in Dar es Salaam, Tanzania: antiretroviral therapy alone is not enough. BMC Public Health.

Taha, E., Kumwenda, I., Broadhead, L., Hoover, R., Graham, M. and van der Hoven, L., 1999. Mortality after the first year of life among human immunodeficiency virus type 1-infected and uninfected children. Pediatric Infectious Disease Journal.

Tanzania Food and Nutrition Centre (TFNC), 2016. National Guidelines for Nutrition Care and Support of People with HIV. Dar es Salaam, Tanzania: TFNC.

Tette, E.M., Sifah, E.K., Nartey, E.T., Nuro-Ameyaw, P., Tete-Donkor, P. and Biritwum, R.B. Maternal profiles and social determinants of malnutrition and the MDGs: What have we learnt? BMC Public Health.

UNAIDS, 2022. Report on the global AIDS epidemic. Geneva: UNAIDS.

United Nations Children's Fund (UNICEF), 2018. Statistics.

United Nations Children's Fund (UNICEF), 2020. Improving young children's diets during the complementary feeding period. Available from: https://www.unicef.org/nutrition/index_68626.html.

United Nations Children's Fund (UNICEF), 2020. Statistics on malnutrition among adolescents living with HIV.

United Nations Children's Fund, World Health Organization, and World Bank (UNICEF-WHO-WB), 2022. Global Health Observatory visualizations. Joint child malnutrition estimates.

Ukegbu, P.O. and Ogu, V.C., 2016. Dietary diversity and nutritional status of under-five children in rural and urban areas of Abia State, Nigeria. Journal of Nutrition and Health Sciences.

Van-Graan, A.E., 2015. Nutritional status and dietary intake of HIV-infected individuals in resource-limited settings: A review of the literature. Public Health Nutrition.

World Health Organization (WHO), 2003. Nutrient requirements for people living with HIV/AIDS: report of a technical consultation. Geneva: WHO.

World Health Organization (WHO), 2010. Antiretroviral therapy for HIV infection in infants and children: Toward universal access recommendations for a public health approach. Austria: WHO Library Cataloguing-in-Publication Data.

World Health Organization, 2010. WHO child growth standards and the identification of severe acute malnutrition in infants and children. Available at: https://www.who.int/publications/i/item/9789241598163 [Accessed 22 Oct. 2024].

World Health Organization, 2014. Health for the world's adolescents: a second chance in the second decade. Available from: https://apps.who.int/adolescent/second-decade/.

World Health Organization, 2020. Malnutrition. Available from: https://www.who.int/news-room/fact-sheets/detail/malnutrition.

World Health Organization, 2020. News room/questions and answer details nutrition. Available at: https://www.who.int/news-room/q-a-detail/malnutrition.

World Health Organization (WHO), 2020. Obesity and overweight. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.

World Health Organization, 2021. Adolescent health. Available at: https://www.who.int/health-topics/adolescent-health.

World Health Organization, 2021. Malnutrition. Available at: https://www.who.int/news-room/fact-sheets/detail/malnutrition.

World Health Organization, 2021. Nutrition. Available at: https://www.who.int/health-topics/nutrition.

World Health Organization, 2022. HIV data and statistics. Available at: https://www.who.int/teams/global-hiv-hepatitis-and-stis-programmes/hiv/strategic-information/hiv-data-and-statistics.

Yusufu, I., Cliffer, I.R., Yussuf, M.H., Anthony, C., Mapendo, F., Abdulla, S., Masanja, M., Tinkasimile, A., Ali, A.S., Mwanyika-Sando, M. and Fawzi, W., 2023. Factors associated with anemia among school-going adolescents aged 10-17 years in Zanzibar, Tanzania: a cross-sectional study. BMC Public Health.

Zijenah, L.S., Bandason, T., Bara, W., Chipiti, M.M. and Katzenstein, D.A., 2021. Mother-to-child transmission of HIV-1 and infant mortality in the first six months of life, in the era of Option B Plus combination antiretroviral therapy. International Journal of Infectious Diseases, 109, pp.92-98.

Zegeye, E.A., Tadesse, M., Geremew, B.M., Gebeyehu, D.T., Tadie, D.M., Ayalew, H. et al., 2022. Malnutrition and associated factors among HIV positive adults receiving ART in North West Ethiopia: a cross-sectional study. BMC Nutrition.

Zegeye, M., Belew, A., Aserese, A. and Daba, D., 2022. Time to recovery from malnutrition and its predictors among human immunodeficiency virus positive children treated with ready-to-use therapeutic food in a low-resource setting area: a retrospective follow-up study. Health Science Reports.

APPENDICES

Appendix 1: Consent Form (English Version)

MUHIMBILI UNIVERSITY OF HEALTH SCIENCES ALLIED SCIENCES

DIRECTOR OF RESEARCH AND PUBLICATIONS, MUHAS

CONSENT FORM

ID-NO ☐☐☐

Consent to participate in this study

Greetings! My name is **SHAKILA MAJURA**, I am conducting a research project aimed at assessing the nutritional status and associated dietary diversity factors among adolescents living with HIV in the Ilala Municipal Council of Dar es Salaam.

