

**" HOUSEHOLD FOOD AND NUTRITION SECURITY IN
ASSOCIATION WITH HIV PROGRESSION: A COMPARATIVE
STUDY OF HIGHLANDS AND LOWLANDS IN WUNDANYI
DIVISION, COAST PROVINCE, KENYA."**

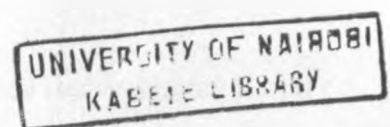
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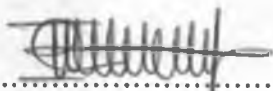


**A DISSERTATION SUBMITTED TO THE DEPARTMENT OF FOOD
SCIENCE, NUTRITION AND TECHNOLOGY OF THE UNIVERSITY
OF NAIROBI IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF SCIENCE IN APPLIED HUMAN
NUTRITION.**



Declaration

I hereby declare that this dissertation is my original work and has not been presented for a degree in any other University.

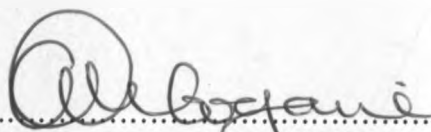


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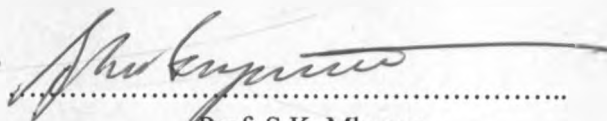
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Dedication

This work is dedicated to three beloved people: Aunt, Maren Nyabwa; Dad, Jacton Mboya and close friend, Martha Mwanyiro for their prayers and encouragement throughout the study period.

Acknowledgement

I am extremely elated that I have finally accomplished my research project. I could not have achieved this extraordinary feat were it not for the support and assistance that I received from various individuals and institutions that gave so selflessly of their time, finances, advice and moral support. It is impossible to list all the individuals and institutions but I feel that the following deserve a particular mention.

I thank God for granting me His grace for the entire period of the study. It is only because of Him that I have achieved this undertaking which seemed daunting and quite impossible to me.

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DEFINITIONS

Agro-ecological zones: Regions having same climatic setting that favour similar agricultural activities and productivity.

B cells: Lymphocytes that play a larger role in the humoral immune response
i.e. secrete antibodies against antigens.

CCR5- Δ 32: CCR5 chemokine receptor in which a 32 base pair has been deleted.

Chemokines: Family of cytokines secreted by cells either under response of cells to infections (pro-inflammatory) or homeostatic control of cell migration during tissue development.

Cross-sectional study: A descriptive study in which incidence and exposure status are measured simultaneously in a given population.

Cytokines: Proteinous messengers between cells that perform various functions
e.g. regulating inflammatory responses by interacting with cells of the immune system, mediating other normal cellular processes in the body.

HIV Progression: Development of HIV from one stage to the next as exhibited by continuous wasting and infection in an infected person. This is exacerbated by continual invasion of body system by the virus.

HLA: Collection of human genes on chromosome 6 that encode proteins that functions in cells to transport antigens from within cell to cell surface. These proteins are sometimes referred to as Major histocompatibility complex (MHC).

Household: A social unit in which economic production and consumption are organized jointly.

Long term non progressors: Group of individuals who are infected with HIV, but whose infection does not progress to AIDS.

Gene encoding: Systematic alignment/incorporation of nitrogen bases on strand.

Gene polymorphism: A genetic variant i.e. gene with a distinct allelic difference in DNA strand as compared to usual expectation.

M-tropic: A strain of HIV-1 virus that infects macrophages and activated T cells and the entry facilitated by CCR5, a co-receptor for chemokines.

Nutrition security: Appropriate quantity and combination of food, nutrition, health services and care taker's time to ensure adequate nutrition status for individual/community.

Retrospective study: A study that looks backwards in time, usually using medical records and/or interviews individuals for past exposure.

Sero-conversion: Production of HIV antibodies and cytotoxic lymphocytes by the body due to response of HIV infection.

T cells: Lymphocytes that have special receptors on their surface hence play central role in cell mediated immunity (phagocytes).

Viral load: Viral concentration in the blood.

Viral load test: Measure of HIV-RNA concentration in the lymph nodes during clinically asymptomatic stage.

ABBREVIATIONS AND ACRONYMS

AIDS: Aquired Immunodeficiency Syndrome.

ARV: Antiretroviral.

