NUTRITIONAL AND FOOD SECURITY STATUS OF HIV+ADULTS ON ANTIRETROVIRAL AND THERAPEUTIC NUTRITION AT KIBRA INFORMAL SETTLEMENT, NAIROBI CITY COUNTY KENYA

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DECLARATION

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

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DEDICATION

This work is dedicated to my husband Charles and my daughters Charlene and Shanice for their unwavering support through the whole course.

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ABBREVIATIONS AND ACCRONYMS

AIDS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral Therapy
ARV	Antiretroviral
BMI	Body Mass Index
CCC	Comprehensive Care Centre
CD4	Cluster of Differentiation 4
CDC	Centre for Disease Control and prevention
FANTA	Food and Nutrition Technical Assistance
HAART	Highly Active Antiretroviral Therapy
HIV	Human Immuno-Deficiency Virus
IDDQ	Individual Dietary Diversity Questionnaire
IDDS	Individual Dietary Diversity Score
KDHS	Kenya Demographic and Health Survey
MDD-W	Minimum Dietary Diversity for Women
MUAC	Middle Upper Arm Circumference
NASCOP	National AIDS and STI Control Program
RUTF	Ready to Use Therapeutic Food
SPSS	Statistical Packages for Social Sciences
WDDS	Women's Dietary Diversity Score

DEFINITION OF OPERATIONAL TERMS

Anti-retroviral Therapy	Treatment given to HIV^+ people using regimens of medicine that specifically target viruses including HIV.
Diet	Amount and kind of food or drink taken by a person.
Dietary diversity	Dietary diversity refers to the number of different food groups consumed by an individual over a specific reference period, usually 24 hours. It serves as a proxy indicator of diet quality and micronutrient adequacy. It can be classified Low dietary diversity**:** consumption of ≤ 3 food groups, Medium dietary diversity**:** consumption of 4–5 food groups or High dietary diversity**:** consumption of ≥ 6 food groups
Food by prescription	Intervention program for Intervention program for PLHIV that involves provision of RUTF, nutritional assessment monitoring and counseling.
Individual Dietary Diversity Score	The Individual Dietary Diversity Score (IDDS) is a measure used to assess the variety of food groups consumed by an individual within a 24-hour recall period. It serves as a proxy indicator for the micronutrient adequacy of an individual's diet. It is calculated based on the number of different food groups consumed from a predefined list, with

	higher scores indicating greater dietary diversity and improved potential for nutrient intake.
Immune suppression	This indicates a weakened defense system increasing vulnerability to other infections.
MDD-W	This is a dichotomous indicator of whether women 15-49 years of age have consumed at least five out of ten defined food groups the previous day or night.
Nutritional Status	The measurement of the extent to which a person's physiological needs for nutrients are being met or not. Anthropometric measurements used (Body Mass Index - BMI <18.5 → Undernourished, 18.5–24.9 → Normal nutritional status, ≥25.0 → Over-nourished (overweight or obese) and Middle Upper Arm Circumference - MUAC, <23cm- undernourished, ≥23cm - normal)
Opportunistic infections	These are Illnesses caused by various organisms, some of which occur in individuals with compromised immunity.

ABSTRACT

Antiretroviral therapy (ART) is the use of antiretroviral (ARV) medication to inhibit viral replication and delay immune deterioration. ART plays a critical role in the management of HIV by suppressing viral replication and improving immune function. An appropriate diet is vital when ART commences. The nutritional needs of HIV^+ adults are immense and have a great impact on HIV/AIDS management outcomes. The effectiveness of ART is closely linked to the nutritional status and dietary diversity of HIV^+ adults. Despite the well-documented importance of nutrition in HIV management, limited research has focused on the dietary diversity and nutritional outcomes of HIV-positive adults on ART in Kenya's informal settlements. This study assessed the socio-demographic and economic characteristics of HIV-positive adults on ART, evaluated their dietary diversity and nutritional status, examined the relationship between dietary diversity and nutritional status and the relationship between socio-economic characteristics and both dietary diversity and nutritional status. A cross-sectional analytical study was conducted among HIV-positive adults attending health centres in Kibra informal settlement, Nairobi City County, Kenya. Data were collected using structured questionnaires, 24-hour dietary recalls, food frequency questionnaires, and anthropometric measurements including Body Mass Index (BMI) and Mid-Upper Arm Circumference (MUAC). Descriptive statistics, chi-square tests, Fisher's exact test, and bivariate regression analysis were conducted using Statistical Package for Social Sciences (SPSS) version 20. The Individual Dietary Diversity Score (IDDS) and Minimum Dietary Diversity for Women (MDD-W) were used to assess dietary diversity, while nutritional status was categorized by BMI. Multivariable logistic regression identified significant predictors of dietary diversity and nutritional status. Findings revealed that 55.7% of respondents had low dietary diversity, with only 7% attaining high dietary diversity. Meal frequency and wealth index were significant predictors of dietary diversity ($p<0.001$ and $p=0.019$, respectively). Most respondents (57.4%) had normal nutritional status, while 8.7% were undernourished and 35.7% were overweight or obese. Statistically significant associations were found between dietary diversity variables such as being on a special diet ($p=0.033$), receiving nutrition counselling ($p=0.023$), meal frequency (<0.001) and food shortage (0.048), and nutritional status ($p<0.05$). Some socio-economic and socio-demographic factors showed a significant association with dietary diversity and nutritional status. The study concludes that dietary diversity remains low among HIV^+ adults in informal settlements, with direct implications for their nutritional health and ART outcomes. The findings underscore the need for enhanced nutrition-focused interventions integrated into HIV care, routine monitoring of dietary diversity and nutritional status. Further research on how improvements in dietary diversity influence nutritional status and ART adherence over time, the impact of nutrition counselling and food support on nutritional outcomes among HIV-positive adults as well as gender-based disparities in dietary access and nutritional vulnerability among HIV-positive adults to inform interventions strategies is recommended.

CHAPTER ONE: INTRODUCTION

This chapter provides the foundation of the study by presenting the background, problem statement, research objectives, hypotheses, significance, and scope. It introduces the context of the research, outlines the key issues being addressed, and explains the rationale behind the investigation. The chapter also defines the boundaries within which the study is conducted and highlights the conceptual framework guiding the analysis. Through this structure, Chapter one sets the stage for a deeper exploration of the research problem and its relevance to the field.

1.1 Background of the study

Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) remain significant global public health challenges, with sub-Saharan Africa disproportionately affected. The region accounts for more than 67% of the world's HIV burden, with Kenya reporting approximately 1.4 million people living with HIV (UNAIDS, 2023; NASCOP, 2022). Nairobi City County records a prevalence of about 6.8%, but this rate nearly doubles in urban informal settlements like Kibra, where estimates suggest HIV prevalence is as high as 12.6% (NASCOP, 2020).

Multiple studies indicate that socioeconomic factors such as limited education, low income, and unemployment, are significant barriers to adherence to antiretroviral therapy (ART) and can negatively impact health outcomes among people living with HIV (South et al., 2024; Zhang et al., 2025). Kibra, one of the largest informal settlements in Africa, is characterized by overcrowding, poor sanitation, high unemployment, limited healthcare access,

and persistent food insecurity (UN-Habitat, 2022). These factors create a high-risk environment that exacerbates the vulnerabilities of HIV^+ adults, especially those on antiretroviral therapy (ART) whose health and treatment outcomes are closely linked to nutrition (Githinji et al., 2023). Socioeconomic constraints such as education, income, and employment strongly predict dietary diversity and overall nutritional status among HIV^+ adults in Nairobi's informal settlements (Associated Factors, 2024; Apiyo Adundo et al., 2025). Given the increasing number of PLHIV accessing ART and the socio-economic constraints in urban slums, understanding how dietary diversity influences nutritional status is critical.

Nutrition plays a dual role in the management of HIV. On one hand, adequate nutrition enhances immune function, supports the efficacy of antiretroviral therapy (ART), and contributes to improved treatment outcomes. On the other hand, poor nutritional status can accelerate HIV disease progression, increase susceptibility to opportunistic infections, and impair ART adherence (Obeagu et al, 2024; Alebe et al, 2022). HIV infection increases energy and micronutrient requirements due to the increased metabolic nature of the disease and recurrent infections, while simultaneously compromising nutrient absorption as a result of gastrointestinal complications and ART side effects (Thieme Medical Publishers, 2024; Nutritional Aspects of PLHIV, 2022). These disruptions in nutrient intake, utilization, and absorption contribute to weight loss, immune suppression, and increased morbidity if not addressed through appropriate dietary interventions.

Dietary diversity, or the variety of food groups someone eats over time, is a reliable way to measure how healthy and nutrient-rich their diet is (Frontiers in Public Health, 2025). For HIV^+ adults, adequate dietary diversity is crucial for maintaining optimal nutritional

status and supporting treatment outcomes. For individuals on ART, consuming a balanced and varied diet is essential in boosting immunity and enhancing treatment outcomes. However, dietary diversity is often lacking in informal urban settlements due to economic hardships and limited food choices. (Omwanda et al., 2020).

Nutritional status is a vital health marker in people living with HIV, with both under-nutrition and over-nutrition presenting significant health risks. Malnutrition impairs immune function and may accelerate the progression of HIV, while overweight and obesity are emerging issues partly due to ART side effects and poor dietary habits (Juma et al., 2022). Recent evidence from urban informal settlements in Ethiopia revealed 32% under-nutrition and 28% overweight/obesity among ART clients, with gastrointestinal issues and poor meal patterns significantly predicting under-nutrition, and prolonged ART use associated with weight gain (Bekele et al., 2023). In Kenya, a 2024 study in Nairobi slums found that approximately 40% of HIV +ve adults experienced gastrointestinal side effects that correlated with reduced dietary intake and lower IDDS scores—factors that negatively affected treatment outcomes (Kamau et al., 2024). However, the intersection of ART-related side effects with nutritional status remains poorly documented in Kibra's context, highlighting a gap in localized understanding.

There is a well-documented association between dietary diversity and nutritional status among HIV-positive populations. Studies conducted in Kenya have demonstrated a significant positive correlation between dietary diversity and nutritional variables such as body mass index (BMI), micronutrient adequacy, and energy intake. A study by Juma et al. in 2022, found that individuals with higher Individual Dietary Diversity Scores (IDDS) had

notably better nutritional outcomes, including higher BMI and improved iron and vitamin A levels. Similarly, research by Korir et al. (2022) indicated that dietary diversity was a strong predictor of energy sufficiency and nutrient adequacy among HIV-positive adults in low-income settings. Similar findings have been reported in other African countries, supporting the importance of diversified diets in improving the health status of individuals on ART (Omwanda et al., 2020, Khamis et al., 2021). Understanding the relationship between dietary diversity and nutritional status among HIV+ adults in Kibra is crucial for tailoring nutrition-sensitive HIV care, improving treatment outcomes, and guiding public health interventions.

Studies across Nairobi's informal settlements show that inconsistent food intake, limited nutritional knowledge, and poverty significantly contribute to poor nutrition among ART clients (Owuor et al., 2024; Soma et al., 2022). A longitudinal study in Kibera and Mathare found maternal nutrition and ART adherence significantly influenced infants' nutritional outcomes (Kiilu et al., 2025). An agricultural-intervention trial in Kenya (Shamba Maisha) significantly improved food availability and mental health among adults on ART, though it didn't change BMI or viral suppression (Hatcher et al., 2022).

1.2 Problem Statement

Human Immunodeficiency Virus (HIV) continues to pose a significant public health challenge in Kenya, particularly within densely populated informal settlements such as Kibra in Nairobi City County. While the scale-up of Antiretroviral Therapy (ART) has greatly improved the survival and quality of life of HIV +ve adults, the success of treatment is influenced by multiple factors, including dietary diversity and nutritional status. Studies

highlight that inconsistent food intake, low nutrition awareness, and socio-economic limitations contribute heavily to poor nutritional status among ART clients in urban informal settlements (Owuor et al., 2024; Downs et al., 2022).

Despite the significant gains made through antiretroviral therapy (ART) in reducing HIV-related morbidity and mortality in Kenya, malnutrition remains a major barrier to optimal treatment outcomes among HIV^+ adults, particularly in low-resource urban settlements like Kibra (MOH, 2023; Fathima et al., 2022). HIV infection elevates the body's energy and micronutrient demands while often impairing nutrient absorption and appetite, a situation made worse by gastrointestinal side effects like nausea, vomiting, and diarrhea (Khaoury et al., 2024; Smith & Jones, 2025; World Health Organization, 2023). A study on adult HIV +ve adults reported that asymptomatic individuals need ~10% more energy, symptomatic individuals 20–30% more, and those in recovery even more; the authors emphasize weight loss caused by decreased appetite, nausea, vomiting, and diarrhea (Nguyen et al., 2024). Another analysis highlighted that HIV increases energy requirements, reduces food intake, and impairs nutrient utilization (Adeyemi et al., 2024).

In informal settlements such as Kibra, where HIV prevalence (12.6%) significantly exceeds the national average (4.9%), food shortage, poverty, and inadequate access to quality healthcare create a compounded vulnerability for HIV^+ adults (NASCOP, 2020) Dietary diversity, an established measure for micro-nutrient adequacy has been consistently associated with improved nutritional status and ART adherence (Aderajew et al., 2021; Khamis

et al., 2021). Dietary diversity is often limited in informal settlements, leading to both under-nutrition and over-nutrition among ART clients (Oppong et al., 2023; Korir et al., 2024).

Existing literature highlights a strong association between low dietary diversity and increased susceptibility to opportunistic infections, and reduced ART efficacy (Apprey et al., 2025). Yet, most of these studies have been conducted in rural or peri-urban regions such as Kisii and Kiambu, and very few have directly assessed this relationship in urban informal settlements where the socio-economic dynamics and nutritional vulnerabilities differ significantly (Omwanda et al., 2020).

Moreover, there remains a critical gap in understanding how socio-economic and demographic factors such as education, income, employment status, and household size interact with dietary diversity to influence the nutritional status of HIV-positive adults in Kibra informal settement. Without localized empirical data, nutritional support programs risk being inadequately tailored, poorly targeted, or ineffective in addressing the specific needs of urban slum populations (Downs et al., 2022). This study therefore sought to fill this knowledge gap by assessing dietary diversity, nutritional status, and their interrelationship among HIV-positive adults on ART in Kibra. It further investigated the influence of socio-economic and demographic factors on these outcomes, thereby generating context-specific evidence to inform integrated nutrition and HIV care strategies in urban informal settlements.

1.3 Justification of Study

Nutrition plays a vital role in the management of HIV in enhancing immune function, supporting the efficacy of antiretroviral therapy (ART), and contributes to improved treatment outcomes. Urban informal settlements such as Kibra in Nairobi City County present unique and compounding challenges to HIV care due to high population density, poverty, unemployment, food insecurity, and poor access to health-supportive environments which increase vulnerability to nutritional deficiencies due to limited access to affordable and diverse foods. There is a lack of localized, empirical data that links dietary diversity to nutritional outcomes in urban informal settlements like Kibra. Socioeconomic constraints such as education, income, and employment strongly predict dietary diversity and overall nutritional status among HIV^+ adults in Nairobi's informal settlements.

Based on this background, this study addresses a critical knowledge gap by generating specific empirical data on the dietary diversity and nutritional status of HIV-positive adults on ART in Kibra, The study explored the relationship between socio-economic and demographic factors and their impact on dietary diversity and nutritional outcomes. This information is vital for designing tailored and effective nutrition-sensitive HIV care interventions. The findings align with global and national priorities that emphasize integrating nutrition into HIV/AIDS care frameworks. The study investigated the needs of a high-risk subgroup - HIV-positive adults on ART, By identifying predictors of poor nutritional outcomes such as low meal frequency, food shortage, and limited dietary diversity the study supported more responsive and data-driven HIV programming. The findings provide ac-

tionable insights for healthcare providers, NGOs, community-based organizations, and policy-makers. These stakeholders can use the study results to strengthen nutrition support, improve ART adherence, and reduce HIV-related morbidity and mortality in Kibra and similar settings. This study contributes to both public health practice and academic discourse by offering evidence that links nutrition, socio-economic vulnerabilities, and chronic disease management within marginalized urban populations. It seeks not only to improve individual health outcomes for HIV^+ adults but also to inform broader strategies for enhancing the quality and effectiveness of HIV care in urban informal settlements.

1.4 Research questions

1. What are socio-demographic and economic characteristics of HIV^+ adults on ART in health centres in Kibra informal settlement?
2. What are the dietary diversity patterns among HIV-positive adults on ART in health centres in Kibra informal settlement?
3. What is the nutritional status of HIV-positive adults on ART in health centres in Kibra informal settlement?
4. To what extent do dietary diversity variables predict the nutritional status of HIV-positive adults on ART in health centres in Kibra informal settlement?
5. What is the relationship between socio-demographic and socio-economic characteristics and dietary diversity among HIV-positive adults on ART in health centres in Kibra informal settlement?

6. What is the relationship between socio-demographic and socio-economic characteristics and nutritional status among HIV-positive adults on ART in Kibra informal settlement?

1.5 Hypotheses

H01. There is no significant relationship between dietary diversity and nutritional status of HIV+ adult on ART.

H02. There is no significant relationship between socio-economic and socio-demographic characteristics and dietary diversity among HIV+ adult on ART.

H03. There is no significant relationship between socio-economic and socio-demographic characteristics and nutritional status among HIV+ adults on ART.

1.6 Objectives

1.6.1 General objective

To assess, dietary diversity and nutritional status of HIV^{+} adults on ART at health centers in Kibra informal settlement, Nairobi city county, Kenya.

1.6.2 Specific objectives

1. To determine the socio-demographic and economic characteristics of HIV-positive adults on ART in health centres in Kibra informal settlement.
2. To examine the dietary diversity patterns among HIV-positive adults on ART in health centres in Kibra informal settlement.