Purpose of the study

The purpose of this study is to collect information on the nutritional status and associated dietary diversity factors among adolescents living with HIV/AIDS in Ilala Municipal Council, Dar es Salaam.

You are invited to participate in this study because your unique knowledge and experiences may provide valuable insights.

What Participation Involves

If you agree to take part in this study, the following will occur:

1. You will participate in an interview with a trained interviewer, where you will discuss factors you believe are associated with nutritional status and share your thoughts on how to improve the health status of adolescents living with HIV/AIDS. The interviewer will record your responses in a questionnaire.
2. No identifying information will be collected during the interview, except for your age, level of education, marital status, religion, and current occupation.

3. You will be interviewed once, in a private setting, for approximately 30 minutes. Before the interview, your height and weight measurements will be taken.

Confidentiality

I assure you that all the information collected during the study will be kept confidential. Only the research team will have access to the data. The final report will include responses from various participants, presented in a way that does not identify any individuals. We will not include your name or any other identifying details in the records of the information you provide.

Risks

You will be asked questions about factors affecting the health of adolescents living with HIV. Some questions may make you feel uncomfortable. You have the right to decline to answer any question and may stop the interview at any time.

Rights to Withdraw and Alternatives

Participation in this study is entirely voluntary. You can choose not to participate or withdraw from the study at any point without facing any negative consequences. Your decision to not participate or to withdraw will not result in any penalty or loss of benefits to which you are otherwise entitled.

Benefits

The information you provide will contribute to a better understanding of the factors associated with poor nutrition among adolescents aged 10-19 years living with HIV/AIDS. This understanding can help in developing effective interventions and programs for this population group. Additionally, individuals identified with poor nutritional status may receive nutritional counseling as a benefit of participating in the study.

In Case of Injury

We do not anticipate that any harm will occur to you or your family as a result of participation in this study.

Who to contact

If you ever have questions about this study, you should contact the research coordinator or the research assistants.

Signature

Do you agree?

Participant Agrees [__]

Participant disagree [__]

I _____ have read/understood the contents in this form. My questions have been answered. I agree to participate in this study.

Signature of Participant _____

Signature of witness (if participant cannot read) _____

Signature of research assistant _____

Date of signed consent _____

Appendix 2: Consent Form (Swahili Version)

CHUO KIKUU CHA AFYA NA SAYANSI SHIRIKISHI – MUHIMBILI

KURUGENZI YA TAFITI NA MACHAPISHO

FOMU YA RIDHAA

NAMBA YA UTAMBULISHO ☐☐☐

Ridhaa ya Kushiriki katika utafiti huu

Habari! Jina langu naitwa **SHAKILA MAJURA,** nafanya kazi katika mradi huu wa utafiti wenye lengo la kuangalia hali ya lishe na kuchunguza sababu zinazohusishwa na hali ya lishe kwa vijana wenye umri kuanzia miaka 10-19 wanaoishi na maambukizi ya virusi vya UKIMWI katika Halmashauri ya Manispaa ya Ilala, Jijini Dar es Salaam.

Malengo ya Utafiti

Utafiti huu una lengo la kukusanya taarifa ya hali ya lishe pamoja na sababu zinazohusishwa na hali ya lishe kwa vijana wenye umri kuanzia miaka 10-19 wanaoishi na maambukizi ya virusi vya UKIMWI katika Halmashauri ya Manispaa ya Ilala, Jijini Dar es Salaam.

Unaombwa kushiriki katika utafiti huu kwa sababu una uelewa na uzoefu ambao unaweza kuwa muhimu katika tafiti hii.

Ushiriki Unahusisha Nini

Ukikubali kushiriki katika utafiti huu yafuatayo yatatokea:

1. Utakaa na msaili/mtafiti aliyepewa mafunzo ya jinsi ya kuhoji na kujibu maswali yahusuyo ufahamu wako wa sababu zinazohusishwa na hali ya lishe na mwisho kabisa kwa maoni yako ni nini kifanyike kuborehsa hali ya afya kwa wanaotumia madawa ya kulevya kwa njia ya kujidunga. Msaili atakua ananukuu majibu yako katika dodoso.
2. Hakuna taarifa zozote za utambulisho tutakazokusanya wakati wa usaili isipokua umri, kiwango cha elimu, hali yako ya ndoa, dini na kazi yako kwa sasa.

3. Utahojiwa mara moja tu kwa takriban dakika 30 kwenye sehemu ya faraga. Kabla ya usaili utapimwa urefu na uzito.

Usiri

Nakuhakikishia kwamba taarifa zote zitakazokusanywa kutoka kwako zitakua ni siri, ni watu wanaofanya kazi katika utafiti huu tu ndio wanaweza kuziona taarifa hizi. Tutajumuisha ripoti ambayo itakua na majibu kutoka kwa washiriki tofauti wa mradi bila kuweka vitambulisho vyao. Hatutaweka jina lako au taarifa yoyote ya utambulisho kwenye kumbukumbu za taarifa utakazotupa.