CCC: Comprehensive Care Centre.

CCR5: Chemokine Co-receptor sub-type 5.

CMV: Cytomegalovirus.

DNA: Deoxyribose nucleic acid.

FAO: Food and Agricultural Organization.

HAZ: Height for age Z score.

HDDS: Household dietary diversity score.

HIV-1: Human Immunodeficiency Virus type 1

HLA: Human leucocyte antigen.

KFSSG: Kenya Food Security Steering Group.

MAC: Mycobacterium Avium Complex.

MoH: Ministry of Health.

NAADS: National Agricultural Advisory Services.

NGO: Non-Governmental Organization.

PCP: Pneumocystis carinii pneumonia.

PML: Progressive Multifocal Leucoencephalopathy.

UN: United Nations.

UNDP: United Nations Development Programme.

USAID: United States Agency for International Development.

TLC: Total Lymphocyte Counts.

WAZ: Weight for age Z score.

WHZ: Weight for height Z score.

Abstract

Household food security that includes household food availability, accessibility and utilization, is synergistically associated with Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS) on the basis of nutrition status. Poor nutrition increases the risk and progression of the disease in turn the disease exacerbates malnutrition. Therefore it has been under assumption that high food potentiality (food security) generally contributes to better Human Immunodeficiency Virus (HIV) mitigation on nutritional basis. This study at the Coastal region of Kenya was done to determine the relationship between household food and nutrition security and HIV progression among infected individuals.

The project entailed initial documentation of food potentiality/security of two study sites: Wundanyi-118 households and Paranga-80 households, which were selected on the grounds of variation in agro ecological zones (lowlands and highlands). A retrospective study comprising of 768 People Living With HIV/AIDS (PLWHA) clients (highlands: 404, lowlands: 364) was conducted to assess and compare the HIV progression trend in the zones. The indicators sought for food security included: food production, food handling and preservation methods, dietary diversity, sanitation and hygienic practices (implications), anthropometric measurements; while those for HIV progression were: anthropometry (weight), Total lymphocytes and T cell counts, World Health Organization symptomatic staging.

Data were analyzed using Statistical Package for Social Sciences (SPSS) software that included basic (descriptive analysis and graphical presentations) and advanced (chi-square, independent t-test) statistics at 95% confidence interval (p value of 0.05), to determine strength of relationship between the two parameters –household food security and HIV progression.

The results indicated significantly higher proportion of households in the lowlands (Paranga) to be having low household dietary diversity score (HDDS <5) than the highlands (Wundanyi: 12%, Paranga: 30%). A higher proportion, of statistical significance, of the highland households as compared to the lowland households was able to sell their subsistence produce (Wundanyi: 86.4%, Paranga: 38.8%). There was significant difference in average proportion of income expenditure on food, between the zones, with lowlands spending higher on food as compared to the highlands (Wundanyi: 41.6% and Paranga: 59.6%). In addition the general HIV progression trend was similar in both zones despite variation in household food security as indicated by similar rates of weight change and progression from one stage to the next using WHO staging. Interestingly, no significant variation existed in inhabitants' nutritional status between the zones as evidenced by the similar anthropometric results on children less than five years in both zones.

In conclusion, despite statistical significance in some of the household food security between the highlands and lowlands in the coast region of Kenya, the mean rate of HIV progression for clients on highly active antiretroviral therapy, is the same. Ultimately, nutritional HIV mitigation of clients on HAART is not directly related to the agro-ecological zone as it is indicated that the two zones could be different in the level of food potentiality but not to a magnitude that triggers variation in nutritional status-that directly mitigates HIV manifestation.

To attain better nutritional mitigation, this study recommends more emphasis on nutrition security in both agro-ecological zones by the actors/policy makers to strengthen the prevailing household food security situation. Foremost adequate training on simple affordable food production and preservation techniques is necessary to minimize wastage and increase food consumption and utilization. Other sustainable interventions that can improve nutritional status of People Living With HIV/AIDS like micronutrient supplementation, food fortification and accessibility to well

balanced diet should be implemented. A direct assessment of household and nutrition security for People Living With HIV/AIDS, in association with HIV progression can further improve this prognosis as food potentiality in a region is just a seasonal overview information. A detailed study is also necessary to determine conclusive relationship between Total Lymphocyte Counts and CD4 counts in order to validate fully the reliance on the affordable Total Lymphocyte Count tests in administering Highly Active Antiretroviral Therapy. This would indirectly support HIV nutritional mitigation.