3. To assess the nutritional status of HIV-positive adults on ART in health centres in Kibra informal settlement.
4. To evaluate the predictive value of dietary diversity variables on the nutritional status of HIV-positive adults on ART in health centres in Kibra informal settlement.
5. To establish the relationship between socio-economic and socio-demographic characteristics and dietary diversity among HIV-positive adults on ARTin health centres in Kibra informal settlement.
6. To determine the relationship between socio-economic and socio-demographic characteristics and nutritional status among HIV-positive adults on ART in Kibra informal settlement.

1.7 Limitations and Delimitations and scope of study

While this study offers important insights into the dietary diversity and nutritional status of HIV-positive adults on ART in Kibra, several limitations were highlighted. Self-reported dietary data based on 24-hour recall may have been affected by recall bias and social desirability. Sample limitation to health centres in Kibra reduced the generalization of findings to other informal or rural settings. Unmeasured confounders such as ART regimens, and psycho-social factors were not controlled and could have affected nutritional outcomes. Absence of biochemical assessments means nutritional status was assessed only through anthropometry, limiting micronutrient-level insights.

This study was conducted within specific boundaries to maintain focus and relevance. The research was limited to health centers within Kibra informal settlement, Nairobi City

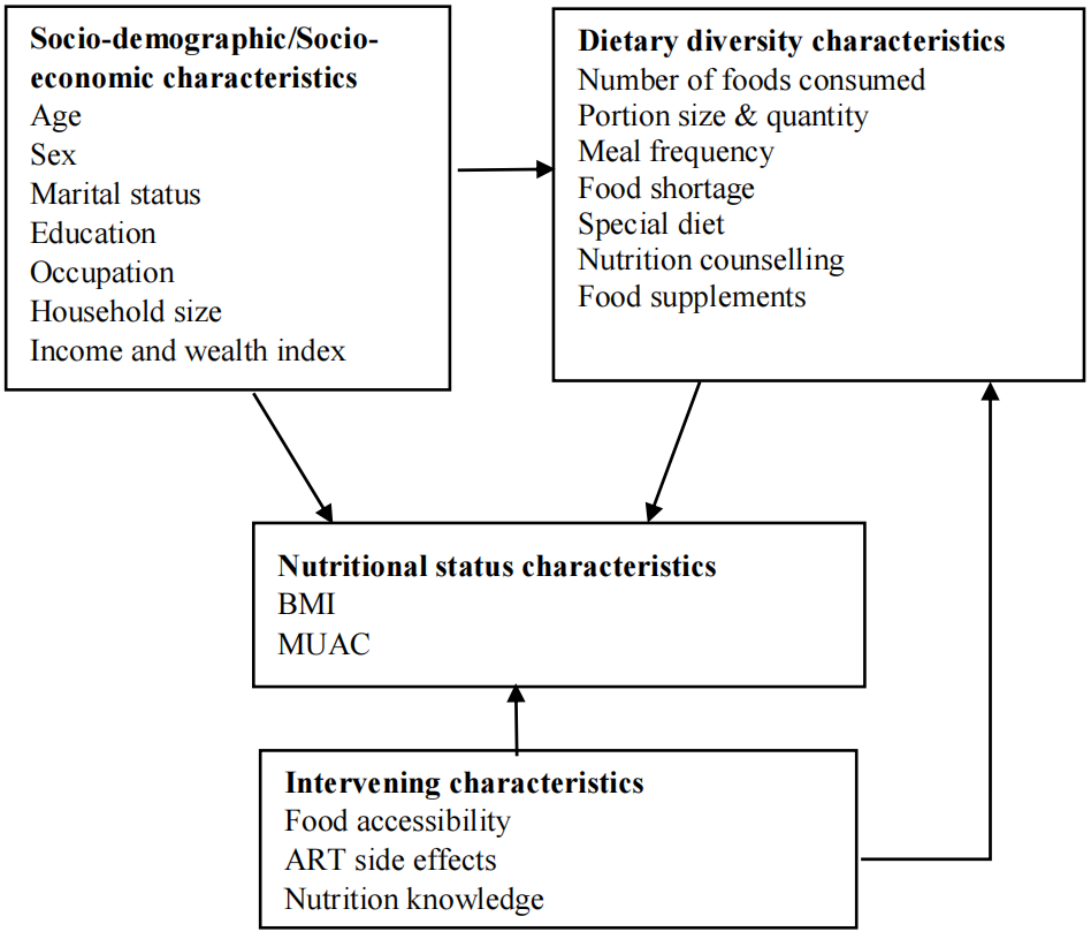
County, due to its high HIV burden and socio-economic challenges. Only HIV-positive adults (18+ years) on ART for at least two months not less were included. Children, adolescents, and HIV-negative individuals were excluded. The study focused on socio-economic and demographic characteristics, dietary diversity, and nutritional status (measured using BMI and MUAC). Other influencing factors like mental health or biochemical variables were not covered. Data was collected cross-sectionally, capturing only current dietary and nutritional status without assessing long-term changes.

This study was confined to assessing the relationship between dietary diversity and nutritional status among HIV-positive adults on antiretroviral therapy (ART) residing in Kibra Informal Settlement, Nairobi City County, Kenya. It focused on individuals aged 18 years and above who were actively receiving ART services at selected health centres. The study assessed dietary intake using a 24-hour dietary recall to determine dietary diversity scores based on the Minimum Dietary Diversity for Women (MDD-W) and Household Dietary Diversity Score (HDDS) frameworks. Nutritional status was evaluated using Body Mass Index (BMI) classifications. The study also examined socio-demographic and economic factors that may influence dietary diversity and nutritional status. The findings are specific to the study population and setting, and may not be generalizable to HIV-positive individuals outside Kibra or those not on ART.

1.8 Conceptual Framework

This study was guided by an adapted conceptual framework based on insights from Foziya et al. (2021). It illustrates how dietary diversity and socio-demographic characteristics interact to influence the nutritional status of HIV-positive adults on ART. The framework

conceptualizes nutritional status as the dependent variable, primarily determined by dietary diversity variables, both of which are influenced by various socio-economic and demographic characteristics. These included age, sex, education level, household income, household size, food access, marital status and duration on ART. These factors may independently influence both food group consumption and nutritional outcomes. These variables and their relationships are presented in Figure 1.1.



Adapted from Foziya et al, 2021. Dietary diversity and nutritional status among HIV+ adults

Figure 1.1: Conceptual Framework showing the relationship between variables in the study

1.9 Significance of Study

This study is significant in bridging a critical knowledge gap regarding the dietary diversity and nutritional status of HIV-positive adults on ART in Kibra informal settlement, an urban setting characterized by poverty, food insecurity, and limited healthcare access. While nutrition is a well-established component of effective HIV management, there is limited localized data in Kenya's urban slums to guide policy and programmatic responses. The findings will inform the Ministry of Health, NASCOP, NGOs, and HIV program implementers by offering empirical evidence on how socio-economic and demographic factors influence dietary practices and nutritional outcomes among HIV^+ adults. This will support the development of integrated, nutrition-sensitive HIV care strategies and improve the design of food assistance, dietary counseling, and supplementation programs. Additionally, the study contributes to national frameworks such as the Kenya National AIDS Strategic Framework (KNASF) and National Nutrition Action Plan (NNAP) by providing data necessary for policy refinement and targeted resource allocation. It also enhances the monitoring and evaluation of existing HIV nutrition programs in resource-limited urban contexts. The study enriches the body of literature on HIV, nutrition, and urban health, offering context-specific insights for future research. The study supports a patient-centered approach by identifying at-risk subgroups, such as individuals in large households, thus informing household-sensitive nutrition interventions.

CHAPTER TWO:LITERATURE REVIEW

This chapter reviews existing literature relevant to the dietary diversity and nutritional status of HIV-positive adults on ART. It explores global, regional, and local perspectives on the socio-demographic and economic factors influencing nutrition among HIV^+ adults, the concept and measurement of dietary diversity, and the nutritional challenges associated with ART. The review also highlights gaps in the literature, particularly within informal settlements like Kibra.

2.1 Socio-Economic and Demographic Determinants of Dietary Diversity and Nutritional Status among HIV^+ adults

Socio-economic and demographic factors play a fundamental role in determining dietary practices and nutritional outcomes among HIV^+ adults. In urban informal settlements like Kibra, where poverty, unemployment, and low education levels are prevalent, ART adherence and nutritional well-being are often compromised (Muthamia et al., 2022; Wekesa et al., 2020). Research in Nairobi's slums has shown that individuals with limited formal education and low income are significantly less likely to adhere to ART or maintain a nutritious diet (Owuor et al., 2024).

Demographic characteristics such as age, sex, household size, and marital status influence dietary intake and health outcomes among HIV^+ adults. For example, larger households often face greater food insecurity and lower dietary diversity (Smith et al., 2024). In several African countries Zambia, Nigeria, and Ghana, higher education, income, and smaller family size have been linked to improved nutritional status and food security among HIV^+ adults (Jones et al., 2023; Patel et al., 2024). However, few studies in Kenya, especially in

Kibra, have explored these domains jointly. While socio-economic determinants of ART adherence and nutrition are acknowledged, integrated analyses that explore their combined effects in high-density urban slums like Kibra are limited.

2.2 Dietary Diversity of HIV-Positive Adults on ART

Dietary diversity is defined as the number of different foods or food groups consumed over a specific reference period, usually 24 hours, serving as a qualitative indicator of both food access and nutritional adequacy (Herforth et al., 2023; Ruel et al., 2024). It reliably reflects the likelihood of meeting micronutrient and energy requirements in low-resource contexts and has been validated across age groups and settings, including infants, women of reproductive age, school-aged children, and adults in informal settlements, highlighting its flexibility and relevance (Frontiers in Nutrition, 2024). Among HIV^+ adults, dietary diversity is critical for immune support and ART efficacy. In Kenya, a study in Kisii County found that 33.2% of HIV^+ adults recorded poor dietary diversity, with significant predictors including household income, marital status, and education (Omwanda et al., 2025).

Similarly, Negera et al. (2023) reported that 61% of HIV^+ adults in Southwest Ethiopia consumed a limited range of food groups, correlating with poor nutritional outcomes. A 2024 cross-sectional survey involving 220 HIV^+ adults in Ghana found that 33.2% of participants recorded low dietary diversity per IDDS, with 20% underweight; higher IDDS correlated with being employed and consuming ≥ 3 meals daily, while under-nutrition was more common among women on first-line ART (Abdulai et al., 2024). In Kenya, a nationwide analysis showed that increased individual dietary diversity significantly improved BMI among underweight women and decreased BMI in overweight women, underscoring

the role of the IDDS in identifying both under- and over-nutrition in low-income urban settings (Korir et al., 2022). Another facility-based assessment of adults in Ghana during the COVID-19 pandemic used 24-hour recall and IDDS to reveal that over half of participants (55.5%) required dietary improvement; factors like employment status and age were strong predictors of diet quality (Abdulai et al., 2024). A 2022 study from Chad demonstrates the effective use of 24-hour recall and dietary diversity scores to link low household dietary diversity with high stunting prevalence, an approach that could be mirrored in Kibra's HIV^+ adult population (N'Djamena Study Group, 2022). In Ghana, a 2024 cross-sectional study found that poor dietary diversity and low meal frequency were associated poor nutritional outcomes in ART clients, particularly among women and those with irregular income (Abdulai et al., 2024).

2.3 Nutritional Status among HIV^+ adults on ART

ART has improved survival rates and quality of life among HIV +ve adults but may also contribute to nutritional complications. ART side effects such as nausea, vomiting, and appetite loss can negatively impact nutrient intake and increase the risk of malnutrition (Fathima et al., 2022). ART significantly influences nutritional outcomes among HIV^+ adults, with both positive and complex metabolic effects. Nutritional improvements are often observed following ART initiation due to viral suppression and immune restoration; however, challenges such as weight gain, dyslipidemia, and metabolic syndrome have been reported, particularly in long-term ART users (Herforth et al., 2023). HIV^+ adults face a dual burden of malnutrition: under-nutrition due to inadequate dietary intake and over-nutrition related to ART side effects and poor diet quality. In Kisii, 20% of HIV^+ adults

were underweight, while nearly 40% were overweight or obese (Omwanda et al., 2020). Research in Nairobi slums also shows that poor dietary habits, limited nutrition education, and food shortage contribute to both extremes of malnutrition (Owuor et al., 2024). A cross-sectional study among adult ART recipients in Gauteng, South Africa, identified a high prevalence of both under-nutrition (13%) and overweight/obesity (39%), demonstrating a double burden of malnutrition in peri-urban informal settings. Obesity was significantly associated with longer ART duration, female gender, employment status, and higher income levels. Under-nutrition correlated with advanced HIV clinical stage and difficulty accessing food, reinforcing how both forms of malnutrition coexist among HIV^+ adults (Naidoo et al., 2023).

Complementing this, a longitudinal cohort of HIV^+ adults in Northern Ethiopia showed incremental increases in BMI over time on ART, while unemployment, advanced HIV stage, and specific ART regimens were linked to slower BMI gain, highlighting predictors of nutritional change across treatment (Tekalegn et al., 2024). A study from Kenya's urban HIV programs suggest that unsuppressed viral load, which is worsened by poor adherence, itself tied to malnutrition and remains a barrier to viral control (Mwangi et al., 2024).

2.4 Relationship between Dietary Diversity variables and Nutritional Outcomes.

Numerous studies have demonstrated a positive association between dietary diversity variables and nutritional outcomes among HIV^+ adults. In Ethiopia, those with adequate dietary diversity had higher mean BMI compared to undernourished counterparts (Zewudie & Sewale, 2025). Likewise, a recent PLoS ONE survey found dietary diversity to be a strong

predictor of micronutrient intake adequacy among HIV^+ adults, with diverse diets shielding against deficiencies that impair immune function (Nutrition Survey Group, 2024).

These findings mirror Kenyan data: a 2024 BMI quantile analysis using nationally representative DHS data revealed that increased dietary diversity was significantly associated with higher BMI across underweight and normal-weight groups, suggesting its dual utility in identifying both under- and over-nutrition (Balanced Choices Group, 2024).These findings support the idea that diet quality, rather than quantity alone, plays a crucial role in influencing the nutritional status of HIV^+ adults. There is limited empirical evidence from Kibra informal settlement examining how dietary diversity directly influences nutritional status, particularly using both anthropometric and dietary measures.

2.5 Nutrition Challenges in Kibra Informal Settlement

Kibra's socio-economic environment, characterized by overcrowding, limited access to healthcare, and high levels of food insecurity amplifies the vulnerability of HIV^+ adults. These conditions contribute to inadequate dietary diversity and heightened risk of opportunistic infections (Muhula et al., 2021; Ayaya et al., 2024). Recent research among HIV^+ adults in Kibra indicated that approximately 86.8% experienced food insufficiency in the two weeks prior to assessment (Ayaya et al., 2024). A regional study in Tanzania revealed that even when nutrition guidelines are available at ART clinics, healthcare providers face barriers such as insufficient training and poor integration into routine care, a situation likely mirrored in informal settlements like Kibra (Ngome et al., 2025).

There is growing consensus that nutrition support interventions tailored to local contexts can improve both ART adherence and nutritional status. In Busia County, Kenya, a locally

formulated porridge known as PROLCARMIV significantly improved BMI, blood lipid profiles, and hemoglobin levels among HIV^+ adults compared to standard nutritional support (Oketch et al., 2023). Such context-relevant solutions highlight the need for similar approaches in urban informal settlements. Despite Kibra's high HIV burden, few studies have comprehensively examined the intersection of poverty, diet, and HIV management in this specific setting. This lack of localized data limits the design of effective, sustainable nutrition strategies for HIV^+ adults in Kenya's informal urban settlements. The reviewed literature highlights the relationship between socio-economic factors, dietary diversity, and nutritional status among HIV^+ adults in urban informal settlements. There is a lack of integrated research examining how these variables jointly influence health outcomes. This study addresses this gap by employing a cross-sectional design and validated tools (IDDS, BMI, MUAC) to explore the associations among socio-demographic factors, dietary diversity, and nutritional status of HIV-positive adults on ART in Kibra. The next chapter outlines the methodology used to achieve the study objectives.

CHAPTER THREE:MATERIALS AND METHODS

This chapter outlines the methodological approach adopted to investigate the relationship between dietary diversity and nutritional status among HIV-positive adults on ART in selected health centres within Kibra informal settlement. It describes the research design, study area, target population, sampling methods, data collection tools and procedures, and analytical techniques used. The inclusion and exclusion criteria, considerations of ethical standards and the validity and reliability of instruments applied. The methodology was designed to ensure the collection of accurate, relevant, and reliable data.

3.1 Research Design

A cross-sectional analytical study design was used for observation and clear analysis of different variables and their relationships.

3.2 Variables

The dependent variable was nutritional status of HIV^{+} adults on ART, whereas the independent variables were dietary diversity, socio-demographic characteristics and socio-economic factors. Expected confounding factors may have influenced the observed relationship between dietary diversity and nutritional status among HIV-positive adults. These include socio-economic status, education level, gender, age, household size, duration on ART, and access to nutrition counseling.

3.3 Location of Study

The study was conducted in Kibra informal settlement, located in Nairobi City County, Kenya. Kibra is one of the largest urban slums in Africa, with an estimated population of over 200,000 people living in densely populated conditions (UN-Habitat, 2020). The area is characterized by poor sanitation, inadequate housing, and widespread poverty, all of which contribute to heightened public health risks (APHRC, 2014). The HIV prevalence in Kibra stands at 12.6%, which is significantly higher than the national average of 4.9% (NASCOP, 2020). The settlement hosts several health facilities that offer comprehensive HIV care and ART services (MOH, 2021), making it a suitable site for the study. The choice of Kibra was further informed by the need to assess dietary diversity and nutritional status within a population disproportionately affected by HIV and socio-economic challenges.