Madhara

Utaulizwa maswali juu ya ufahamu wako kuhusu sababau zinazohusishwa na hali ya lishe ya vijana wenye umri kuanzia miaka 10-19 wanaoishi na maambukizi ya virusi vya UKIMWI. Baadhi ya maswali yanaweza kukufanya usijiskie vizuri. Unaweza kukataa kujibu swali lolote na unaweza kusimamisha usaili wakati wowote.

Haki ya kujitoa na mbadala wowote

Kushiriki katika utafiti huu ni uchanguzi wako, kama utachagua kutokushiriki au utaamua kusimamisha kushiriki hutapata madhara yoyote. Unaweza kusimamisha kushiriki katika tafiti hii mda wowote hata kama ulisharidhia kushiriki. Kukataa kushiiriki au kujitoa katika utafiti hakutaambatana na adhabu yoyote au upotevu wa faida yoyote unayotakiwa kupata.

Faida

Taarifa utakayotupatia itasaidia kuongeza uelewa wetu kuhusu sababu zinazohusishwa na hali ya lishe kwa vijana wenye umri kuanzia miaka 10-19 wanaoishi na maambukizi ya virusi vya UKIMWI ili kutayarisha mipango na mikakati kwa hawa watu. Faida binafsi ni pamoja na ushauri nasaa kwa watakaogundulika kuwa na uzito usiostaili.

Endapo Utadhurika

Hatutegemi madhara yoyote kutokea kwa kushiriki kwako katika tafiti hii.

Watu wa kuwasiliana nao

Kama una maswaIi katika utafiti huu unaweza kuwasiliana na msimamizi wa utafiti huu au watafiti wasaidizi.

Sahihi

Unakubali?

Mshiriki amekubali [__]

Mshiriki amekataa [__]

Mimi _____ nimesoma/nimeielewa hii fomu, maswali yangu yamejibiwa. Nakubali kushiriki katika utafiti huu.

Sahihi ya mshiriki _____

Sahihi ya shahidi (kama hawezi kusoma na kuandika) _____

Sahihi ya mtafiti msaidizi _____

Tarehe ya makubaliano _____

Appendix 3: Questionnaire (English Version)

NUTRITIONAL STATUS AND ASSOCIATED DIETARY DIVERSITY FACTORS AMONG ADOLESCENTS LIVING WITH HIV IN ILALA MUNICIPAL COUNCIL, DAR ES SALAAM.

1. Date [__ __] - [__ __] - [2024]
2. Respondents ID # ☐☐☐
3. Interviewer initial [__ __]

Instruction: Please fill in the empty blanks or circle the right answer

SECTION 1: SOCIO-DEMOGRAPHIC INFORMATION

A: Demographic Information

1. Age of the respondent (years) **(Right age …….)**
2. Gender of the respondent **1 = Male**
   2 = Female
3. What is your current level of education? **1 = Primary**
   2 = Secondary
   3 = Not studying

B: Caregiver Information

4. Who is your primary caregiver?
   1 = Parents
   2 = Others

5. What is your highest education level attained by your caregiver?
   1 = no formal education
   2 = primary school education
   3 = secondary school education
   4 = Post-secondary/tertiary education

C: Family and Health Information

6. How many people are there in your family?

1 = Less than 5

2 = 5 or more

7. Has your HIV status been disclosed to anyone?

1 = Yes

2 = No

8. How long have you been on Antiretroviral Therapy (ART)?

1 = 5 years or less

2 = More than 5 years

9. What is your latest CD4 count (cells/µL)? (checked from the hospital recorded data)

1 = Less than 500

2 = 500 or more

10. Have you ever had any opportunistic infections?

1 = If yes, specify……

2 = No

11. What is your current HIV-staging? (checked from the hospital recorded data)

1 = Stage-I

2 = Stage-II or above

12. What is your hemoglobin level? (checked from the hospital recorded data)

1 = Normal

2 = Anemia

SECTION 2: DIETARY DIVERSITY INFORMATION

A: 24-Hour Dietary Recall

Please describe the foods (meals and snacks) that you ate yesterday during the day and night, whether at home or outside the home. Start with the first food eaten in the morning.

Write down all food and drinks mentioned by the respondent. When the respondent has finished, probe for meals not mentioned.

Breakfast	Lunch	Dinner

When the respondent recall is complete, fill in the food groups based on the information recorded above. For any food groups not mentioned, ask the respondent if a food item from this group was consumed.