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND INFORMATION

Food security is defined as a situation/condition when all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life (USAID, 2000). Achieving this condition requires aggregate availability of physical supplies of food in household through production, market or other sources and effective utilization to meet the specific dietary needs of individuals.

Major factors that affect the food security of households include chronic poverty, rapid population growth, declining per capita food output, poor infrastructure, ecological constraints, limited access to land, inappropriate policies, diseases, poor water and sanitation, inadequate nutritional knowledge and civil war and ethnic conflicts (USAID, 2000). Basically food security is assessed using its three elements, food- availability, accessibility and utilization. The elements of food security are the underlying factors influencing nutritional status (food availability, household access to adequate quantities and qualities of food, appropriate feeding practices and distribution of food within the household).

Chronic malnutrition is a major problem in sub-Saharan Africa which results from consumption of a diet of inadequate quality for a prolonged period of time as well as chronic disease (Panagides *et al.*, 2007). Where food accessibility tends to fluctuate due

to drought, flooding, conflict or changes in government policy, an important determinant of income instability level is the exposure to any one or more of these risk factors.

HIV/AIDS interacts at different levels with food and nutrition security. At immediate/biological level, it induces immune impairment and heightens risk of infection which leads to nutritional deficiencies through decreased food intake, malabsorption, and increased body nutrient loss which later results into symptomatic phase. The positive attributes of nutrition among HIV/AIDS infected people is overlapped in resource limited situations due to insufficient food available within the family stores. Therefore increasing food security of vulnerable families can be effective in improving nutritional status and health of the population.

In short and medium term, HIV/AIDS impoverishes households through loss of labor in agriculture and other livelihood activities, increased cost of health care, diminished capacity to take care for the household members and erosion of asset base (Panagides *et al.*, 2007). In the long term, HIV/AIDS develops impact on socio-economic systems and institutions in hard hit countries. It forces children especially girls to withdraw from schools in order to work and erodes human resource base of institution required to address the sectoral and cross-sectoral impacts of the epidemic. HIV/AIDS reduces the availability of labour and knowledge that in turn affects household level of access to food (NAADS, 2003).

Kenya has potential to meet its food and nutritional needs. However, this has not been realized due to natural and structural causes with HIV pandemic being an important

obstacle to household food security. This research focused on food security and nutritional status in a population in the context of assessing the capacity to nutritionally manage HIV infected and affected families. It was part of a major project funded by Irish government with the overall objective of improving productivity, incomes and nutrition security for small-scale farmers (women) and HIV infected and affected farm and non-farm households in the coastal areas, through improved production, utilization and marketing of local produce- milk and vegetables.

In general the coastal highlands depict higher food potential zones than the lowlands due to favourable climatic conditions prevailing (KFSSG, 2007). This variation is also expected to concur with the household food security situation.

1.2 PROBLEM STATEMENT

Food security situation and HIV/AIDS severity are closely interrelated with either having direct influence on the other, ie low food production and accessibility in turn contribute to nutrition insecurity that compromise immunity to infections. HIV progression in a population also reduces human resource in food production. Adequate nutritional intervention to people living with HIV/AIDS (PLWHA) is still however a challenge especially in Kenya (UNDP, 2001) where achievement of food security is constrained by a number of factors including the fact that national policies are sector specific and lack multi-sectoral approaches that would mainstream the relationship between HIV/AIDS and food/nutrition security.

Also because of multi-dimensional nature of the impact of HIV/AIDS to the society, a response to the crisis should include an integrated or comprehensive approach involving persons from various sectors such as health, agriculture, social welfare and education (Panagides *et al.*, 2007). While good nutrition is important for HIV infected persons, it is not clear how household food security impacts on the progression of HIV to AIDS among household infected members.

More importantly, different levels of nutrition intervention i.e at individual, household and community based programmes have varying response to HIV mitigation both at individual and population level hence it is a challenge to the policy makers to decide on the most effective strategy . Therefore this research specifically picked on the impact and role of household food security on slowing the rate of HIV progression in the infected individuals.