3.4 Target Population

The study targeted men and women aged 18 years and above who were attending ART clinics at health centers in Kibra informal settlement, Nairobi City County, Kenya. Eligible participants had been on antiretroviral therapy for at least two months to ensure a meaningful health history and consistent treatment exposure. The population included individuals from diverse socio-economic backgrounds, varying household sizes, and different stages of HIV management. This group was selected based on their regular interaction with HIV care services, which provided an appropriate context for assessing dietary diversity and nutritional status.

3.5 Inclusion Criteria and exclusion Criteria

Participants included in the study were HIV-positive adults (18+ years) enrolled at the two main health centres serving residents of Kibra and had attended ART for at least two months prior to data collection for meaningful health history. The respondents who were willing and able to provide informed consent and participate in interviews and anthropometric assessments and possessing updated clinical records for verification of ART and nutrition history were included. Participants were excluded if they were critically ill or hospitalized, were pregnant or lactating due to altered nutritional needs and had co-existing medical conditions such as cancer affecting nutrition or those not on ART during the study period.

3.6 Sample technique and sample size determination

3.6.1 Sampling technique

Nairobi City County was purposively selected as the study location, as it hosts the Kibra informal settlement, which is characterized by unique socio-economic and environmental factors that may exacerbate the effects of HIV/AIDS. Within Kibra, four health centers were initially purposively selected based on their high ART client enrollment. These included Kibra Health Centre, Kibra South Health Centre (sponsored by AMREF), Lang'ata Health Centre, and Ngong Road Health Centre.

However, at the time of data collection, Kibra South Health Centre and Ngong Road Health Centre had been repurposed as COVID-19 rapid response centers and were no longer ac-

cessible for routine ART services. Consequently, the study was conducted at the two remaining centers, Kibra Health Centre and Lang'ata Health Centre, which were designated to serve all HIV-positive adults residing in Kibra during this period.

The combined monthly ART attendance at the two selected centers was approximately 600 clients. Based on this estimated population, a sample size of 251 participants was calculated using a standard sample size determination formula. Systematic random sampling was applied during participant recruitment. Using a table of random numbers, every even-numbered individual who met the eligibility criteria (aged 18 years or older), enrolled in ART for at least two months as confirmed through medical records, and who provided informed consent, was selected consecutively during clinic days.

3.6.2 Sample size determination

The required sample size was calculated using the Charan &Tomaghna, 2013 formula. In the formula used ($Z_{1\alpha/2}{}^2 p(1-p)/d^2$), where $\mathbf{Z_{1\alpha/2}{}^2}$ is the standard normal variate at the required confidence level (1.96). **P** is the proportion of the target population on ART at health centers in Kibra informal settlement, and **d** is the marginal error allowed or degree of accuracy (0.05), hence**; $\mathbf{(1.96)^2 \times 0.4(0.6) \div (0.05)^2 = 368.79}$**. Hence; **369**

Since the population is less than 10000, (about 600(**N**) clients on ART in the selected centers, the following formula; finite populations correction of proportions was used to come up with the final sample size, then, **nf=n/(1+(n/N)) =369/ (1+369/600)** =228. Therefore, the sample size was given as 228 plus 10% to allow for attrition hence the final sample size obtained was **251.**

3.7 Data Collection tools and Instruments

Information for the study was gathered through a structured questionnaire (Appendix C), which covered key areas including demographic and socio-economic characteristics, as well as aspects related to antiretroviral therapy (ART). Respondents provided details on the types of ART medications they were using, prescribed dosages, frequency of intake, any side effects experienced, and barriers encountered in maintaining adherence.

Dietary data were collected using multiple tools. A 24-hour recall form (Appendix G) captured the types and quantities of all foods and beverages consumed by the respondents within the past day, including ingredients used and methods of preparation. In addition, a food frequency questionnaire (Appendix H) was administered to determine how often selected food items were consumed over the course of one week. These tools enabled the assessment of dietary diversity, serving as an indirect indicator of nutrient adequacy.

To support accurate estimation of food quantities, enumerators were trained to apply standardized portion size referencing tools. These included everyday kitchen items such as cups, plates, and spoons to help participants approximate food portions. The estimated portion sizes were converted into gram equivalents based on data from the Kenya Food Composition Tables, which enabled the categorization of foods into groups and the calculation of individual dietary diversity scores.

Anthropometric measurements were taken to assess nutritional status. Body weight was measured using a digital scale, height was obtained using a calibrated wooden stadiometer, and mid-upper arm circumference (MUAC) was measured with a standard tape. All measurement tools were regularly checked to ensure precision.

3.8 Pilot study and pretesting the research instruments

Pre-testing was carried out to ensure accuracy and clarity of the information required. The questionnaire was pre-tested at one of the health centers in Kibra informal settlement by the researcher and trained assistants. The pre-test comprised of 25 (10% of 251) individuals with the same characteristics as the actual sample but were not considered in the final sample. This helped identify ambiguous or poorly understood items and allowed for refinement of language, structure, and flow to improve clarity and consistency. After the pre-test, the tools were adjusted to ensure that all data needed would be collected and entered correctly.

3.8.1 Validity

To enhance the accuracy of the research tools, the instruments were adapted from well-established sources, including the FAO's dietary diversity guidelines and WHO nutrition standards. The questionnaires were reviewed by nutrition professionals working at the selected clinics, who provided feedback to improve the clarity and relevance of the questions. Their input helped refine the content to better suit the study context. In addition, the pre-test offered useful insights that further improved the quality and effectiveness of the tools.

3.8.2 Reliability

To ensure consistency in anthropometric measurements such as weight, height, and mid-upper arm circumference (MUAC), data collectors were trained using standardized procedures. They conducted practice measurements on selected individuals, after which their results were compared to check for consistency. This process helped to minimize variation

between different assessors and reduce the risk of measurement errors. Enumerators followed uniform protocols throughout data collection to maintain accuracy and reliability.

3.8.3 Training research assistants

Three research assistants with qualifications in food, nutrition, and dietetics—holding either a bachelor's degree or diploma were recruited to assist with data collection. To ensure accurate and consistent data gathering, they underwent training aligned with the study's objectives. The training focused on administering questionnaires, selecting eligible participants, and maintaining professional communication with respondents. They were also taught how to clearly present and explain each question, address any misunderstandings, and manage language barriers when interacting with participants. In addition, the research assistants received hands-on instruction in collecting anthropometric measurements using standardized procedures.

3.9 Data collection techniques

Questionnaires were administered to clients who were randomly selected from the participating health centers. These tools were used to gather information on demographic and socio-economic characteristics, knowledge related to ART, dietary practices, and anthropometric indicators. Data collection took place during scheduled clinic and appointment days, as agreed upon with the respective health facility administrators. On these days, the research team, comprising the principal investigator and trained assistants, introduced themselves to the clients, explained the purpose of the study, and obtained informed consent before proceeding.

Dietary assessment was conducted using both food frequency questionnaires and 24-hour dietary recall methods. For each participant, three 24-hour recalls were completed, two on weekdays and one on a weekend day, to determine meal frequency, nutrient adequacy, types of foods consumed, and methods of preparation. The food frequency questionnaire was used to assess how often certain nutrient-rich foods were consumed over a seven-day period. Additionally, an Individual Dietary Diversity Questionnaire (IDDQ) was used to evaluate food intake during the day and night, both at home and away.

Anthropometric measurements were taken to evaluate nutritional status. Weight was recorded to the nearest 0.1 kilograms using a digital scale placed on a flat surface, with participants wearing light clothing. Height was measured to the nearest 0.1 centimeters using a calibrated height board, with participants standing barefoot and upright. Body mass index (BMI) was computed as weight in kilograms divided by height in meters squared, and categorized using WHO classifications: thinness (<18.5 kg/m²), normal range (18.5–24.9 kg/m²), overweight (25.0–29.9 kg/m²), and obesity (30.0–39.9 kg /m²), and morbid obesity (>40 kg/m²). Mid-upper arm circumference (MUAC) was also recorded using a standard measuring tape. Individuals with MUAC readings of less than 23 cm for women and less than 25 cm for men were classified as underweight. Each participant's anthropometric data was collected once during the interview session.

3.10 Data analyses methods

Data collected from the questionnaires were first entered into Microsoft Excel, where they were cleaned, coded, and checked for consistency. The cleaned dataset was then exported to the Statistical Package for the Social Sciences (SPSS) version 20 for analysis.

Descriptive statistics were used to summarize participant characteristics, and results were presented in the form of frequencies, means, and percentages. To assess household wealth status, a wealth index was generated using Principal Component Analysis (PCA), based on household ownership of various assets and other related variables, following procedures aligned with national survey guidelines.

For inferential analysis, different statistical techniques were applied depending on the type of variables. Associations between categorical variables were tested using the Chi-square test, while relationships involving continuous variables were assessed using Pearson's correlation. Bivariate analysis was conducted to explore associations between independent variables and dietary diversity. Variables that showed statistically significant associations at $p < 0.05$ were included in a multivariable logistic regression model.

Logistic regression was also used to identify demographic, socio-economic, and dietary factors associated with nutritional status. To account for potential confounding variables, multivariate logistic regression was performed. In examining dietary diversity, the strength and direction of associations were expressed using odds ratios and 95% confidence intervals. Statistical significance was considered a level of 0.05. The summary of data collection and analysis methods is represented in Table 3.1.

Table 3.1: Data collection and analysis methods

Objective	Data collection method	Data analysis
To assess socio-economic and demographic characteristics of the respondents	A structured questionnaire	Statistical Package for Social Sciences (SPSS). Descriptive statistics Principal component analysis (Kenya Demographic and Health Survey procedures)
To assess dietary diversity among the study respondents	A food frequency recall sheet (FAO, 2013) Individual Dietary Diversity Questionnaire A 24-hr food recall sheet	Descriptive statistics Nutri-Survey
To determine nutritional status of the study respondents	Anthropometric data (MUAC, BMI)	Descriptive statistics
To establish the relationship between socio-economic characteristics, dietary diversity and nutritional status among the respondents		Fischer's exact test Chi square test Pearson Product Moment Correlations Logistic regression analysis

3.11 Ethical considerations

Clearance approval and research authorization were obtained from Graduate school and the Ethical Review Committee of Kenyatta University were granted (APPENDIX F). A research permit were obtained from NACOSTI (APPENDIX G). The respondents' consent was sought (APPENDIX A). The respondents were assured of confidentiality informed that the information obtained would be entirely for the study and that no names or personal information would be disclosed in any forum. The respondents were also assured that the participation was voluntary. The respondents were informed that their personal information would be used only for drawing conclusions on the study objectives. The respondents were informed that recommendations would be made by the study for informing policy and programs that would potentially benefit them. All data was securely stored.

CHAPTER FOUR:RESULTS

This chapter presents the findings of the study based on the data collected from HIV-positive adults on antiretroviral therapy (ART) attending selected health centres in Kibra informal settlement. The results are organized according to the study objectives and include descriptive statistics, dietary diversity patterns, nutritional status, and statistical relationships between key variables. Tables and figures are used to summarize the data for clarity and ease of interpretation.

4.1 Socio-economic and socio-demographic Characteristics of HIV$^+$ adults in Kibra informal settlement

This section presents the socio-demographic and socio-economic characteristics of the study respondents. Variables examined include age, sex, marital status, education level, occupation, and household size, alongside economic indicators such as source of income, spouse's occupation, and employment status. These characteristics provide essential context for interpreting dietary diversity patterns and nutritional status, as they influence access to food, healthcare, and overall well-being among adults living with HIV. The mean age of the respondents was determined as 46.1. The proportion by gender of the study respondents is represented in Figure 4.1

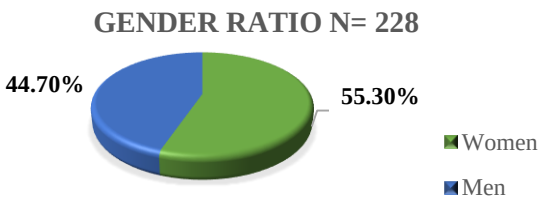


Figure 4.1: Proportion by gender of HIV$^+$ adults on ART in Kibra Informal settlement

In this study, HIV+ adults participated, of which 126 (55.3%) were females.Other socio-economic and socio-demographic characteristics of the study respondents are represented in Table 4.1 (Socio-demographic characteristics), Table 4.2 (Socio-economic charachteristics), and Table 4.3 (Monthly expenditure)

Table 4.1: Socio-demographic characteristics of HIV$^+$ adults in Kibra informal settlement

Characteristic	Total N = 228	Total %	Men N = 102	Men %	Women N = 126	Women %
Education						
No formal education	8	3.5	4	3.9	4	3.2
Std 1-4	6	2.6	1	1.0	5	4.0
Std 5-8	56	24.6	23	22.5	33	26.2
Secondary Education	86	37.7	36	35.3	50	39.7
Diploma level	23	10.1	9	8.8	14	11.1
University level	9	3.9	6	5.9	3	2.4
Marital Status						
Married	148	64.9	69	67.6	79	62.7
Widowed	20	8.8	6	5.9	14	11.1
Divorced/separated	16	7.0	6	5.9	10	7.9
Single	46	20.2	21	20.6	25	19.8
Household Size						
<5	166	72.8	71	69.6	95	75.4
5-16	62	27.2	30	29.4	32	25.4
>16	0	0.0	0	0.0	0	0.0

Table 4.2: Socio-economic Characteristics of HIV$^+$ adults in Kibra informal settlement

Characteristic	Total N =228	Total %	Men N = 102	Men %	Women N = 126	Women %
Occupation						
Casual work	108	47.4	52	51.0	56	44.4
Formal/regular employment	18	7.9	10	9.8	8	6.3
Self-employment	33	14.5	16	15.7	17	13.5
Not employed	69	30.3	22	21.6	47	37.3
Spouse Occupation						
Casual worker	71	31.1	16	15.7	45	35.7
Formal/regular employment	40	17.5	6	5.9	9	7.1
Self-employed	65	28.5	12	11.8	23	18.3
Not employed	52	22.8	37	36.3	6	4.8
Income Source						
Salaried job	64	28.1	32	31.4	32	25.4
Spouse income	59	25.9	12	11.8	47	37.3
Own business	62	27.2	34	33.3	27	21.4
Other	42	18.4	21	20.6	21	16.7

Table 4.3: Monthly expenditure of HIV$^+$ adults in Kibra informal settlement

N=228	Mean+SD	LL-UL
Monthly rent	3786.26+1658.41	1200 - 13000
Daily Food Expenditure	262+132	00 – 1,000
Monthly Education Expenditure	4427.95+4512.75	00-20,000
Monthly Health Expenditure	2010.82+2472.7	00-8,000

Nearly half (47.4%) were engaged in casual employment, while 64.9% were married. In terms of education, 37.7% had attained secondary school level, representing the highest proportion within the group. Most participants (72.8%) resided in households with fewer than five members, and 27.2% reported owning small businesses as a source of income. Regarding household expenditures, respondents reported spending between Kshs 1,200

and Kshs 13,000 on monthly rent, up to Kshs 8,000 on medical expenses, and as much as Kshs 1,000 daily on food, reflecting varied levels of economic burden across the study population.

Figure. 4.2 below represents the wealth index of the study respondents, calculated from PCA. The wealth index was computed using PCA, where data on ownership of household assets, type of building materials, fuel and light source were considered. The analysis included key items such as television, radio, video player, motorcycle, sofa, wall type, floor type, source of lighting and fuel source.

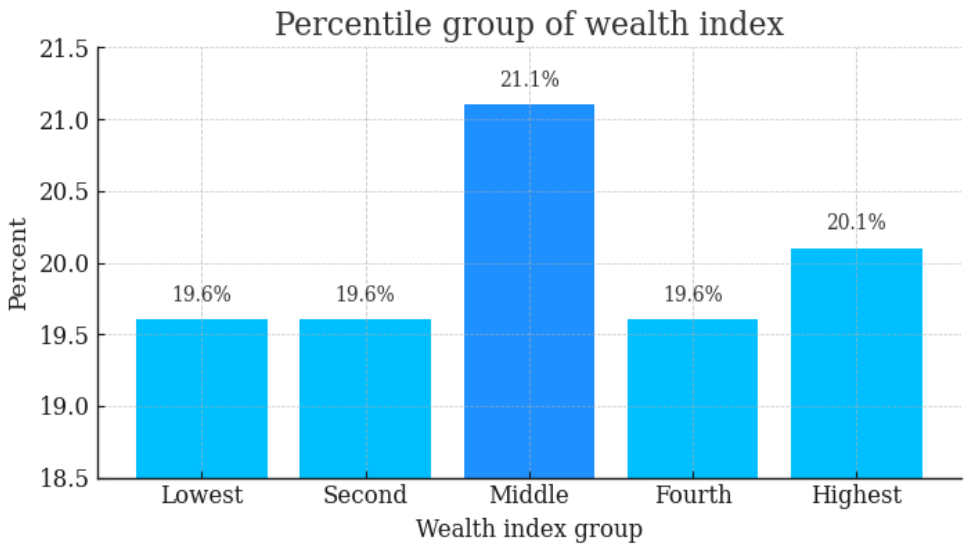


Figure 4.2. Wealth percentiles for HIV⁺ adults on ART in Kibra Informal settlement

The Principal Component Analysis (PCA) extracted three components accounting for a total of 50.1% of the variance in the data. The first component had an eigenvalue of 2.35, explaining 23.5% of the variance; the second component had an eigenvalue of 1.53 (15.3% variance), and the third component had an eigenvalue of 1.12 (11.2% variance). All selected household indicators loaded significantly onto one of the three components. The first

principal component was retained and used to construct the wealth index, representing the relative economic status of each household. This wealth index was then categorized into five quintiles, ranging from the lowest to the highest wealth groups. The majority of respondents were classified within the middle quintile, indicating a moderate distribution of household wealth among participants.