Question No.	Food group	Examples	YES = 1 NO = 0
1	CEREALS, WHITE TUBERS AND ROOTS AND PLANTAINS	corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) + insert local foods e.g. ugali, nshima, porridge or pastes or other locally available grains, white potatoes, white yams, white cassava, or other foods made from roots	
2	LEGUMES	beans, peas, lentils,	
3	NUTS AND SEEDS	nuts, seeds or foods made from these	
4	DIARY PRODUCTS	milk, cheese, yogurt or other milk products	
5	MEAT, POULTRY AND FISH	liver, kidney, heart or other organ meats or blood-based foods, beef, pork, lamb, goat, rabbit, wild game, chicken, duck, or other birds, fresh or dried fish or shellfish	
6	EGGS	chicken, duck, guinea hen or any other egg	
7	DARK GREEN LEAFY VEGETABLES	Dark green/leafy vegetables, including wild ones + locally available vitamin-A rich leaves such as amaranth, cassava leaves, kale, spinach etc.	
8	VITAMIN A RICH VEGETABLES, FRUITS.	pumpkin, carrots, squash, or sweet potatoes that are orange inside + other locally available vitamin-A rich vegetables (e.g. red sweet pepper), ripe mangoes, cantaloupe, apricots (fresh or dried), ripe papaya, dried peaches + other locally available vitamin A-rich fruits	
9	OTHER VEGETABLES	other vegetables (e.g. tomato, onion, eggplant), including wild vegetables	
10	OTHER FRUITS	other fruits, including wild fruits	

(Food and Agriculture Organization's (FAO) Minimum Dietary Diversity for Women (MDD-W)-2016).

The total DDS will be the sum of scores across all food groups, ranging from 0 to the total number of predefined food groups

B: Dietary practices

13. On average, how many meals do you consume per day?

1= 2 meals

2 = 3 meals

3 = 4 meals

4 = More than 4 meals

14. Do you skip meals regularly?

1 = Yes

2 = No

15. Do you consume snacks in between meals?

1 = Yes

2 = No

SECTION 4: ADHERENCE TO ART IN RELATION TO NUTRITIONAL INTAKE

A: Nutritional Information

16. In the past week, how often did you have difficulty eating due to side effects of their medication?

1 = Never

2 = Rarely

3 = Sometimes

4 = Often/always

17. On average, how many servings of fruits and vegetables do you eat per day?

1 = 0-1

2 = 2-3

3 = 4-5

4 = More than 5

18. On average, how many times per week do you eat a source of protein (meat, fish, eggs, beans, lentils)?

1 = Less than 3

2 = 3-5

3 = 6-7

4 = More than 7

19. Have you experienced any significant changes in appetite in the past month?

1 = Increased

2 = Decreased

3 = No change

B: Adherence-Related Behavior

20. In the past week, how many doses of medication did you miss?

1 = None

2 = 1-2

3 = 3-4

2 = More than 4

21. If you missed doses, what was the main reason?

1 = Side effects

2 = Difficulty swallowing

3 = Forgetfulness

3 = Other, specify …….

22 What strategies do you currently use to help you remember to take the medication?

1 = Medication reminders

2 = Medication schedules

3 = Pill boxes

4 = Other, specify ……

THANK YOU FOR YOUR TIME AND PARTICIPATION.

Appendix 4 : Questionnaire (Swahili Version)

DODOSO LA UTAFITI JUU YA HALI YA LISHE NA MAMBO YANAYOHUSISHWA NA ULAJI WA MAKUNDI TOFAUTI YA LISHE MIONGONI MWA VIJANA WANAOISHI NA VIRUSI VYA UKIMWI KATIKA MANISPAA YA ILALA.

1. Tarehe ya leo [__ __] - [__ __] - [2024]
2. Namba ya utambulisho ya mshiriki ☐☐☐
3. Herufi za majina mawili ya mwanzo ya msaili [__ __]

Maelekezo: Tafadhali jaza sehemu ilio wazi au zungushia jibu lililo sahihi

SEHEMU 1: TAARIFA ZA KIJAMII NA KIDEMOGRAFIA

<u>Kipengele A: Taarifa za Kidemografia</u>

1. Una umri gani? **(*Umri sahihi …….*)**
2. Jinsia **1 = Mwanaume**
   2 = Mwanamke
3. Umesoma mpaka darasa la ngapi?
   1 = Elimu ya msingi
   2 = Elimu ya sekondari
   3 = Sijasoma

<u>Kipengele B: Taarifa za Mzazi/ Mlezi</u>

4. Mlezi wako mkuu ni nani?
   1 = Wazazi
   2 = Wengine
5. Je, ni kiwango gani cha juu cha elimu alichofikia mzazi/ mlezi wako?
   1 = Hajasoma
   2 = Elimu ya shule ya msingi
   3 = Elimu ya sekondari
   4 = Elimu ya baada ya sekondari/ elimu ya juu

Kipengele C: Taarifa za Familia na Afya

6. Je, kuna watu wangapi katika familia yako?

1 = Chini ya 5

2 = 5 au zaidi

7. Je, hali yako ya VVU imefichuliwa kwa mtu yeyote?

1 = Ndiyo

2 = Hapana

8. Je, umetumia Tiba ya Kudhibiti Virusi vya Ukimwi (ART) kwa muda gani?

1 = miaka 5 au chini

2 = Zaidi ya miaka 5

9. Je, idadi ya CD4 (seli/µL) zako za mwilini ni ngapi? (imeangaliwa kutoka kwa data zilizorekodiwa hospitalini)

1 = Chini ya 500

2 = 500 au zaidi

10. Je, umewahi kupata magonjwa nyemelezi?

1 = Kama ndiyo, taja …….

2 = Hapana

11. Je, uko kwenye hatua gani vya VVU kwa sasa? (imeangaliwa kutoka kwa data zilizorekodiwa hospitalini)

1 = Hatua ya I

2 = Hatua ya II au zaidi

12. Kiwango chako cha hemoglobini ni kiasi gani? (imeangaliwa kutoka kwa data zilizorekodiwa hospitalini)

1 = Kawaida

2 = Upungufu wa damu

SEHEMU YA PILI: TAARIFA JUU YA ULAJI WA MAKUNDI TOFAUTI YA LISHE

A: Kumbukumbu ya Ulaji wa Lishe wa Masaa 24

Tafadhali eleza vyakula (milo na vitafunwa) ambavyo mtoto wako alikula jana mchana na usiku, iwe nyumbani au nje ya nyumba. Anza na chakula cha kwanza kilicholiwa asubuhi.

Andika vyakula na vinywaji vyote vilivyotajwa na mhojiwa. Mhojiwa anapomaliza, chunguza milo ambayo haijatajwa.

Kifungua kinywa	Chakula cha mchana	Chakula cha jioni

Marejesho ya mhojiwa yanapokamilika, jaza vikundi vya chakula kulingana na taarifa iliyoandikwa hapo juu. Kwa makundi yoyote ya vyakula ambayo hayajatajwa, muulize mhojiwa kama chakula kutoka kwa kikundi hiki kilitumiwa.

Swali Na.	Kundi la chakula	Mifano	NDIO = 1 HAPANA = 2
1	NAFAKA, MAJIZI NYEUPE NA MIMEA	mahindi/mahindi, mchele, ngano, mtama, mtama au nafaka yoyote au vyakula vilivyotengenezwa kutokana na hivi (k.m. mkate, tambi, uji au bidhaa nyinginezo za nafaka) + ingiza vyakula vya kienyeji k.m. ugali, nshima, uji au tambi au nafaka nyinginezo zinazopatikana ndani ya nchi. viazi vyeupe, viazi vikuu nyeupe, mihogo nyeupe, au vyakula vingine vinavyotengenezwa na mizizi.	
2	KUNDE	maharagwe, mbaazi, dengu.	
3	KARANGA NA MBEGU	karanga, mbegu au vyakula vinavyotengenezwa kutokana na hizi.	

4	BIDHAA ZA MAZIWA	maziwa, jibini, mtindi au bidhaa nyingine za maziwa.	
5	NYAMA, KUKU NA SAMAKI	Maini, figo, moyo au nyama nyingine ya kiungo au vyakula vinavyotokana na damu. Nyama ya ng'ombe, nguruwe, kondoo, mbuzi, sungura, nyama ya porini, kuku, bata au ndege wengine, samaki wabichi au waliokaushwa au samakigamba.	
6	MAYAI	ya kuku, bata, kuku wa guinea au yai lingine lolote	
7	MBOGA ZA MAJANI YA KIJANI ILIYOKOZA	Mboga za kijani kibichi/majani, ikijumuisha zile za mwituni + majani yenye vitamini A kwa wingi kama vile mchicha, majani ya muhogo, kale, mchicha n.k.	
8	MBOGA ZA VITAMINI A NA MATUNDA	maboga, karoti, boga, au viazi vitamu vilivyo na chungwa ndani + mboga nyinginezo zenye vitamini-A zinazopatikana hapa nchini (k.m. pilipili nyekundu), maembe yaliyoiva, tikitimaji, parachichi (mbivu au kavu), mbivu. papai, pichi zilizokaushwa + matunda mengine yanayopatikana ndani ya nchi yenye vitamini A.	
9	MBOGA MBOGA NYINGINE	mboga nyingine (k.m. nyanya, vitunguu, biringanya), ikiwa ni pamoja na mboga za mwitu.	
10	MATUNDA MENGINE	matunda mengine, ikiwa ni pamoja na matunda ya mwitu.	

(*Food and Agriculture Organization's (FAO) Minimum Dietary Diversity for Women (MDD-W)-2016).*

Jumla ya DDS itakuwa jumla ya alama katika vikundi vyote vya chakula, kuanzia 0 hadi jumla ya idadi ya vikundi vya chakula vilivyoainishwa awali.