4.2 Use of ART by of HIV$^+$ adults in Kibra informal settlement

Various aspects of use of ART by the participants were analysed and the results represented in Table 4.4

Table 4.4. ART characteristics of HIV$^+$ adults on ART in Kibra Informal settlement

Variable	Frequency	Percent (%)
Duration on ART		
≤ 1 year	33	14.5
1-3 years	77	33.8
> 3 years	118	51.8
Side effects		
Nausea and vomiting	78	34.2
Diarrhea and abdominal pain	27	11.8
Appetite loss	72	31.6
No side effects	61	26.8
Ways of addressing side effects N=228		
Don’t know how to handle them	119	52.2
Changing diet	46	20.1
Skipping medication	63	27.6

About half of the respondents (51.8%) had been on ART for over three years. Most experienced side effects likely to affect food choice, intake and retention. Only 26.8% did not

experience side effects. Those that experienced side effects devised different coping mechanisms including skipping the medication by 27.6% of the respondents.

4.3 Dietary Diversity of the HIV^{+} adults on ART in Kibra Informal settlement

In this study, respondents were analysed based on various dietary diversity variables and the results represented in tables and figures.

4.3.1 Variables related to dietary diversity

Variables of dietary diversity, such as number of meals per day, food shortage, food groups, food restrictions are represented in Table 4.5.

Table 4.5: Food Access and Nutrition-Related Characteristics of HIV$^+$ adults in Kibra informal settlement

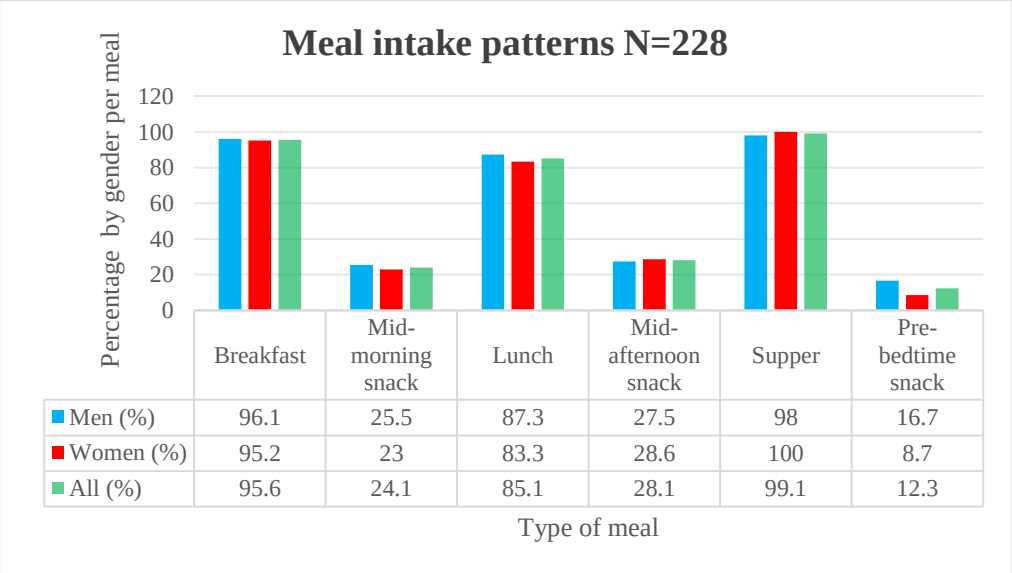
Variable	n (%)		Variable	n (%)
Number of meals per day			**Coping strategies**	
1	5 (2.2%)		Fewer meals	61 (26.8%)
2	88 (38.6%)		Cheaper foods	124 (54.4%)
3	119 (52.2%)		Borrowing	18 (7.9%)
4	13 (5.7%)		Other ways	15 (6.6%)
Experiencing food shortage			**Received nutritional counselling**	
Yes	166 (72.8%)		Yes	161 (70.6%)
No	62 (27.2%)		No	67 (30.3%)
Affected food groups			**Source of nutrition counselling**	
Cereals	52 (22.8%)		(N=161)	
Pulses	122 (53.5%)		Nurse	1 (0.9%)
Vegetables	86 (37.7%)		Nutritionist	159 (98.2%)
Fruits	138 (60.5%)		Doctor	1 (0.9%)
Most available and affordable food groups				
Cereals	91 (39.9%)		**On food supplements (N=228)**	
Pulses	33 (14.5%)		Yes	27 (11.8%)
Vegetables	208 (91.2%)		No	201 (88.2%)
Fruits	119 (52.2%)			
All	22 (9.6%)			

Many of the respondents (52.2%) had at least three meals per day with 72.8% reporting experiencing food shortage. The main food groups affected in food shortage were pulses, as reported by 53.5% and fruits as reported by 60.5% of the respondents. Only 9.6% of the respondents reported to be able to access and afford all food groups. 26.8% of the respondents reported coping with the food shortage by eating fewer meals. 70.6% of the respond-

ents received nutritional counselling, with many of the providers (98.8%) being nutritionists in the health centers. Two hundred and one respondents (88.2%) reported that they had not been given any prescription for food supplements.

4.3.2 Meal intake patterns of HIV$^+$ adults in Kibra informal settlement

Meal intake patterns were analysed and the results presented in Figure 4.3.



	Breakfast	Mid-morning snack	Lunch	Mid-afternoon snack	Supper	Pre-bedtime snack
Men (%)	96.1	25.5	87.3	27.5	98	16.7
Women (%)	95.2	23	83.3	28.6	100	8.7
All (%)	95.6	24.1	85.1	28.1	99.1	12.3

Figure 4.3. Meal intake patterns of HIV$^+$ adults on ART in Kibra Informal settlement

Most respondents recorded that they had at least the three main meals a day with very few having in between snacks. Almost the whole study population (99.1%) reported that they made effort to have supper frequently.

4.3.3 Food group consumption patterns of HIV$^+$ adults in Kibra informal Settlement

The FAO has prescribed food groups expected to be consumed by individuals to meet dietary diversity. Table 4.6 represents the consumption of these food groups and the percentage of the individual dietary diversity score of the study respondents.

Table 4.6: Food group consumption of HIV$^+$ adults on ART in Kibra Informal settlement

Food Group #	Description	Overall, N=		Men, N=102		Women, N=126	
		n	**%**	**n**	**%**	**n**	**%**
1	Grains, white roots and tubers and plantains		100	102	100	126	100
2	Pulses	90	39.1	43	42.2	47	37.3
3	Nuts and Seeds	7	3.0	6	5.9	1	0.8
4	Dairy	84	36.5	39	38.2	45	35.7
5	Meat, Fish and Poultry	95	41.3	45	44.1	50	39.7
6	Eggs	24	10.4	12	11.8	12	9.5
7	Dark Green Leafy Vegetables	122	53.0	54	52.9	68	54.0
8	Other Vitamin A rich Vegetables and Fruits	72	31.7	38	37.3	34	27.8
9	Other Vegetables	37	16.1	18	17.6	19	15.1
10	Other Fruits	23	10.4	9	8.8	14	11.8
	Met IDDS (consumed ≥5 food groups)	**40**	**17.4**	**23**	**22.5**	**17**	**13.5**

Source of food group information: Food and Agriculture Organization of the United Nations. (2021). *Minimum dietary diversity for women: An updated guide for measurement—From collection to action*. FAO.

All the respondents were able to access carbohydrate-based foods. 39.1% of the respondents accessed pulses and meat-based foods with more men than women consuming these foods. Dark green leafy by about 53% of the respondents. Only 95 respondents reported

access to fruits. Among the 228 respondents, only 17.4% (n = 40) met the minimum dietary diversity threshold, defined as consumption of at least five out of ten food groups. A higher proportion of male respondents (22.5%, n = 23) met the IDDS threshold compared to female respondents (13.5%, n = 17)**.** This suggests that men were more likely to achieve minimum dietary diversity than women in this study, although the overall dietary diversity across both groups remained low. The ≥5 food group threshold, validated for women of reproductive age (MDD-W), was applied to male respondents in this study to enable comparison of dietary diversity patterns across sex only.

4.3.4 Food by prescription (FBP)

A few of the participants had been issued with ready to use food (RUTF) (FBP) before and during the period of data collection. Related data is presented in Table 4.7.

Table 4.7. Food by prescription characteristics of the participants

Variable	Description	Frequency	Percent
Duration on FBP program, N=24	< 2 months	13	54.2
	2 – 4 months	3	12.5
	4 – 6 months	5	20.8
	> 6 months	3	12.5
Has it been beneficial to you? N=24	yes	21	87.5
	no	3	12.5
How often do you eat FBP food? N=21	Daily	13	61.9
	Twice a week	4	19
	Once a week	4	19
Do you share with other family members? N=22	yes	7	31.8
	no	15	68.2

Only 24 of the respondents were given the RUTF from the health center to support their diet, 54.2% of whom had used it for two months and indicated to have benefited a lot.

4.3.5 Dietary diversity level of HIV^{+} adults in Kibra informal settlement

Dietary diversity level of the study respondents is represented in Fig. 4.4.

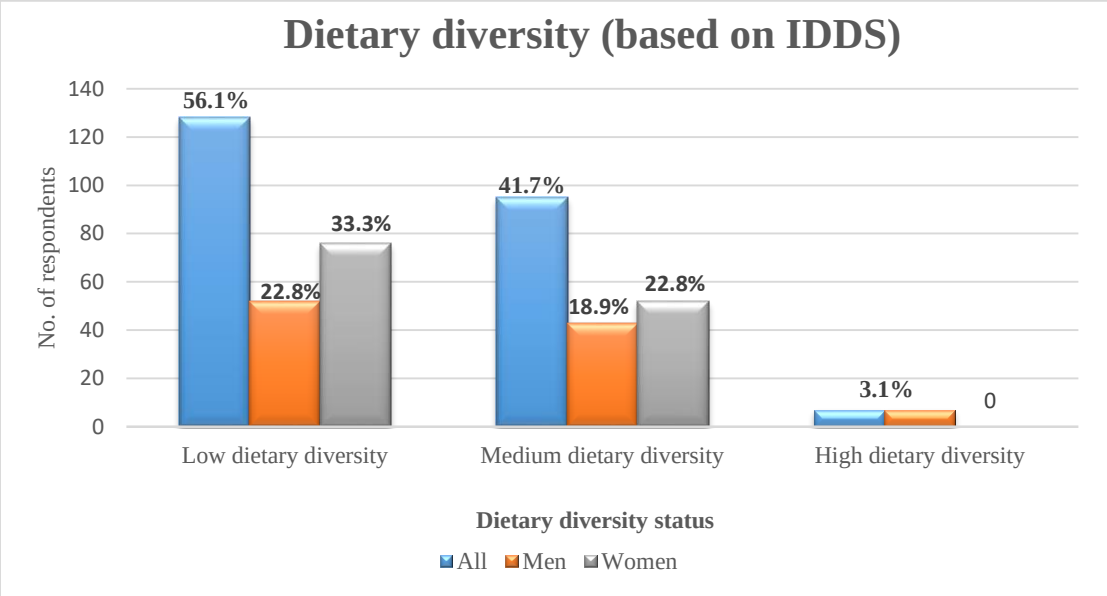


Figure 4.4. Dietary diversity level of HIV^{+} adults on ART in Kibra Informal settlement

The participant's dietary diversity status was determined based on IDDS. Many of the respondents (128 [56.1%]) registered low dietary diversity. More women than men registered low and medium dietary diversity and none of the women registered high dietary diversity.The dietary diversity status of the participants was determined in indicators such as Individual Dietary Diversity Score (IDDS), Women's Dietary Diversity Score (WDDS), Minimum Dietary Diversity for Women (MDD-W)**,** Household Dietary Diversity Score (HDDS)**,** the results are represented in Table 4.8.

Table 4.8. Indicators of dietary diversity among HIV^{+} adults in Kibra informal settlement

Variable	Overall, N=	Men, N=102	Women, N=126
	Mean + SD (LL-UL)	Mean + SD (LL-UL)	Mean + SD(LL-UL)
Meal Frequency (Out of 6) IDDS	4.96+1.59(2-9)	3.52+1.05(1-6)	3.34+0.93(2-6)
WDDS (out of 9)			3.26+0.99(1-5)
MDD-W (out of 10)			3.30+1.01(1-5)
HDDS (out of 12)	4.48+1.39(2-8)		

Overall, meal frequency was moderate, with a mean of 4.96 meals per day, with women (3.34) reporting slightly lower frequencies. The WDDS and MDD-W averaged 3.26 and 3.30 out of 9 and 10 food groups respectively, falling below the recommended threshold of 5, indicating inadequate dietary variety among women. The HDDS averaged 4.48 out of 12, suggesting low household-level food variety.

4.3.6 Fisher's exact test between various variables and dietary diversity

Fisher's Exact Test was used to determine the statistical association between selected demographic, socio-economic, with dietary practice characteristics and the likelihood of meeting the Individual Dietary Diversity Score (IDDS) among HIV-positive adults on antiretroviral therapy. Fisher's Exact Test was applied for binary categorical variables that produced 2x2 tables, especially where expected cell counts were below 5, to ensure statistical validity. The relationship between demographic, socio-economic and dietary diversity characteristics among the study respondents was determined at 0.05% confidence level and the result represented in Table 4.9

Table 4.9. Fisher's Exact Test for socio-economic, socio-demographic and dietary practice characteristics versus dietary diversity of HIV$^+$ adults in Kibra informal settlement

DV	IVs	N	Chi-square	df	p-value	ES
Met IDDS	Sex	228	3.394	1	0.080*	
	Ethnicity	228	1.845	5	0.870	
	Occupation		2.262	3	0.520	
	Education	228	11.123	6	0.072	
	Marital Status	228	3.888	3	0.274	
	HH size		1.493	1	0.243*	
	Presence of other HIV$^+$ HH members		1.677	1	0.220*	
	Food shortage	228	5.841	1	0.019*	0.16
	Being on special diet		5.003	1	0.033*	0.148
	Duration in FBP program	24	1.115	3	0.773	
	Received nutrition counselling	228	5.188	1	0.023*	0.15
	On food supplements	228	2.764.	1	0.145*	

* Fisher's exact test

Being on a special diet was significantly but weakly associated with meeting the minimum dietary diversity ($\chi^2(1, N =) = 5.003$, $p = 0.033$, Effect Size (ES) = 0.148). This suggests that respondents following a prescribed dietary regimen were more likely to achieve adequate dietary diversity, albeit with a small effect size. Receiving nutrition counselling also showed a statistically significant relationship with dietary diversity ($p = 0.023$, ES = 0.15), indicating the potential positive influence of nutrition education on food variety intake. Experiencing food shortage was significantly associated with lower dietary diversity ($p = 0.019$, ES = 0.16), implying that food shortage negatively impacts dietary quality.

Variables that showed a significant relationship with dietary diversity were subjected to bivariate regression analysis and the results are represented in Table 4.10.

Table 4.10. Bivariate linear regression analysis of the association between various variables and dietary diversity among HIV$^+$ adults in Kibra informal settlement

DV	IV	B	r	r2	%	p-value
IDDS	BMI	0.012	0.049	0.002	0.2	0.456
	WI	0.185	0.163	0.027	2.7	0.019
	MF	0.445	0.399	0.159	15.9	<0.001
	Age	0.012	0.107	0.011	1.1	0.105

Among the independent variables (BMI, wealth index, meal frequency (MF) and age), MF (β=0.445, P<0.001) and wealth index (β=0.185, p<0.019) were found to significantly predict IDDS. A unit change in MF accounted for 15.9% variability in IDDS. To identify predictors of dietary diversity, variables that previously showed a significant relationship were subjected to bivariate linear regression analysis. Meal frequency (MF) and wealth index (WI) were significant predictors of the Individual Dietary Diversity Score (IDDS). Meal frequency had the strongest predictive value ($\beta = 0.445$, $p < 0.001$), explaining 15.9% of the variability in dietary diversity ($r^2 = 0.159$). This suggests that more frequent meals are strongly associated with higher dietary diversity. Wealth index also significantly predicted IDDS ($\beta = 0.185$, $p = 0.019$), accounting for 2.7% of the variance, implying that higher economic status is linked to greater dietary variety. In contrast, BMI and age were not significant predictors ($p > 0.05$), indicating a weaker or negligible contribution to dietary diversity in this population.

4.4 Nutritional Status of HIV$^+$ adults on ART in Kibra Informal settlement

Figure 4.5 represents the percentage distribution of participants' responses in regards to prior nutritional assessment.

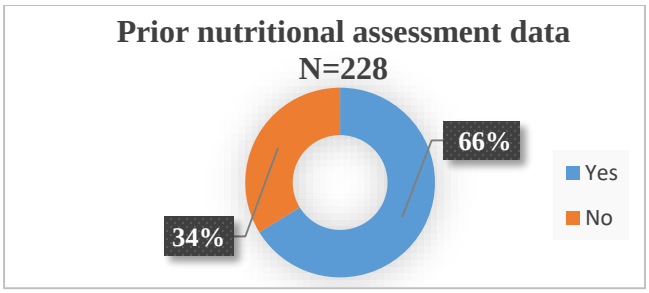


Figure 4.5. Percentage distribution of participants' responses regarding prior nutritional assessment

The results show that 66% indicated that they had undergone nutritional assessment at the health centers prior to the study. This was important information for the research assistants when handling individual respondents.

4.4.1 Anthropometric assessment of HIV$^+$ adults on ART in Kibra Informal settlement.

The BMI and MUAC means were recorded for determination of the nutritional status of the study respondents. These are represented in table 4.11.