B: Mazoea ya ulaji wa vyakula

13. Kwa wastani, unatumia milo mingapi kwa siku?

1 = Milo 2

2 = Milo 3

3 = Milo 4

4 = Zaidi ya milo 4

14. Je, wewe huacha kula mara kwa mara?

1 = Ndio

2 = Hapana

15. Je, unatumia vitafunio kati ya milo?

1 = Ndio

2 = Hapana

SEHEMU YA 3: UHUSIANO KATI YA KUFUATA DAWA ZA UKIMWI NA ULAJI WA LISHE

Kipengele A: Sehemu Ya Lishe

16. Katika wiki iliyopita, ni mara ngapi ulipata shida ya kula kutokana na madhara ya dawa?

1 = Kamwe

2 = Mara chache

3 = Wakati mwingine

4 = Mara nyingi/ Daima

17. Kwa wastani, unakula matunda na mboga mboga mara ngapi kwa siku?

1 = 0-1

2 = 2-3

3 = 4-5

4 = Zaidi ya 5

18. Kwa wastani, ni mara ngapi unakula chanzo cha protini (nyama, samaki, mayai, maharagwe, dengu) kwa wiki?

1 = Chini ya 3

2 = 3-5

3 = 6-7

4 = Zaidi ya 7

19. Je, unatumia mara kwa mara bidhaa za maziwa (maziwa, mtindi, jibini)?

1 = Ndiyo

2 = Hapana

18. Unakunywa maji ya kutosha siku nzima (maji, juisi, maziwa)?

1 = Ndiyo

2 = Hapana

19. Je, unewahi kupata mabadiliko yoyote muhimu katika hamu ya kula katika mwezi uliopita?

1 = Kuongezeka

2 = Imepungua

3 = Hakuna mabadiliko

Kipengele B: Tabia Inayohusiana na Dawa

20. Katika wiki iliyopita, ulikosa dozi ngapi za dawa?

1 = Hakuna

2 = 1-2

3 = 3-4

4 = Zaidi ya 4

21. Ikiwa ulikosa dozi, sababu kuu ilikuwa nini?

1 = Madhara

2 = Ugumu wa kumeza

3 = Kusahau

4 = Nyingine, taja ………….

22. Je, unatumia mbinu gani kwa sasa zinazokusaidia kukumbuka kutumia dawa zako?

1 = Vikumbusho

2 = Ratiba ya dawa

3 = Sanduku za vidonge

4 = Nyingine, taja …….

ASANTE KWA MUDA WAKO NA KWA KUSHIRIKI KATIKA TAFITI HII.

Appendix 5: Approval for ethical clearance

UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

OFFICE OF THE DIRECTOR – RESEARCH, PUBLICATIONS AND INNOVATIONS

Ref. No.DA.282/298/01.C/2314 Date: 07/06/2024

MUHAS-REC-06-2024-2314
SHAKILA BASHIRU MAJURA
SCHOOL OF PUBLIC HEALTH AND SOCIAL SCIENCES
MUHAS

RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED: NUTRITION STATUS AND ASSOCIATED DIETARY DIVERSITY FACTORS AMONG ADOLESCENTS LIVING WITH HIV IN ILALA MUNICIPAL COUNCIL, DAR ES SALAAM.

Reference is made to the above heading,

I am pleased to inform you that the Chairperson has on behalf of the University Senate, approved ethical clearance of the above-mentioned study, on recommendations of the Senate Research and Publications Committee meeting accordance with MUHAS research policy and Tanzania regulations governing human and animal subjects research.

APPROVAL DATE: 07/06/2024
EXPIRATION DATE OF APPROVAL: 07/06/2025

STUDY DESCRIPTION:
Purpose:
The purpose of this cross-sectional descriptive study is to assess the nutritional status and associated dietary diversity factors among adolescents living with HIV in Ilala Municipal Council, Dar es Salaam.

The approved protocol and procedures for this study is attached and stamped with this letter, and can be found in the link provided: https://irb.muhas.ac.tz/storage/Certificates/Certificate%20-%2015697.pdf and in the MUHAS archives.

The PI is required to:

1. Submit bi-annual progress reports and final report upon completion of the study.
2. Report to the IRB any unanticipated problem involving risks to subjects or others including adverse events where applicable.
3. Apply for renewal of approval of ethical clearance one (1) month prior its expiration if the study is not completed at the end of this ethical approval. You may not continue with any research activity beyond the expiration date without the approval of the IRB. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.
4. Obtain IRB amendment (s) approval for any changes to any aspect of this study before they can be implemented.
5. Data security is ultimately the responsibility of the investigator.
6. Apply for and obtain Data Transfer Agreement (DTA) from NIMR if data will be transferred to a foreign country.
7. Apply for and obtain Material Transfer Agreement (MTA) from NIMR, if research materials (samples) will be shipped to a foreign country.
8. Apply for and obtain permission to publish the results from National Institute for Medical Research. The application should be before submitting to a publisher and not concurrently through the email publications@nimr.or.tz.
9. Any researcher, who contravenes or fail to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine as per NIMR Act No. 23 of 1979, PART III section 10 (2)
10. The PI is required to ensure that the findings of the study are disseminated to relevant stake holders.
11. PI is required to be versed with necessary laws and regulatory policies that govern research in Tanzania. Some guidance is available on our website https://drp.muhas.ac.tz/.

Muhimbili University of Health and Allied Sciences
DIRECTOR
Research, Publications & Innovations

Dr. Nahya Salim Masoud,
Chairperson, MUHAS Research and Ethics Committee

Appendix 6: Introduction Letter

UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR – POSTGRADUATE STUDIES

In reply quote;
Ref. No. HD/MUH/T.768/2022 11th June, 2024

The Executive Director,
Amana Regional Referral Hospital,
P.O. Box 25411,
DAR ES SALAAM

Re: INTRODUCTION LETTER SHAKILA BASHIRU MAJURA

We would like to inform you that the bearer of this letter is **Shakila Bashiru Majura** with Reg. No. **HD/MUH/T.768/2022** is a student at Muhimbili University of Health and Allied Sciences (MUHAS) "pursuing **MPH-Executive Track.**

As part of her studies, she will be doing an elective research titled: "**Nutrition Status and Associated Dietary Diversity Factors Among Adolescents Living with HIV in Ilala Municipal Council, Dar es Salaam".**

The research has been approved by the Chairman of University Senate.

Kindly provide her the necessary assistance to facilitate the conduct of her research.

We thank you for your cooperation.

Mr. Sebe Mohamed
For: DIRECTOR, POSTGRADUATE STUDIES

c.c **Shakila Bashiru Majura**

9 United Nations Road; Upanga West; P.O. Box 65001, Dar Es Salaam: Tel. G/Line: +255-22-2150302/6; Ext. 1015; Direct Line:+255-22-2151378;Telefax:+255-22-2150465;E-mail:dpgs@muhas.ac.tz;Web:https://www.muhas.ac.tz

Appendix 7: Permission Letter

THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF HEALTH

AMANA REGIONAL REFERRAL HOSPITAL

Telegram "HEALTH", DODOMA
Phone No.: +255 026 – 2323267
Email: ps@afya.go.tz

P.O. Box 25411
DAR ES SALAAM
Phone: 022—2861903

REF. NO. MoHCDGEC/ARRH/R.1/VOL II/54

Date: 11/06/2024

Director, Postgraduate Studies,
MUHAS,
P.O. Box 65001,
DAR ES SALAAM.

Re: PERMISSION FOR DATA COLLECTION

Refer to your letter dated 11th June, 2024 which requested us to **Shakila Bashiru Majura** to conduct research and collect data in our institution.

We are here to acknowledge your request with the following conditions, that she must submit the results of her research after completion of analysis in order the hospital to make use of data's to solve hospital problems.

Regards.

For:
MEDICAL OFFICER I/C
AMANA REGIONAL REFERAL HOSPITAL
P. O. Box 25411
DAR ES SALAAM

Dr. Rose Ntambuto
FOR: MEDICAL OFFICER INCHARGE
AMANA REGIONAL REFERRAL HOSPITAL

JAMHURI YA MUUNGANO WA TANZANIA

OFISI YA RAIS
TAWALA ZA MIKOA NA SERIKALI ZA MITAA
HALMASHAURI YA JIJI LA DAR ES SALAAM

Ref. DCC/D.F.31/IX/65

28Jun, 2024

Mganga Mfawidhi,
Hospitali ya Mnazi Mmoja.

Seen: 25/06/2024
Katibu Mkuu
Seen.

YAH: UTAMBULISHO WA UTAFITI KUHUSU "NUTRITION STATUS AND ASSOCIATED DIETARY DIVERSITY FACTORS AMONG ADOLESCENTS LIVING WITH HIV IN DAR ESSALAAM CITY COUNCIL, TANZANIA "

Tafadhali husika na kichwa cha habari hapo juu.

2. Ofisi ya Mganga Mkuu wa Halmashauri ya Jiji la Dar es Salaam, inapenda kumtambulisha **Ndg. SHAKILA BASHIRU MAJURA** mwenye namba ya usajili **HD/MUH/T.768/2022** kutoka Chuo kikuu cha Afya na Sayansi Shirikishi Muhimbili (MUHAS) anayesoma Shahada ya Uzamili wa Udaktari wa Afya ya Jamii.

3. Amepewa kibali cha kufanya tafiti katika Halmashauri ya Jiji la Dar es Salaam katika kituo cha afya cha Mnazi Mmoja, iwapo lengo kuu la utafiti huu ni kuchunguza hali ya lishe ya vijana wanaoishi na maambukizi ya virusi vya Ukimwi wenye umri wa miaka kumi (10) hadi miaka kumi na Tisa (19) wanaohudhiria kituoni.

4.Aidha, utafiti huu unatarajiwa kufanyika kuanzia tarehe **28/06/2024** hadi tarehe **7/07/2024** katika **Hospitali ya Mnazi Mmoja.**

5. Kwa barua hii naomba umpokee mtafiti huyu na kumpa ushirikiano kulingana na taratibu na miongozo iliyopo.
Natanguliza shukrani zangu za dhati.

Anence Kamasho
Kny: MGANGA MKUU HALMASHAURI YA JIJI
DAR ES SALAAM

Kny: MGANGA MKUU
HALMASHAURI YA JIJI LA DAR-ES-SALAAM

OFISI YA MKURUGENZI, 1 MTAA WA MISSIONI, S.L.P 20950, 11883 DAR ES SALAAM,SIMU NA 2128800, 2128805.Tovuti.www.dcc.gp.tz.
Barua pepe info@ilalamc.go.tz

NB: Mtafiti amepewa sharti la kurudisha nakala ya matokeo ya tafiti hii pindi amalizapo uandishi wa taarifa. Endapo mtafiti huyu hatarudisha taarifa taratibu zilizowekwa za ufuatiliaji chuoni zitazingatiwa.