Table 4.11. Nutritional status parameters among HIV$^+$ adults in Kibra informal settlement

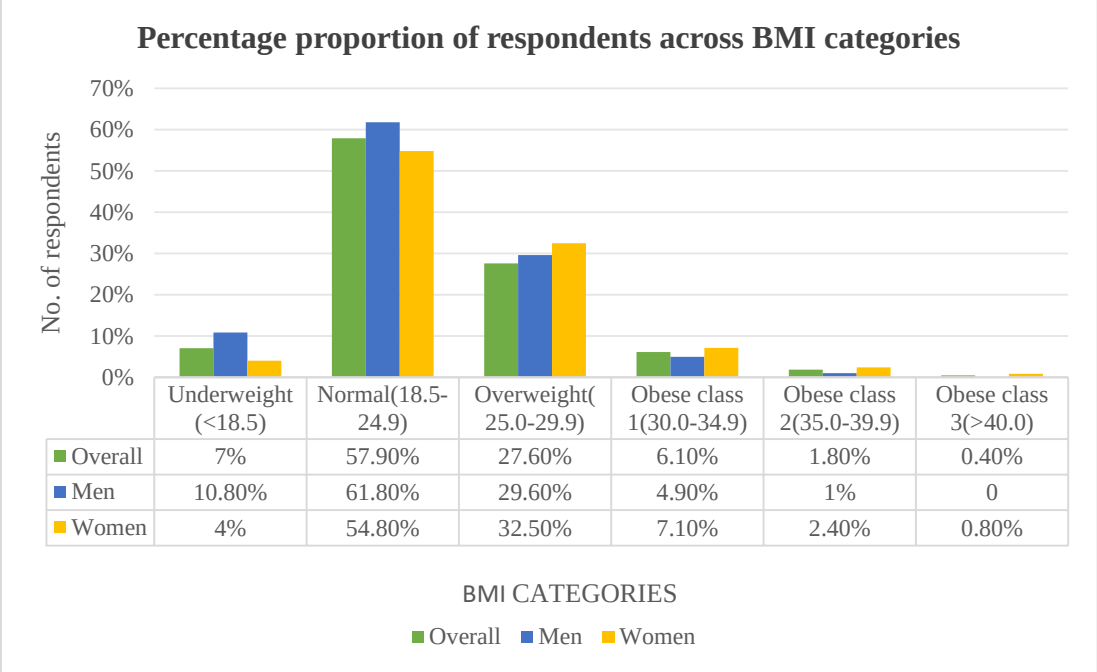
Variable	Overall, N=228	Men, N=102	Women, N=126
	Mean + SD (LL-UL)	**Mean + SD (LL-UL)**	**Mean + SD(LL-UL)**
MUAC	28.33+6.49 (16-48)	28.06+6.5(16-45.1)	28.55+6.4(18.2-48)
BMI	23.96+4.49(13.7-42.8)	23.12+4.02(2-7)	24.63+4.70(15.6-42.8)

The Body Mass Index (BMI) of the study respondents had a mean value of 23.96 ± 4.49, with individual values ranging from 13.7 to 42.8, indicating the coexistence of under-nutrition and overweight/obesity within the population. Both male and female participants exhibited comparable BMI distributions. The overall Mean Upper Arm Circumference

(MUAC) was 28.33 ± 6.49 cm, with a range of 16 to 48 cm. Gender-specific analysis revealed that women had slightly higher average MUAC (28.55 cm) and BMI (24.63 kg/m²) compared to men (MUAC: 28.06 cm; BMI: 23.12 kg/m²), suggesting relatively better nutritional reserves among female respondents. These findings offer a comprehensive overview of nutritional status among HIV-positive adults in the study and underscore both the gender-related differences and the dual burden of malnutrition in this population.

4.4.2 Nutritional status of HIV⁺ adults on ART in Kibra Informal settlement

The nutritional status of the respondents by BMI was determined. The results are represented in two different aspects in Fig. 4.6 and Table 4.12.



	Underweight (<18.5)	Normal(18.5-24.9)	Overweight(25.0-29.9)	Obese class 1(30.0-34.9)	Obese class 2(35.0-39.9)	Obese class 3(>40.0)
Overall	7%	57.90%	27.60%	6.10%	1.80%	0.40%
Men	10.80%	61.80%	29.60%	4.90%	1%	0
Women	4%	54.80%	32.50%	7.10%	2.40%	0.80%

Figure 4.6 Percentage proportion of HIV⁺ adults in Kibra informal settlement across BMI categories

The result shows that 7.0% of the respondents were underweight (low BMI), many of the respondents, 57.9% had a normal BMI, while 27.6% were overweight. More women than men were overweight.

Table 4.12. Nutritional status of HIV⁺ adults in Kibra informal settlement

Nutritional status by BMI	Overall, N=			Men, N=102			Women, N=126		
	N	n	%	N	n	%	N	n	%
Severe under-nutrition (< 16.0)		4	1.7	102	3	2.9	126	1	0.8
Moderate under-nutrition (16.0 - 16.9)		4	1.7	102	2	2.0	126	2	1.6
Mild under-nutrition (17.0 - 18.4)		8	3.5	102	6	5.9	126	2	1.6
Normal nutritional status (18.5 - 24.9)		132	57.9	102	63	61.8	126	69	54.8
Overweight (25.0 - 29.9)		63	27.6	102	22	21.6	126	41	32.5
Obese (> 30.0)		19	8.3	102	6	5.9	126	13	10.3

The majority of respondents (57.9%) had a normal nutritional status (BMI 18.5–24.9). Overweight individuals accounted for 27.6%, while obesity was recorded in 8.3%, indicating that more than one-third of participants experienced over-nutrition. Under-nutrition was present but less common, with severe (1.8%), moderate (1.8%), and mild (3.6%) forms of under-nutrition identified.

Gender-specific Trends: Among men (n = 102):10.8% were undernourished (severe to mild), compared to 6.1% of women (n = 126). 61.8% had normal BMI, 21.6% were overweight, and 5.9% obese. Among women, 32.5% were overweight, and 10.3% obese, a higher prevalence of over-nutrition compared to men. These findings indicate a double burden of malnutrition among HIV-positive adults on ART in Kibra, with under-nutrition

more prevalent in men and over-nutrition more common in women, signaling the need for gender-sensitive nutritional interventions.

4.5 Analysis of various variables against nutritional status of HIV$^+$ adults in Kibra informal settlement

The Chi-square test of independence was used to examine associations between categorical variables where most of the expected cell frequencies were greater than five. Analysis of various variables and nutritional status was done, and the results were represented in Table 4.13.

Table 4.13. Associations between socio-economic and demographic characteristics and nutritional status among HIV$^+$ adults in Kibra informal settlement

DV	Ivs	Chi-square	df	p-value	ES
BMI Category	Sex	7.929	2	0.019	0.186
	Occupation	7.191	6	0.304	
	Education	5.801	6	0.446	
	Marital Status	7.667	6	0.264	
	Spouse occupation	5.818	6	0.444	
	HH size	7.083	2	0.029	0.176

The chi-square analysis examined the association between selected socio-demographic variables and the nutritional status of HIV-positive adults, measured by BMI category. The results showed that sex ($p = 0.019$) and household size ($p = 0.029$) were significantly associated with nutritional status.

Other variables such as occupation, education, marital status, and spouse's occupation were not significantly associated with nutritional status, indicating that in this context, these factors had less direct influence on the respondents' nutritional condition.

4.6 Analysis of the relationship between dietary diversity and nutritional status among HIV$^+$ adults in Kibra informal settlement

Bivariate regression analysis was performed to ascertain the effects of dietary diversity scores and dietary diversity variables on the nutritional status (BMI category) of the study respondents as shown in Table 4.14.

Table 4.14. Bivariate regression analysis of the relationship between dietary diversity variables and nutritional status of HIV$^+$ adults in Kibra informal settlement

DV	IV	Chi -square	df	p-value
BMI Category	Food shortage	6.053	2	0.048
	Meal frequency	33.509	2	<0.001
	Duration FBP	3.128	2	0.209
	Special diet	20.651	2	<0.001
	Nutrition counselling	6.333	2	0.042
	Food supplements	19.652	2	<0.001
	Met MDD-W	0.476	2	0.788

Variables that showed significant association with the dependent variable nutritional status (BMI category) were food shortage, being on special diet, use of food supplements, nutrition counselling and meal frequency. Chi-square analysis revealed that being on a special diet was significantly associated with the nutritional status of the respondent with $\chi 2$ (2, n=) = 20.651; p <0.001 and meal frequency registered significant values of $\chi 2$ (2, n=) = 33.509: p <0.001.

The above-mentioned variables were included in a multinomial regression model to determine their prediction of the outcome variable. The result is demonstrated through Tables 4.15. 4.16, and 4.17.

Table 4.15. Pseudo R-Square Values for Logistic Regression Model

Pseudo R-Square	
Cox and Snell	0.209
Nagelkerke	0.255
McFadden	0.137

The logistic regression model demonstrated a moderate fit to the data as indicated by the pseudo R-square values. The Cox and Snell R^2 was 0.209, while the Nagelkerke R^2**,** an adjusted version that can reach a maximum of 1, was 0.255. This suggests that the model explained approximately 25.5% of the variation in the nutritional status of the respondents. The McFadden R^2 was 0.137, which, although lower, still falls within an acceptable range for models in social science research. These values indicate that the model had a moderate explanatory power, supporting its relevance in assessing the relationship between dietary diversity and nutritional status.

Table 4.16. Likelihood Ratio Tests for Dietary Predictors of Nutritional Status

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	105.349[a]	.000	0	.
total no. of meals consumed	120.822	15.473	2	.000
Do you experience food shortage?	114.253	8.904	2	.012
are you on any special diet?	109.373	4.024	2	.134
are you on any food supplements	109.880	4.531	2	.104
Have you received nutrition counselling?	105.617	.268	2	.875

The likelihood ratio tests assess the contribution of individual dietary predictors to the model. The number of meals consumed **(**p = .000**)** and food shortage experience **(**p = .012**)** were statistically significant, suggesting they have a strong influence on nutritional status. In contrast, variables such as special diet, food supplements, and nutrition counselling were not significant (p > .05), indicating they did not significantly improve the model fit.

Multinomial logistic regression was conducted to examine the influence of dietary diversity–related variables on the nutritional status of HIV-positive adults, with over-nourished individuals serving as the reference category as presented in Table 4.17.

Table 4.17. Predictors of Nutritional Status Based on Dietary Diversity variables

Nutritional Status Category	Predictor Variable	β (Estimate)	Wald χ^2	p-value	Adjusted Odds Ratio (AOR)	95% CI for AOR
Undernourished	Number of meals consumed	1.372	10.41	0.001	3.95	1.71 – 9.08
	No food shortage (no vs. yes)	-3.133	5.35	0.021	0.044	0.003 – 0.619
	Intercept	-5.647	5.71	0.017	–	–
Normal Nutritional Status	Number of meals consumed	-0.018	0.009	0.925	0.98	0.68 – 1.41
	No food shortage (vs. yes)	-0.296	0.742	0.389	0.74	0.38 – 1.46
	Intercept	-0.254	0.072	0.788	–	–

The analysis revealed that meal frequency and food shortage experience were significant predictors of under-nutrition. Specifically, an increase in the number of meals consumed

was associated with significantly reduced odds of being undernourished (β = 1.372, p = 0.001), with respondents who consumed more meals having approximately 3.95 times greater odds of maintaining adequate nutrition compared to those who consumed fewer meals. Additionally, participants who did not experience food shortage had significantly lower odds of being undernourished (β = -3.133, p = 0.021), with an adjusted odds ratio (AOR) of 0.044, indicating a protective effect of food availability. In contrast, none of the assessed variables significantly predicted normal nutritional status relative to over-nutrition. Meal frequency and food shortage were not statistically significant in this category (p > 0.05), suggesting that while these factors strongly influence the risk of under-nutrition, they do not meaningfully differentiate between normal and over-nutrition among the respondents. These findings underscore the critical role of regular meal intake and food availability in preventing under-nutrition among people living with HIV. Being on a special diet, receiving food supplements, and nutrition counselling did not show statistically significant predictive value in the model. The Nagelkerke R^2 value of 0.255 indicates that the model explains about 25.5% of the variability in nutritional status, suggesting a moderate model fit.

4.7 Analysis of the relationship between socio-economic and demographic characteristics and nutritional status among HIV$^+$ adults in Kibra informal settlement

This study established a bi-variate regression analysis between socio-economic and demographic characteristics and nutritional status (BMI) among the respondents showed that some variables recorded significant association For example, gender, house-hold size, respondent's source of income and wealth quintiles. The result is presented in table 4.18.

Table 4.18. Relationship between socio-economic and demographic characteristics and nutritional status among HIV$^+$ adults in Kibra informal settlement

DV	IV	Chi -square	df	p-value
BMI category	Gender	8.021	1	0.018
	Marital status ethnicity	0.343	2	0.842
	Respondent occupation	3.528	2	0.171
	Respondent education	0.809	2	0.667
	Spouse occupation	0.127	2	0.938
	HH Size	8.027	2	0.018
	Source of income	8.487	2	0.014
	Wealth index	6.431	2	0.040
	WI quintile	6.968	2	0.031

The results show the outcomes of chi-square tests assessing the relationship between various socio-economic and demographic variables and the nutritional status of HIV-positive adults, as measured by BMI categories. Several variables were found to have a statistically significant association with nutritional status ($p < 0.05$): Gender ($\chi^2 = 8.021$, $p = 0.018$): Suggests that nutritional status varies significantly between male and female respondents. Household size ($\chi^2 = 8.027$, $p = 0.018$): Indicates that the number of individuals in a household is significantly associated with the respondent's nutritional status.

Source of income ($\chi^2 = 8.487$, $p = 0.014$): Highlights a significant link between how respondents earn income and their nutritional condition. Wealth index ($\chi^2 = 6.431$, $p = 0.040$) and Wealth index quintile ($\chi^2 = 6.968$, $p = 0.031$): Both point to a meaningful association between household economic status and nutritional outcomes. On the other hand, variables such as marital status, respondent occupation, education level, and spouse's occupation did not show statistically significant associations ($p > 0.05$), suggesting that these factors may

not strongly influence nutritional status within this population. The variables that showed statistical significance were included in a multivariate model to determine their prediction of the outcome variable. This is demonstrated through Tables 4.19, 4.20, 4.21

Table 4.19. Pseudo R-Square Values for Logistic Regression Model

Pseudo R-Square	
Cox and Snell	0.219
Nagelkerke	0.267
McFadden	0.145

Table 4.20. Likelihood Ratio Tests for socio-economic and demographic predictors of nutritional status

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	268.237[a]	0.000	0	.
Rank of Wealth index	268.340	0.103	2	.950
sex of respondent	281.840	13.604	2	.001
Number of people living in house	281.323	13.086	2	.001
Respondent's source of income	285.245	17.008	6	.009
Percentile Group of Wealth index	269.282	1.045	8	.998

The model was assessed using chi-square statistics. The model fit was significant. The pseudo-R-square test showed that the model accounted for 15.5% - 26.7% of the variance and thus represented relatively decent sized effects. The likelihood ratio test showed that predictor variables gender, household size and respondent's source of income contributed significantly to the final model ($p<0.05$) however the wealth index groups did not contribute significantly to the final model ($p>0.05$) The reference group was those who were over-

nourished. Accordingly, each predictor has two parameters, one for predicting those undernourished and one for those with normal nutritional status. The parameter estimates are as shown in Table 4.21.

Table 4.21. Socio-economic and demographic predictors of nutritional status among HIV$^+$ adults on ART in Kibra Informal settlement.

Nutritional Status	Predictor	B	Wald	p-value	AOR (Exp(B))	95% CI (Lower)	95% CI (Upper)
Undernourished	Intercept	-22.387	16.293	0.0			
Undernourished	Sex = Male	2.326	9.085	0.003	10.235	2.256	46.445
Undernourished	Sex = Female (Ref)	0.0					
Undernourished	HH Size = 1	18.674		.			
Undernourished	HH Size = 2 (Ref)	0.0					
Undernourished	Income: Casual Labour	-1.327	2.261	0.133	0.265	0.047	1.496
Undernourished	Income: Business	-0.258	0.059	0.809	0.773	0.096	6.223
Normal	Income: Remittances	-2.03	2.488	0.115	0.131	0.011	1.636
Normal	Income: No Income	-1.159	0.191	0.662			
Normal	Intercept	1.043	7.868	0.005	2.839	1.369	5.886
Normal	Sex = Male	0.0					
Normal	Sex = Female (Ref)	0.822	5.313	0.021	2.276	1.131	4.579
Normal	HH Size = 1	0.0					
Normal	HH Size = 2 (Ref)	-1.215	5.701	0.017	0.297	0.109	0.804

Multinomial logistic regression revealed that gender, household size, and income source significantly influenced the nutritional status of HIV-positive adults on ART in Kibra, using the over-nourished group as the reference. Gender was a strong predictor: males were over 10 times more likely to be undernourished than females (AOR = 10.24, p = 0.003) and nearly three times more likely to have normal BMI than be overnourished (AOR = 2.84, p = 0.005). This may reflect gender-based disparities in food access or metabolic responses to ART. Household size also mattered: respondents from smaller households (<5 members) were more than twice as likely to have normal nutritional status compared to those in larger households (AOR = 2.28, p = 0.021), suggesting more favorable food distribution in less crowded homes. Regarding income source, individuals with salaried employment were significantly less likely to have normal nutritional status compared to those with no income (AOR = 0.30, p = 0.017), potentially due to high urban living costs or. Casual labor and remittances showed a trend toward reduced under-nutrition risk but did not reach statistical significance. Notably, while wealth index was significant in bivariate analysis, it did not predict nutritional status in the full model, suggesting that income stability and household dynamics may be more direct determinants of nutritional outcomes than perceived wealth.

These findings suggest that gender, household size, and income source are important socioeconomic determinants of nutritional status among HIV-positive individuals. In particular, males and those in smaller households appear more likely to maintain normal BMI, while economic instability, especially casual labor. May be associated with poorer nutritional outcomes.

CHAPTER FIVE: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents a comprehensive discussion of the study's key findings in relation to the research objectives and existing literature. It interprets the results, highlights their implications, and explains how they contribute to the understanding of dietary diversity and nutritional status among HIV-positive adults on ART. The chapter further draws conclusions based on the study's findings and provides practical and policy-oriented recommendations aimed at improving nutritional outcomes. It concludes by suggesting areas for future research to address gaps identified in the current study.

5.1 Discussion

5.1.1 Socio-demographic and socio-economic characteristics of HIV$^+$ adults on ART in Kibra Informal settlements

This study included HIV-positive adults, with 55.3% being female. This gender disparity reflects recent national data (NASCOP, 2023), which confirms a consistently higher HIV prevalence among women, attributed to both biological vulnerability and gender-based inequalities (UNAIDS, 2022). Similar patterns were observed by Odhiambo et al. (2023) in urban Kenya, where women, especially those in informal settlements, were more likely to contract and live with HIV. The mean age of 46.1 years places most respondents in the economically active age group. This aligns with recent findings by Mwau et al. (2022), who noted that adults aged 30–45 account for the majority of ART clients in Kenya. This demographic is central to family support and workforce participation, thus requiring stable nutritional support.

Casual labor was the primary source of income for 44.7% of respondents, indicating financial precarity. Recent studies by Otieno & Wambua (2023) in Nairobi's informal settlements highlight that casual employment is associated with inconsistent income, reduced dietary diversity, and poor ART adherence. Education levels were modest, with 37.7% having completed secondary school, a factor positively linked to better ART outcomes and nutrition literacy (Kiarie et al., 2022). Household dynamics showed that 72.8% of respondents lived in households with fewer than five members, a trend that may reduce household food burden. Notably, 27.2% owned businesses, suggesting a segment with relatively stable income, a factor linked to better ART retention and nutritional adequacy in low-income urban settings (Mwangi et al., 2021).

Spending patterns revealed substantial financial strain, with monthly rent ranging from Kshs 1,200 to 13,000, medical expenses up to Kshs 8,000, and food costs up to Kshs 1,000 daily. This aligns with current reports by the Kenya National Bureau of Statistics (KNBS, 2023) highlighting the disproportionate cost burden of urban living for vulnerable populations, including HIV^+ adults. The wealth index, derived using principal component analysis (PCA), showed most respondents fell in the middle economic tier, consistent with recent DHS methodologies (KDHS, 2022). Asset variables such as type of wall, lighting, and fuel source were used to stratify respondents, critical in understanding economic diversity within the HIV-positive population. The socio-demographic profile highlights significant economic and gender disparities that influence dietary diversity and nutritional outcomes. These findings reinforce the need for targeted, gender-sensitive, and economically inclusive nutrition and ART support interventions in informal settlements.

5.1.2 Use of ART by HIV$^+$ adults on ART in Kibra Informal settlement

In this study, over half of the respondents (51.8%) had been on ART for more than three years, with the majority reporting side effects that affected their food intake and medication adherence. Only 26.8% did not report side effects, while 27.6% coped by skipping doses—highlighting a critical nutrition-treatment interaction. Amare et al. (2020) in Ethiopia found that patients experiencing ART side effects were nearly twice as likely to be undernourished. A Ugandan study by Nanfuka et al. (2021) also showed that adverse drug reactions often led to inconsistent ART use, especially where food insecurity was present. These findings emphasize the need for integrated care that addresses both side effects and nutritional support.

5.1.3 Dietary diversity variables among HIV$^+$ adults in Kibra informal settlement

The findings of this study show that 52.2% of the respondents consumed the three main meals daily. This is consistent with recent studies such as Geda et al. (2021) in Ethiopia, which reported a similar trend among HIV-positive adults, where meal frequency was moderate despite food insecurity. However, while meal frequency was not severely disrupted, dietary diversity remained limited. Over 70% of respondents reported experiencing food shortages, an influencing factor in dietary diversity. Despite universal access to carbohydrate-based staples, only dark green leafy vegetables were consumed by more than half of the participants, mirroring findings from Tolla et al. (2022) in rural Ethiopia, where food groups like dairy, fruits, and proteins were significantly under-consumed among HIV$^+$ adults. In this study, pulses (53.5%) and fruits (60.5%) were reported as the most affected

food groups during shortages. This trend is consistent with Koyra et al. (2023), who highlighted that economic constraints and seasonal variability significantly affect access to nutrient-dense food groups such as legumes and fruits in urban Kenyan settings.

Only 9.6 % of respondents could access and afford all food groups, underscoring a limited dietary diversity score among the majority. Additionally, 26.8% coped with food unavailability by reducing meal frequency, a practice that has been documented as a coping strategy among food-insecure HIV^+ adults (Nyanchoka et al., 2021).

Nutritional counseling was accessed by 70.6% of respondents at least once a month, predominantly provided by nutritionists (98.8%). This aligns with national efforts under the Kenya Ministry of Health's *Nutrition and HIV Strategic Framework (2022–2026),* which emphasizes regular, facility-based nutrition education as a key strategy in HIV care. Despite the large number receiving counseling, only 24 respondents had received Ready-to-Use Therapeutic Food (RUTF), with 82% reporting positive effects. Recent research by Mutunga et al. (2021) confirms that RUTF remains highly effective in managing moderate to severe acute malnutrition among HIV^+ adults, though access remains limited in resource-constrained health systems.

While meal frequency among respondents was stable, dietary diversity was constrained by food unavailability, economic limitations, and protein-based food restrictions. Gender-centred consumption patterns were evident, with women generally having better intake of key micro-nutrients. Nutritional counseling emerged as a vital yet under-leveraged intervention, while access to RUTF was limited despite its proven benefits.

5.1.4 Meal intake patterns among HIV$^+$ adults in Kibra informal settlement

The majority of respondents reported consuming the standard three main meals per day, with minimal intake of snacks between meals. This pattern suggests a focus on maintaining meal regularity, likely influenced by cultural norms and household routines. Notably, 99.1% of participants emphasized making a deliberate effort to consume supper regularly, highlighting the perceived importance of the evening meal, possibly due to its role in completing daily nutritional needs or aligning with medication schedules.

These findings are consistent with recent studies, such as Odhiambo et al. (2021) in Kenya, which found that HIV-positive adults prioritized supper as a critical meal for taking ART. Similarly, Habte et al. (2020) in Ethiopia observed that while meal frequency was relatively stable among PLHIV, the quality and diversity of meals remained a concern. Thus, while meal consistency is commendable, the absence of snacks and limited diversity may still impact overall nutrient adequacy—particularly for individuals experiencing high metabolic demands due to HIV and ART.

5.1.5 Food group consumption patterns among HIV$^+$ adults in Kibra informal settlement

The findings indicate that while all respondents had access to carbohydrate-based foods, access to nutrient-rich food groups such as pulses, meat, fruits, and dark green leafy vegetables was considerably lower. Only 39.1% consumed pulses and meat-based foods, with men reporting higher consumption than women, possibly due to differences in intra-household food allocation or economic access. Dark green leafy vegetables, known for their rich micronutrient content (Toshi, 2024), were consumed by just over half (53%) of the participants, while fruit consumption remained low, reported by only 95 respondents.

Critically, only 17.4% of all respondents met the Minimum Dietary Diversity Score (IDDS) threshold (≥5 food groups), indicating poor dietary diversity overall. A notable gender disparity was observed, with 22.5% of men achieving the threshold compared to only 13.5% of women. Although the MDD-W indicator is validated for women of reproductive age, applying it across sexes in this study enabled meaningful comparison. These findings are consistent with a recent study by Abate et al. (2023) in Addis Ababa, which found that male HIV^+ adults were more likely to meet minimum dietary diversity than females, primarily due to differences in income control and food access.

This underscores the need for targeted nutrition interventions, particularly for female ART clients, to improve access to diverse foods and promote equitable nutritional outcomes.

5.1.6 Dietary diversity status of HIV^+ adults in Kibra informal settlement

The study found that only 7% of HIV-positive adults in Kibra had high dietary diversity, indicating a predominantly inadequate dietary profile. This proportion is notably lower than the 59.4% reported in Ethiopia by Said and Tesfaye (2021), suggesting significant contextual disparities in access to diverse food groups. These parallels point to a consistent pattern of limited dietary diversity among HIV-affected populations in resource-constrained settings. Dietary diversity was assessed using a 24-hour recall method. Individual dietary diversity was measured using the MDD-W framework, where food items were categorized into ten standard food groups. A score of five or more indicated minimum dietary diversity. Although MDD-W is validated for women of reproductive age, the same classification was applied across all respondents for comparison. At the household level, dietary diversity was measured using the HDDS scale, which includes twelve food groups. The

HDDS was calculated by summing the number of different food groups consumed by the household during the recall period, providing a proxy for household food access and diet variety. In terms of score metrics, the mean WDDS (out of 9 food groups) in this study was 3.26, and the MDD-W (out of 10 food groups) was 3.30, reflecting an intake far below the recommended thresholds for dietary adequacy. Such low dietary diversity is concerning, given its known link to micronutrient deficiencies, which accelerate HIV progression, lower CD4 counts, and increase susceptibility to opportunistic infections (Foziya et al., 2021; WHO, 2023). Malnutrition among HIV +ve adults not only weakens immunity but also impairs nutrient absorption and utilization, reinforcing a cycle of deteriorating health.

The Fisher's exact test identified three significant variables associated with dietary diversity: being on a special diet ($p = 0.033$), receiving nutrition counselling ($p = 0.023$), and experiencing food shortages ($p = 0.019$). For special diet, respondents on medically recommended or structured diets were more likely to meet minimum dietary diversity. This aligns with findings from Abdulai et al. (2024) in Ghana, where adherence to special diets among HIV +ve adults significantly improved dietary outcomes. Nutrition counselling significantly influenced dietary diversity, reinforcing existing evidence from Khumalo et al. (2023), who found that personalized nutrition education among HIV clients improved knowledge and behavior regarding nutrient-dense food choices. Counselling provides practical guidance on optimizing dietary intake using available resources. Experiencing food shortages was inversely related to dietary diversity. Participants facing food insecurity were less likely to access a variety of food groups, echoing findings by Weiser et al. (2020), who noted that food insecurity limits the intake of micronutrient-rich foods among HIV-positive individuals in sub-Saharan Africa. Further, a bivariate linear regression confirmed

that meal frequency ($p < 0.001$) and wealth index ($p = 0.019$) were significant predictors of dietary diversity. Meal frequency emerged as the strongest predictor ($\beta = 0.445$), explaining 15.9% of the variation in IDDS. This confirms that consistent meal patterns improve the likelihood of consuming a broader range of food groups, as previously observed by Nankinga et al. (2022). The wealth index ($\beta = 0.185$) accounted for 2.7% of the variation, indicating that greater socio-economic status facilitates access to more diverse and higher-quality foods.

In contrast, BMI ($p = 0.456$) and age ($p = 0.105$) were not significant predictors of dietary diversity in this study. This suggests that in settings of poverty and food unavailability, economic resources and meal frequency are more critical drivers of dietary diversity than physical characteristics or age. These findings support Okusanya et al. (2023), who found that while BMI improves with nutrition counselling and ART, it is not a direct predictor of dietary diversity without access to varied foods.

Overall, the results reject the null hypothesis that there is no significant relationship between socio-demographic characteristics and dietary diversity. The evidence underscores the importance of economic capacity, structured nutritional support, and regular food access in achieving dietary adequacy among HIV-positive individuals.

5.1.7 Nutritional assessment and status of HIV^+ adults in Kibra informal settlement.

Nutritional assessment of about 66% of the respondents in this study was routinely monitored before the onset of data collection with nutritionists in the centers being the main

assessors. During this study, the nutritional status (BMI category) of the respondents recorded a mean of 23.96 which indicates a normal nutritional status and a MUAC mean of 28.33. About 7% of the respondents were found to be underweight and 27.6% were overweight. This is comparable to reports from a study done in Ghana where 14% of the study population was underweight and 28% were overweight (Nanewortor et al, 2021). The presence of both under-nutrition and overweight among people living with HIV suggests a critical need for individualized nutrition care in ART programs. Routine monitoring is essential, but it must be coupled with personalized dietary counselling to address both extremes of malnutrition. In resource-constrained environments like Kibra, interventions should focus on improving diet quality not just quantity and promoting nutrition education that helps patients make better food choices within their socio-economic limits.

5.1.8 Analysis of various variables against the nutritional status ofHIV^+ adults on ART in Kibra informal settlements

The chi-square analysis revealed that among the socio-demographic variables assessed, sex and household size were significantly associated with the nutritional status (BMI category) of HIV-positive adults on ART in Kibra informal settlement. Specifically, sex had a significant relationship with BMI ($\chi^2 = 7.929$, df = 2, p = 0.019), and household size also showed a statistically significant association ($\chi^2 = 7.083$, df = 2, p = 0.029). These findings suggest that both gender and the number of individuals in a household are influential factors in determining nutritional outcomes among HIV^+ adults.

The significant association between sex and nutritional status may reflect gender-related differences in health-seeking behavior, food access, and care-giving roles. In many low-

income settings, women, particularly those who are caregivers or widowed, are more likely to experience under-nutrition due to unequal food distribution within households and limited control over household resources. A study in Ethiopia by Foziya et al. (2021) found that female HIV +ve adultswere more vulnerable to nutritional deficiencies due to sociocultural roles and economic disadvantage.

Household size was also significantly associated with nutritional status, suggesting that individuals from larger households may be at higher risk of under-nutrition due to shared food resources, increased dependency ratios, and greater food insecurity. Muthamia et al. (2022) reported that in Nairobi slums, household size was a key determinant of dietary adequacy and nutritional risk.

Conversely, occupation, education level, marital status, and spouse's occupation did not show significant associations with BMI category in this study. Although these factors are generally associated with health outcomes, their lack of statistical significance may be due to the homogeneity of the study population, most of whom were drawn from low-income households facing similar structural challenges. Wekesa et al. (2020) also observed that in Kibera, socio-economic differences such as employment and education had less influence on nutrition compared to more immediate concerns like food availability and household composition. Based on this result, the null hypothesis that there is no significant relationship between socio-demographic factors and nutritional status is rejected.

5.1.9 Bi-variate regression analysis of the relationship between various dietary diversity variables and nutritional status.

The analysis revealed a significant relationship between certain dietary diversity-related variables and the nutritional status (BMI category) of HIV-positive adults on ART. Specifically, meal frequency and food shortage were found to significantly predict BMI outcomes.

The multi-nomial regression results indicated that a unit increase in meal frequency was associated with nearly four times higher odds of being undernourished compared to being over-nourished (B = 1.372, OR = 3.945, p = 0.001). This finding highlights that more frequent meals do not always equate to improved nutritional status, particularly in food-insecure contexts where meals may be inadequate in both quality and quantity. Similar observations were made by Workie et al. (2023) in Ethiopia, who found that despite meal regularity, the dietary content often lacked protein-rich and micro-nutrient-dense foods, contributing to continued under-nutrition among HIV^{+} adults.

Furthermore, the study established that food shortage was significantly associated with under-nutrition. Respondents who did not experience food shortages were over 20 times less likely to be undernourished than those who did (B = -3.133, OR = 0.044, p = 0.021). This result supports existing literature emphasizing that food insecurity is a strong determinant of poor nutritional outcomes among HIV +VE ADULTS. In a longitudinal study in Uganda, Weiser et al. (2014) demonstrated that food insecurity was consistently linked to inadequate dietary intake and lower BMI, with similar effects observed across multiple sub-Saharan African contexts.

Additionally, although other variables such as being on a special diet, use of food supplements, and receiving nutrition counselling showed significance in the bi-variate chi-square analysis, only meal frequency and food shortage retained significance in the multinomial regression. This suggests that food access and consumption patterns may have a more direct and measurable impact on nutritional status than counselling alone, unless counselling leads to actual behavior change supported by food availability.

These findings emphasize that to improve nutritional outcomes among HIV-positive individuals, interventions must go beyond education and meal frequency. There is a critical need to address food security and dietary quality, ensuring that individuals not only eat regularly but also consume nutritionally adequate and diverse meals. Based on this result therefore, the null hypothesis that there is no significant relationship between dietary diversity and nutritional status is rejected.

5.1.10 Dietary diversity predictors of nutritional status among HIV^{+} adults on ART in Kibra informal settlements

The multinomial logistic regression analysis aimed to identify which dietary diversity-related variables significantly predicted the nutritional status (BMI category) of HIV-positive adults on ART. The model's goodness-of-fit, as indicated by a Nagelkerke R^2 of 0.255, suggests that approximately 25.5% of the variation in nutritional status could be explained by the variables included. From the likelihood ratio tests, meal frequency ($p = 0.000$) and food shortage ($p = 0.012$) were the only variables that significantly improved model fit, indicating they were strong predictors of nutritional status. As shown in Table 4.18, a unit increase in the number of meals consumed was associated with nearly four times higher

odds of being undernourished compared to being over-nourished (*OR = 3.945, p = 0.001*). This counter-intuitive result suggests that although some respondents may consume meals more frequently, the meals could be nutritionally inadequate, low in energy, protein, or micro-nutrients.