NUTRITION
Mpokee Mpe
Kushirikiano
28/06/2024

KUANZIA
1/07/2024

Appendix 8: Digital Receipt

turnitin

Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

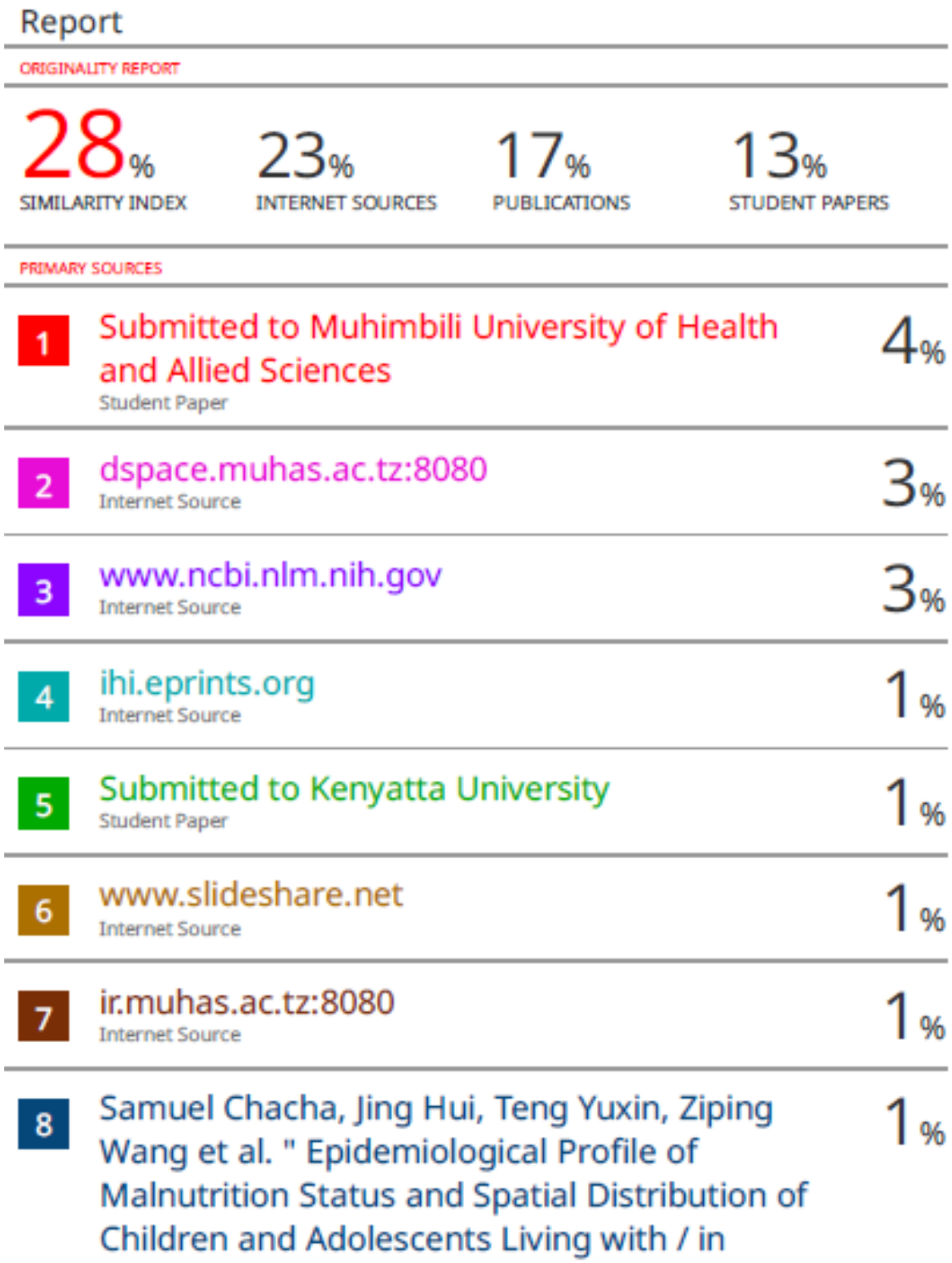
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Submission author:	Shakila Majura
Assignment title:	NUTRITION STATUS AND ASSOCIATED DIETARY DIVERSITY FA...
Submission title:	Report
File name:	TR.pdf
File size:	850.6K
Page count:	98
Word count:	19,195
Character count:	113,818
Submission date:	01-Aug-2024 06:32AM (UTC+0300)
Submission ID:	2350412581



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Appendix 9: Plagiarism Report



Report

ORIGINALITY REPORT

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PRIMARY SOURCES

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8	Samuel Chacha, Jing Hui, Teng Yuxin, Ziping Wang et al. " Epidemiological Profile of Malnutrition Status and Spatial Distribution of Children and Adolescents Living with / in	1%