Similar findings were reported by Workie et al. (2023) in Eastern Ethiopia, where higher meal frequency did not correlate with improved nutritional status due to the poor nutrient quality of meals consumed by food-insecure populations. Their study among HIV-positive adults found that those eating more frequently were still malnourished when their diets lacked dietary diversity and protein-rich food groups. The model also found that respondents who did not experience food shortages were significantly less likely (OR = 0.044, p = 0.021) to be undernourished than those who did. This finding confirms the strong influence of food security on nutritional outcomes. Food shortage limits access to diverse and nutrient-rich foods, increasing the risk of under-nutrition even when meal frequency is relatively high. Although variables such as being on a special diet, use of food supplements, and receiving nutrition counselling were statistically significant in earlier bi-variate analyses, they did not retain predictive significance in the multinomial regression model (*p > 0.05*). This may suggest that while these interventions have some influence, they are not sufficient on their own without improvements in food access and nutrient quality. This supports the notion that effective nutrition interventions must combine both counselling and tangible food security measures.

5.1.11 Analysis of the relationship between socio-economic, demographic characteristics against the nutritional status of HIV^{+} adults on ART in Kibra informal settlements

This study found that gender, household size, and respondent's source of income were significantly associated with the nutritional status (as measured by BMI category) of HIV-positive adults on ART. These findings are consistent with emerging research emphasizing the multi-layered determinants of malnutrition in low-income, urban populations living with chronic illness. Gender was strongly associated with nutritional status, where male respondents had significantly higher odds of being undernourished compared to females. This aligns with findings by Mwangi et al. (2023), who reported that male HIV +ve adults in Nairobi informal settlements had lower BMI and MUAC scores than their female counterparts due to delayed healthcare seeking and inconsistent dietary patterns. Moreover, Khumalo and Moeti (2022) noted that men often under-prioritize nutritional care and are less likely to access nutrition counseling, which negatively impacts their dietary adequacy.

Household size also emerged as a significant predictor, with smaller households (<5 members) being more likely to have normal nutritional status compared to larger ones. This supports the study by Otieno et al. (2021) in Kisumu, which found that larger households faced increased food insecurity due to higher dependency ratios, contributing to reduced per-capita food availability and nutrient intake. The situation is particularly critical in urban slums where economic instability intensifies resource competition within households. In terms of income source, salaried employment was associated with lower odds of having a normal nutritional status compared to informal or diversified income sources. This may

reflect the economic pressures unique to urban slums, where salaried jobs are often insufficient to meet household needs due to high cost of living and extended family obligations. A study by Muiruri et al. (2022) observed similar patterns in Mathare, where salaried workers still experienced food shortage and poor dietary quality due to financial burdens beyond their monthly wages.

Although wealth index and quintile ranking were significant in bivariate analysis, they did not predict nutritional outcomes in the multivariate model. This is in line with findings by Githinji et al. (2023), who argue that in informal settlements, asset-based wealth variables may not accurately reflect food access or dietary quality due to informal economies and irregular income flow. Immediate income, food environment, and social support tend to play a more decisive role. Overall, the findings suggest that individual and household-level characteristics, rather than socio-economic rankings, are stronger predictors of nutritional well-being among HIV^{+} adults. Gender dynamics, resource allocation within households, and employment type must be critically examined when designing nutrition interventions in similar urban low-resource contexts.

5.2 Conclusion

This study set out to examine the relationship between dietary diversity and nutritional status among HIV-positive adults on antiretroviral therapy (ART) in Kibra informal settlement, Nairobi City County, Kenya. The study generated meaningful insights into the socio-demographic and economic contexts, dietary patterns, nutritional status, and associated predictors among this vulnerable population.

The socio-demographic profile revealed that the majority of respondents were middle-aged adults, predominantly female, with modest education levels and reliant on casual employment. These factors significantly influenced dietary behaviors and access to diverse foods.

The study found that dietary diversity among HIV-positive adults on ART in Kibra informal settlement was generally low, with only 7% achieving high dietary diversity. Three factors showed a significant association with dietary diversity: being on a special diet, receiving nutrition counselling and experiencing food shortage. These associations suggest that both access to structured dietary guidance and food availability play a crucial role in improving food variety. Individuals who received counselling or followed a prescribed diet had better dietary diversity scores, while those experiencing food shortages were less likely to meet the minimum dietary diversity threshold. Meal frequency and wealth index as significant predictors of dietary diversity, reinforcing the importance of economic capacity and regular meal intake in supporting dietary quality. Dietary diversity in this population is strongly influenced by socio-economic conditions, food access, and the availability of nutrition counselling. These findings point to the need for integrated nutrition and food security interventions to improve the health outcomes of people living with HIV in informal settlements.

The study established that while the average nutritional status of HIV-positive adults on ART in Kibra fell within the normal BMI range, a significant proportion of respondents were either underweight (7%) or overweight (27%). Nutritional status was significantly associated with sex and household size, suggesting that gender roles and household composition influence access to nutrition. Additionally, meal frequency and food shortage were

strong predictors of under-nutrition. Notably, higher meal frequency did not necessarily imply better nutritional status, particularly in food-insecure households. These findings underscore the urgent need for interventions that go beyond nutrition counselling and focus on improving food access, quality, and intra-household distribution, especially in urban informal settlements where economic vulnerability is high.

The study established a statistically significant association between dietary diversity and key socio-economic and dietary practice factors, including being on a special diet, receiving nutrition counselling, and experiencing food shortage. A multivariate analysis identified meal frequency and wealth index as significant predictors of dietary diversity, while BMI and age were not significant, indicating that economic access and eating regularity are stronger drivers of food variety than physiological or demographic traits.

The findings of this study clearly demonstrate that gender, household size, and source of income are significant socio-economic and demographic predictors of nutritional status among HIV-positive adults on ART in Kibra informal settlement. Specifically, male respondents and those from larger households were more likely to be undernourished, while salaried income did not necessarily point to nutritional advantage. These results highlight the complex interplay between household structure, gender roles, and economic realities in shaping nutritional outcomes. To effectively address malnutrition in HIV care, targeted interventions must consider gender-sensitive approaches, support for large households, and food access beyond income alone.

The study confirmed a significant relationship between dietary diversity variables and nutritional status. The analysis confirmed that meal frequency and food shortage were significant predictors of nutritional status among HIV-positive adults on ART. While higher meal frequency was unexpectedly linked to greater odds of under-nutrition, this likely reflects the poor quality and low nutrient density of meals consumed. Respondents who did not experience food shortages were less likely to be undernourished, highlighting the critical role of food availability in maintaining adequate nutritional status. These findings underscore the need for nutrition interventions that not only promote regular eating but also ensure access to diverse, nutrient-rich foods.

In summary, improving dietary diversity among HIV +ve adults in informal settlements requires integrated strategies that address food shortage, expand access to nutrition counselling, and strengthen economic empowerment. The study underscores the urgent need for nutrition-sensitive interventions within HIV care programs to promote optimal health among affected populations. Based on the findings of this study in relation to dietary diversity, nutritional status, socio-demographic characteristics, and associated predictors among HIV-positive adults on ART in Kibra informal settlement, the recommendations below are proposed.

5.3 Recommendations

5.3.1 Recommendations for Practice

This study recommends strengthened integration of regular nutrition counselling into routine HIV care, focusing not just on meal frequency but on dietary quality and diversity. The study recommends emphasis of gender-sensitive approaches in counselling, ensuring both

male and female clients receive tailored nutrition guidance. Promotion of nutrient-rich meal planning using locally available and affordable foods to improve dietary diversity is recommended as well as expanding access to therapeutic foods and special diets, particularly for undernourished clients. Routine screening for household nutrition risk within HIV care should be incorporated in HIV care.

5.3.2 Recommendations for Policy

This study recommends that dietary diversity be recognized as a key nutrition indicator in national HIV care guidelines. Community-based nutrition programs that consider income, household size, and urban vulnerability should be adopted. Sustainable public funding should be allocated to cater for nutrition-sensitive HIV interventions, especially in informal settlements. Multi-sectoral collaborations (health, agriculture, social protection) to ensure holistic responses to malnutrition among HIV+ adults needs to be adopted.

5.3.3 Recommendations for Further Research

This study recommends that longitudinal studies be conducted to assess how improvements in dietary diversity influence ART adherence, CD4 count, and morbidity over time. Evaluations of the combined impact of nutrition counselling and food support on nutritional outcomes among HIV-positive adults need to be conducted to improve decision making in HIV management. Investigation on gender-based disparities in dietary access and nutritional vulnerability among HIV-positive adults to inform interventions strategies.

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APPENDICES

APPENDIX A: INTRODUCTORY AND CONSENT FORM.

'NUTRITIONAL AND FOOD SECURITY STATUS OF HIV$^+$ ADULTS ON ANTIRETROVIRAL AND THERAPEUTIC NUTRITION AT KIBRA INFORMAL SETTLEMENT, NAIROBI CITY COUNTY KENYA'.

Dear respondent,

My name is Seraphine Mukami, a research student taking a Master of Science degree at Kenyatta University. I am undertaking a study on "Dietary practices and nutritional status of people living with HIV on antiretroviral therapy at health centers in Kibra Informal settlement, Nairobi Kenya." The study findings of this study will be used by government institutions such as MOH, public health and sanitation and other program implementers charged with steering HIV/AIDS management programs.

'This research has been approved by the Kenyatta University Graduate School and an ethical clearance has been obtained from the Ethical Review Committee of the same institution. A research authorization and permit have been obtained from the National Commission for Science, Technology and Innovation'.

I seek your written consent and I assure you of confidentiality of all data collected

I have ensured that all protocol has been observed and the research purpose and objectives have been explained to the community leaders and respective administrators.

All the data collected from you give will be treated with great care, respect and confidentiality and will be used entirely for purposes of the study. No personal information would

be revealed in any form to community members or other relevant users of study findings. All information will be accessed at the health centre level to avoid suspicions that there will be information leakage about you to community members.

Procedures to be followed

(The participant must be a resident of Kibra informal settlement; this will be confirmed from the clinic's patient records.) To each participant: 'With your consent, we (principal investigator and research assistants) will ask you questions on dietary intake, socio-economic status, demographics, your knowledge on ART and FBP as well as water availability, hygiene and sanitation'. 'Some body measurements (weight and height) will also be taken'. 'Utmost physical care and hygiene will be observed by making use of hand gloves and sanitizers. Minimal physical contact will be made and social distancing and use of face masks during the interview will be observed'.

'Please note that interviews will be conducted only at the FBP department of your health center. Our interviews will involve a few questions that may expose your health status but in case such questions arise during the interview, you may decide not to answer the question (s). The research team is adequately trained appropriately to undertake all aspects of this data collection'.

Confidentiality

To the participant: 'Any information given to the researchers will be treated with care, respect and strict confidentiality. The information will be used only for study reasons and any records that may reveal your personal information such as your name or contacts will

not be used'.

Benefits/risk and discomfort

The persons sampled will benefit from long-term programs that are likely to be rolled out in the region as a result of the recommendations this study will make. There is no payment associated with the study.

Liability/termination

'Your participation in this study is purely voluntary and for this reason, the participant will not hold the researchers involved in the study liable for any arising issues during the study or thereafter'.

Persons to contact

'Any questions before consenting or thereafter are welcome. The principal investigator Seraphine Mukami and other research team members are available to answer your questions. You may also contact Professor J. Kimiywe on 0722915449 or Professor Kuria on 0721433619 or Kenyatta University Ethical Review Secretariat on contacts given below'.

'Your participation is highly appreciated'.

_____

Seraphine Mukami
Principal Investigator
Kenyatta University
P. O Box 43844 – 00100, Nairobi
Tel: +254-729811508

Kenyatta University Ethical Committee
P. O Box 43844 – 00100, Nairobi
Tel: 8710901/12
Email: kuerc@ku.ac.ke

Respondent's consent

'I have understood the above information as fully explained to me by the principal investigator, and I voluntarily consent to participate in this study (Please indicate your willingness to participate in this study by signing or impressing using a thumb print)'

Name of participant_____

Yes_____ No _____

Signature/ thumb print_____ Date_____

Investigator's statement

I, the undersigned, have explained to the volunteer participant the procedures to be followed, risks and benefits in the best possible way.

I will give the participant a copy of this signed consent form.

Name of interviewer_____

Interviewer's signature_____ Date_____

APPENDIX B: QUESTIONNAIRE

DIETARY PRACTICES, NUTRITIONAL AND FOOD SECURITY STATUS OF HIV^{+} ADULTS ANTIRETROVIRAL THERAPY AND FOOD BY PRESCRIPTION AT FBP CENTRES KIBERA, NAIROBI

ADMINISTRATIVE DETAILS

Questionnaire ID Number_____ Residence_____

Date of interview _____

Name of interviewer _____(Optional)

Name of respondent _____(Optional)

Date questionnaire checked_____

SECTION A; Demographic data.

A1. Age of client in years ___

A2. Client's ethnic group

a) Luo [ ]
b) Luhyia [ ]
c) Akamba [ ]
d) Kikuyu [ ]
e) Kalenjin [ ]
f) Others [ ]

A3. Occupation

a) Casual worker [ ]
b) Formal/regular employment (specify job) [ ]
c) Self-employment [ ]
d) Non-employed [ ]

A4. Level of education of client

a) No formal education
b) Standard1-4 [ ]
c) Standard 5-8 [ ]
d) Secondary education [ ]
e) Certificate level training [ ]
f) Diploma level training [ ]
g) University level [ ]

h) Adult Literacy [ ]

A5. Marital status of client

a) Married [ ]
b) Widowed [ ]
c) Divorced/separated [ ]
d) Single [ ]

A6. Client's spouse's occupation

a) Casual worker [ ]
b) Non-employed [ ]
c) Formal/regular employment (specify) [ ]
d) Self-employment [ ]

A7. How many people live in your house?

a) Below 5 [ ]
b) 5-16 [ ]
c) Over 16 [ ]

A8. Does any other person in your house live with HIV/AIDS?

Yes---------- No----------

SECTION B. SOCIAL-ECONOMIC FACTORS (by the client)

B1. What is your source of income? (Tick all applicable)

a) Salaried job [ ]
b) Spouse's income [ ]

c) Own business [ ]
d) Others (specify) [ ]

B2. Which of the following items do you own? 1=owned 2= not owned.

a) Television [ ]
b) Radio [ ]
c) Telephone [ ]
d) Video/DVD player [ ]
e) Vehicle [ ]
f) Bicycle [ ]
g) Land [ ]
h) Plot [ ]
i) Sofa [ ]
j) Motorcycle [ ]

B3. Do you live in a;

a) Rented [ ]
b) Own house [ ]

B4. How many rooms are there in your house?

a) 1 [ ]
b) 2 [ ]
c) 3 [ ]
d) 4 [ ]
e) More (specify) [ ]

B5. If rented, how much do you pay per month?

Enter actual amount (Kshs per month).

B6. Indicate the following about the house.

a) Wall made of _____
b) Roof made of _____
c) Floor made of _____

1=Iron sheets 2=Mud and cement 3=Earth 4=Cement 5=Timber

6= Stone bricks 7= others (specify)

B7. What is your main source of lighting? [ ]

1= Kerosene 2=Electricity 3=Solar 4-Candle 5=others (specify)

B8. What is your main source of cooking fuel? [ ]

1= Kerosene 2=Electricity 3=Firewood 4=Charcoal 5=others (specify)

B9. About how much money do you spend on the following items per month, weekly or on a daily basis?

a) Food _____
b) Education _____
c) Health _____

SECTION C. KNOWLEDGE OF (ART) AND ITS IMPLICATIONS ON NUTRITION. (Respondent- client)

C1. How long have you been on ART?

a) 0-12 months [ ]
b) 1-3years [ ]
c) Above three years (specify) [ ]

C2. Which medicine has been prescribed to you?

a) Antibiotic _____ [ ]
b) Antiretroviral _____ [ ]
c) Antimalarial _____ [ ]
d) Anthelminthic _____ [ ]
e) Traditional medicine _____ [ ]

C3. How often should you take these drugs? (Specify which medicine)

a) Once a day [ ]
b) Twice a day [ ]
c) 3 times a day [ ]
d) More than 3 times a day [ ]

C4. Are there any constraints in keeping to the prescription? If yes, specify

Yes_____ No _____

C5. How do you cope with these constraints?

a) Stop prescription [ ]
b) Eat specific foods (specify) [ ]
c) Other ways (specify) [ ]

C6. What are the specific side effects do you get after taking the medication?

a) Nausea and vomiting [ ]
b) Body weakness [ ]
c) Headache [ ]
d) Diarrhea and abdominal pain [ ]
e) Skin rashes [ ]
f) Others (specify) [ ]

C7. Is there any food you eat in an attempt to relieve these side effects?

a) Yes [ ]
b) No [ ]

If yes, which foods?

C8. What constraints do you encounter in addressing these side effects?

a) Not knowing how to handle them [ ]
b) Little knowledge on appropriate foods for alleviating the side effects [ ]
c) Skipping medication to prevent the side effects [ ]
d) Lack of appropriate foods for relieving the side effects [ ]
e) Others (specify) [ ]

C9. How many meals do you take per day?

a) 1 [ ]
b) 2 [ ]
c) 3 [ ]
d) More than 3 (specify) [ ]

C10. Do you experience food shortage?

Yes _____ No _____

C11. Which group of foods are mostly affected?

a) Cereals [ ]
b) Pulses [ ]
c) Vegetables [ ]
d) Fruits [ ]

C12. How do you cope with the shortages?

a) Reducing the number of meals eaten per day [ ]
b) Changing of diet to cheaper foods [ ]
c) Borrowing from well-wishers [ ]
d) Other ways (specify) [ ]

C13. Which group of food is most available and affordable?

a) Cereals [ ]
b) Pulses [ ]
c) Vegetables [ ]
d) Fruits [ ]
e) All [ ]

C14. Are there any foods that you are restricted from eating?

If yes, which ones?

C15. Who restricted you?

a) Doctor
b) Nutritionist
c) Own beliefs
d) Culture

SECTION D; INFORMATION ON FBP BY CLIENT

D1 how long have you been on this program?

a) 2 months
b) 2-4 months
c) 4-6 months
d) More than 6 months

D2. Has it been beneficial to you?

a. Yes[ ]
b. No[ ]

If yes, how?

D3. How do you rate FBP?

a. Good
b. Very good
c. Average

D4. How often do you eat the FBP food?

D5. How much of the FBP do you eat at once?

D6. Do you share this food with other family members?

a) Yes[ ]
b) No[ ]

If yes, why?

D7. Do you eat this food with other meals or on its own?

SECTION E. DIETARY DIVERSITY (Respondent – client)

E1. Are there any foods you are unable to eat?

a) Yes [ ]
b) No [ ]

If yes, how do you feel when you eat them?

E2. Are you on any special diet?

a) Yes [ ]
b) No [ ]

Which one?

E3. Who recommended the diet?

a) Doctor [ ]
b) Nurse [ ]
c) Counsellor [ ]
d) Nutritionist [ ]
e) Others (specify) [ ]

E4. Have you received nutritional counselling on what foods to eat?

a) Yes [ ]
b) No [ ]

E5. If the answer to the question above is yes, who counselled you?

a) Nurse [ ]
b) Nutritionist [ ]
c) Doctor [ ]
d) Others (specify) [ ]

E6. How often do you receive nutritional counselling?

a) Once a month [ ]
b) Once every three months [ ]
c) Once a year [ ]
d) None given yet [ ]

E7. Are you on any food supplements?

a) Yes [ ]
b) No [ ]

If yes, specify which ones

E8. Who recommended these supplements?

a) Doctor
b) Nurse [ ]
c) Nutritionist [ ]
d) Others (specify) [ ]

E9. Have you had your nutritional status analyzed at any one time?

a) Yes [ ]
b) No [ ]

If yes, how often and by whom?

SECTION F: ANHROPOMETRIC ASSESSMENT

MUAC (In centi-meters)	Height (in me-ters)	Weight(in kilo-grams)	BMI(in meters/kilogram squared)
1st Reading			
2nd Reading			

APPENDIX C: DIETARY ASSESSMENT TOOLS

24 –HOUR RECALL RECORD SHEET

Questionnaire number Id number: _____

Age in years_____-

Tick the day of the week which you are recalling (It should be the day before the interview day).

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

Type of Day: Work day [ ]

Non-working day [ ]

School day [ ]

Please think back to when you woke up yesterday morning to the time you went to sleep in the evening. Try to remember all the foods and drinks you ate or drank.

Time	**Dish**	**Ingredients**	**How pre-pared**	**Amounts in household measure**	**Amounts in grams**
Break-fast					
Mid-morning snack					

Time	**Dish**	**Ingredients**	**How pre-pared**	**Amounts in household measure**	**Amounts in grams**
Lunch					
Snack (4.00pm)					
Supper					
Snack before bed					

FOOD FREQUENCY RECORD SHEET

Questionnaire identification number : _____

Remember what foods or drinks you consumed in the last 7 days (from the date of the interview 7 days backwards) including the frequency of taking the meals. (All foods should be ticked only once)

Food	**Daily**	**More than 3 times a week**	**Twice a week**	**Once a week**	**Not con-sumed**	**Ade-quacy.** **ade-quate=1** **not ade-quate =2**
CARBOHY-DRATES						
Maize porridge						
Millet/sor-ghum porridge						
Mixed flour porridge						
Maize flour ugali						
Other types of ugali						
Rice						
Irish potatoes						
Sweet potatoes						
Matoke						

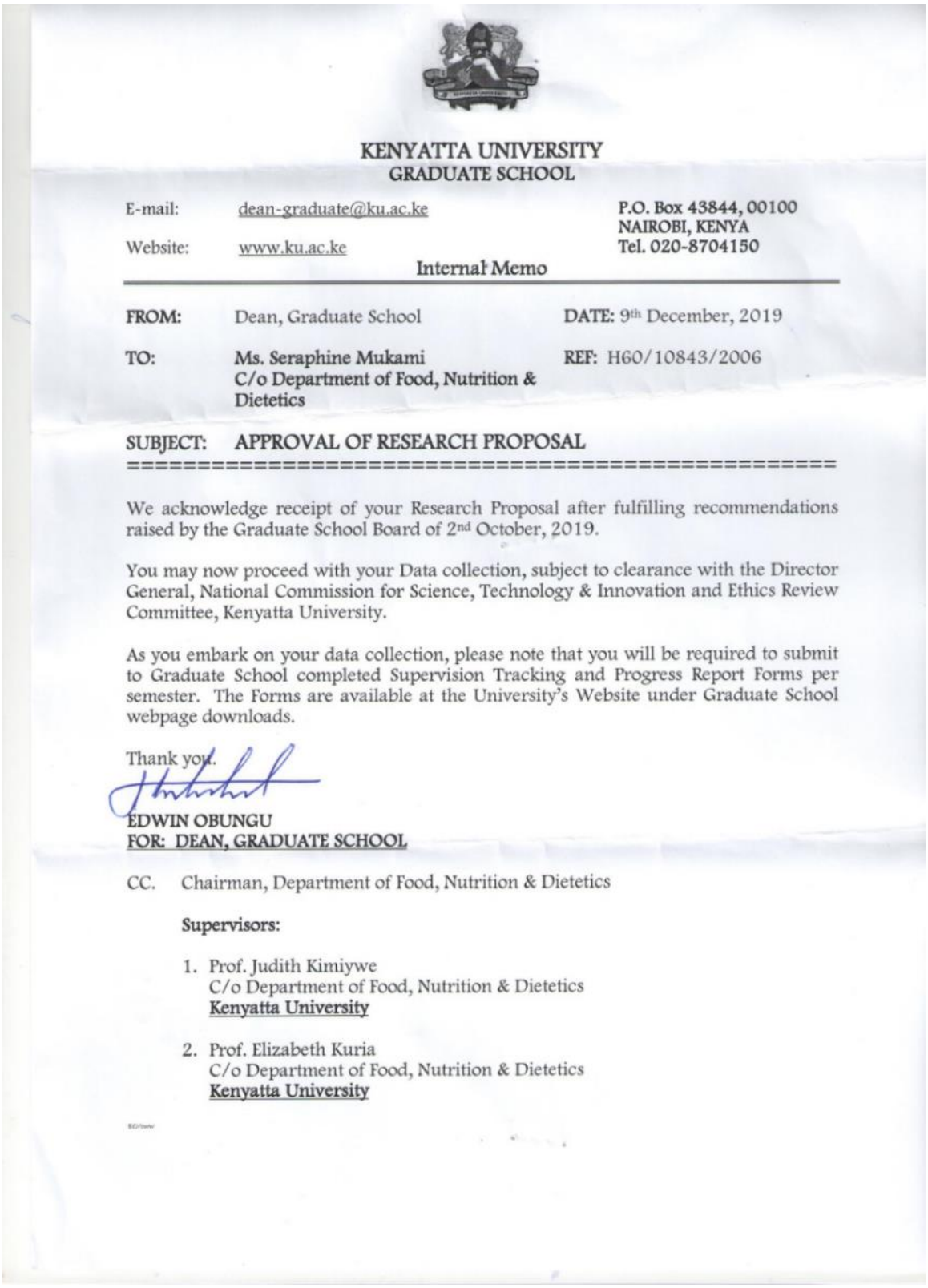
Food	**Daily**	**More than 3 times a week**	**Twice a week**	**Once a week**	**Not con-sumed**	**Ade-quacy.** **ade-quate=1** **not ade-quate =2**
Arrowroots						
Githeri						
Fats/Oils						
Sugar						
OTH-ERS(specify)						
PROTEINS						
Cow's milk/yoghurt						
Milk in tea						
Chicken						
Eggs						
Fish						
Meat(beef)						
Other types of meat(pork, mutton, game						
Liver, heart, kidney						
Termites						
Groundnuts						

Food	**Daily**	**More than 3 times a week**	**Twice a week**	**Once a week**	**Not con-sumed**	**Ade-quacy.** **ade-quate=1** **not ade-quate =2**
Beans						
Ndengu						
Pigeon peas						
Cowpeas						
Soybeans						
OTH-ERS(Specify)						
VEGETA-BLES						
Carrots						
Pumpkins						
Tomatoes						
Capsi-cums(hoho)						
Kales(suku-mawiki)						
Cabbage						
Spinach						
Pumpkin leaves						

Food	**Daily**	**More than 3 times a week**	**Twice a week**	**Once a week**	**Not con-sumed**	**Ade-quacy.** **ade-quate=1** **not ade-quate =2**
Terere/mchich a						
Managu						
Sageti						
Mrenda						
Kunde						
Ethiopian kale(kanzira)						
OTH-ERS(specify)						
FRUITS						
Ripe bananas						
Pears						
Mangoes						
Passion fruits						
Oranges						
Lemons						
OTH-ERS(specify)						
BEVER-AGES						

Food	**Daily**	**More than 3 times a week**	**Twice a week**	**Once a week**	**Not con-sumed**	**Ade-quacy.** **ade-quate=1** **not ade-quate =2**
Black tea						
Juice						
Coffee						
Chocolate						
Soda						
Beer/wine						
HERBS						
Garlic						
Ginger						
Parsley						
Basil						
Bay leaves						
Cinnamon						
Cardamom						
Cloves						

APPENDIX D: APPROVAL BY GRADUATE SCHOOL



KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 020-8704150

Internal Memo

FROM: Dean, Graduate School **DATE:** 9th December, 2019

TO: Ms. Seraphine Mukami
C/o Department of Food, Nutrition & Dietetics

REF: H60/10843/2006

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

We acknowledge receipt of your Research Proposal after fulfilling recommendations raised by the Graduate School Board of 2nd October, 2019.

You may now proceed with your Data collection, subject to clearance with the Director General, National Commission for Science, Technology & Innovation and Ethics Review Committee, Kenyatta University.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed Supervision Tracking and Progress Report Forms per semester. The Forms are available at the University's Website under Graduate School webpage downloads.

Thank you.

EDWIN OBUNGU
FOR: DEAN, GRADUATE SCHOOL

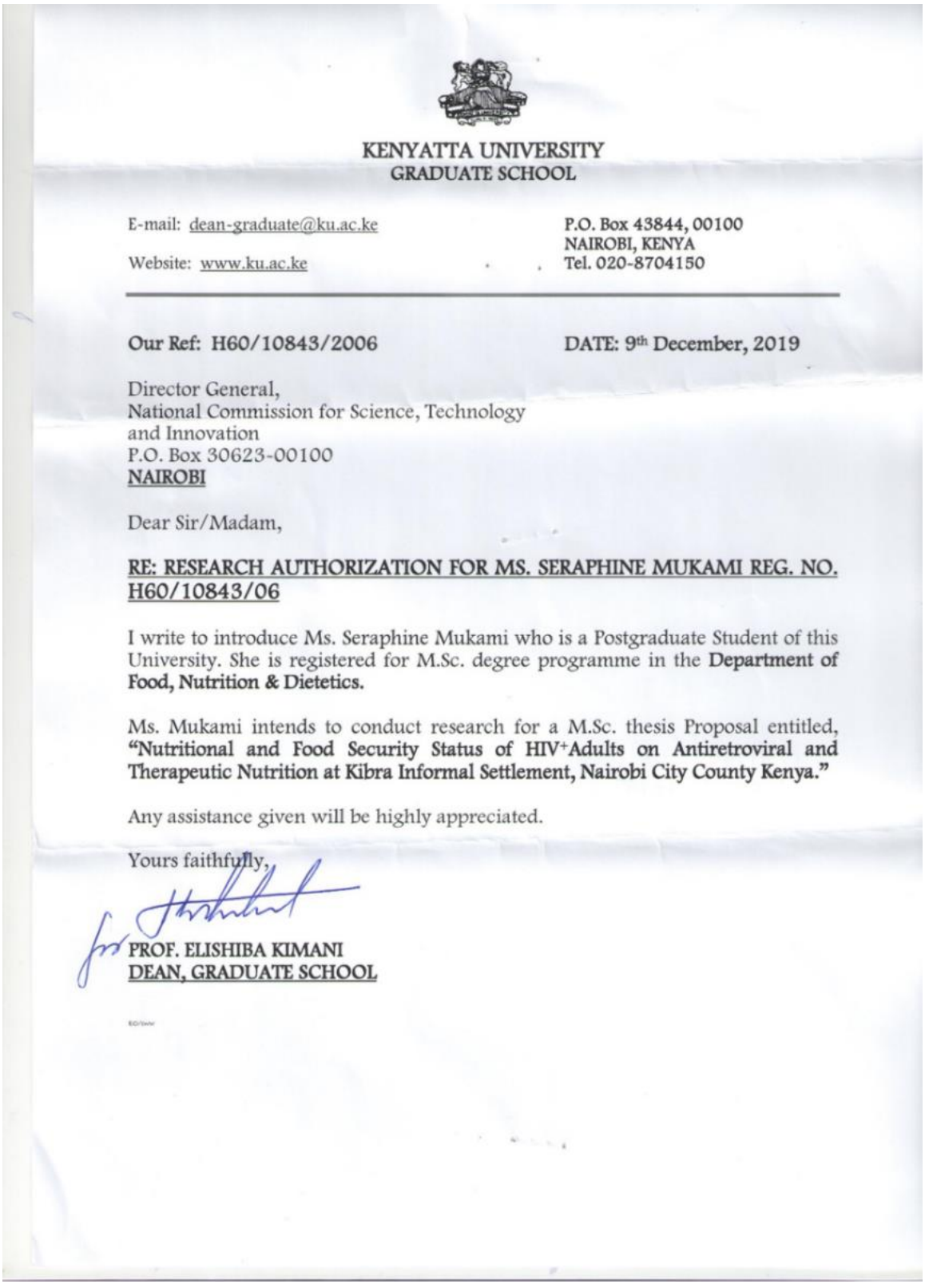
CC. Chairman, Department of Food, Nutrition & Dietetics

Supervisors:

1. Prof. Judith Kimiywe
   C/o Department of Food, Nutrition & Dietetics
   Kenyatta University

2. Prof. Elizabeth Kuria
   C/o Department of Food, Nutrition & Dietetics
   Kenyatta University

APPENDIX E: RESEARCH AUTHORIZATION



KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 020-8704150

Our Ref: H60/10843/2006

DATE: 9th December, 2019

Director General,
National Commission for Science, Technology
and Innovation
P.O. Box 30623-00100
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR MS. SERAPHINE MUKAMI REG. NO. H60/10843/06

I write to introduce Ms. Seraphine Mukami who is a Postgraduate Student of this University. She is registered for M.Sc. degree programme in the **Department of Food, Nutrition & Dietetics.**

Ms. Mukami intends to conduct research for a M.Sc. thesis Proposal entitled, **"Nutritional and Food Security Status of HIV+Adults on Antiretroviral and Therapeutic Nutrition at Kibra Informal Settlement, Nairobi City County Kenya."**

Any assistance given will be highly appreciated.

Yours faithfully,

for **PROF. ELISHIBA KIMANI**
DEAN, GRADUATE SCHOOL

EO/bww

APPENDIX F: ETHICAL REVIEW APPROVAL

KENYATTA UNIVERSITY

ETHICS REVIEW COMMITTEE

Fax: 8711242/8711575

P. O. Box 43844,
Email:**CHAIRMAN.KUERC@KU.AC.KE** Nairobi, 00100 **Tel: 8710901/12**

Website: WWW.KU.AC.KE

Our Ref: **KU/ERC/APPR.1/VOL.1** Date: 23/06/2020

Seraphine Mukami

P.O Box 43844-00100

NAIROBI.

Dear, Seraphine Mukami

RE: APPLICATION NUMBER: PKU/2074/11221 NUTRITIONAL AND FOOD SECURITY STATUS OF HIV^{+} ADULTS ON ANTIRETROVIRALS AND THERAPEUTIC NUTRITION AT KIBRA INFORMAL SETTLEMENT, NAIROBI CITY COUNTY KENYA

This is to inform you that **KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE** has reviewed and approved your above research proposal .Your application approval number is **PKU/2074/11221**.The approval period is **23RD June 2020 - 24th June 2021.**

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments) Will be used.

ii. All changes including (amendments, deviations and violations) are submitted for review and approval by **KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE.**

iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to **KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE** within 72hours of notification.

iv. Any changes ,anticipated or otherwise that may increase the risk or affected safety bor welfare of study participants and others or affect the integrity of the research must be reported to **KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE** within 72 hours.

v. Clearance for export of biological specimens must be obtained from relevant institutions.

vi. Submission of requests for renewal of approval of atleast 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.

vii. Submission of executive summary report within 90 days upon completion of the study to **KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE** prior to commencing your study, you will be expected to obtain a research license from National Commission of Science, Technology Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearance needed.

Yours. Sincerely

Prof.Judith Kimiywe
CHAIRPERSON-KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE

APPENDIX G: NATIONAL COMMISION FOR SCIENCE, TECHNOLOGY AND INNOVATION PERMIT

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 549177

Date of Issue: 16/October/2020

RESEARCH LICENSE

This is to Certify that Miss.. SERAPHINE MUKAMI MUKAMI of Kenyatta University, has been licensed to conduct research in Nairobi on the topic: NUTRITIONAL AND FOOD SECURITY STATUS OF HIV ADULTS ON ANTIRETROVIRALS AND THERAPEUTIC NUTRITION AT KIBRA INFORMAL SETTLEMENT, NAIROBI CITY COUNTY KENYA for the period ending : 16/October/2021.

License No: NACOSTI/P/20/6916

549177

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

APPENDIX H: MAP OF KIBRA INFORMAL SETTLEMENT