1.3 JUSTIFICATION

Nutritional status, a major element of food security as linked to HIV progression, often operates in a tandem; poor nutrition increases the risk and progression of the disease and in turn the disease exacerbates malnutrition. Therefore nutrition plays crucial role in survival of PLWHA through boosting of immunity and body weight maintenance, yet the Kenya National HIV/AIDS Strategic Plan (2005) was skewed towards clinical measures and failed to recognize the food and nutrition dimensions of the disease. In the study area (Taita District) the prevalence of HIV has been declining since 2006 basically by effort of health facility services i.e. provision of ARVs in all public hospitals. More pragmatic,

incremental and sustainable approach is to obtain a comprehensive link between household food security and nutritional HIV mitigation. In fact at the national level, in Kenya, the current agricultural policies focus on food production and lack of links to nutrition and HIV/AIDS (GoK, 2004).

1.4 AIM

The aim of the study was to improve food security and quality of life of the HIV infected and affected population in the Kenyan coast.

1.5 PURPOSE

The purpose of the study was to provide information on the relationship between HIV progression and variation in household food security as basis for emphasis on the importance of a multi-sectoral approach to the epidemic.

1.6 MAIN OBJECTIVE

The main objective of the study was to determine the relationship between household food and nutrition security and HIV progression among infected individuals.

1.7 SPECIFIC OBJECTIVES

1. Compare the demographic and socioeconomic status of inhabitants living in highland and lowland areas.
2. Compare household food availability and accessibility in highland and lowland areas.
3. Determine and compare the nutritional status of children aged 6-59 months in the highland and lowland regions.
4. Compare modes of food handling and preservation by highland and lowland households.
5. Evaluate and compare HIV progression of infected people on HAART hailing from the highlands and those from lowlands for a retrospective period of 18 months by assessing their nutritional status and clinical conditions.

1.8 HYPOTHESES

1. Household food and nutrition security in the highlands is not different from lowlands in the coastal region.

2. The rate of HIV progression, in clients on highly active antiretroviral therapy, in the highlands is not significantly different from the lowlands.
3. Nutritional HIV mitigation is not related to agro-ecological zone.

1.9 STUDY QUESTIONS

1. Does significant variation in household food security exist between highland and lowland regions?
2. Between study subjects hailing from the highlands and those from the lowlands, which group indicates a higher progression of HIV among the infected and is this related to agro-ecological zone?

1.10 LIMITATIONS

The design of this study did not consider the assessment of household food security of the specifically sampled HIV/AIDS clients on HAART. The fact that clients hailed from highlands or lowlands did not automatically predict their household food security, therefore the assessment of relationship between household food security and HIV progression was indirect. However the error that was attributed by this procedure was reduced by using large sample sizes of PLWHA from each region/zone in order to include any household with HIV infected individual.

CHAPTER 2: LITERATURE REVIEW

2.1 FOOD SECURITY AND NUTRITION

2.1.1 INTRODUCTION

Complexity of food security makes it impossible to have a single direct indicator. Therefore the three distinct intertwined elements are used to define food security.

- Food availability: achieved when sufficient quantities of food are consistently available to all individuals in an area.
- Food access: attained when households and all individuals within them have adequate resources to obtain appropriate foods and nutritious diets. This depends on income and its distribution and also food prices.
- Food utilization: entails proper biological use of food including provision of essential nutrients and adequate sanitation. This entirely depends on food handling and storage and preservation techniques and appropriate nutrition knowledge.

Therefore, household inadequacy in attaining average requirement of any of these elements is food insecure. According to the USAID (2005), several factors have been identified as underlying causes of food insecurity. These include among others: chronic poverty, rapid population growth, declining per capita food output, poor infrastructure, ecological constraints, limited arable land, inappropriate policies, disease, poor water and sanitation, inadequate nutritional knowledge, civil wars and ethnic conflicts. Detailed verification of these underlying causes enhances both designing of appropriate interventions and establishment of food security indicators.

It is necessary to work backwards from the immediate manifestations of food insecurity to the root causes of the problem in designing a program for solving particular dimensions of food insecurity. According to USAID 2005, the main information to obtain in assessing food security situation include: source of food for the household, factors that limit ability of households to obtain food from the main food sources, income sources and limiting factors in attaining required income level, factors hindering adequate utilization of available food and the most vulnerable population groups.

The main indicators employed in assessing food security are: food production, income, total expenditure, food storage and preservation methods, share of expenditure on food, nutrient intake by the households and their nutritional status.

Chronic malnutrition which (as exhibited by the vulnerable – under 5 years) is a leading problem in sub-Saharan Africa and results from consumption of diet of inadequate quality for prolonged period of time as well as chronic disease. This being a direct indication of food insecurity, as assessed by composite measure of stunting and wasting (underweight), may increase the risk and progression of HIV (as HIV can be both a cause and consequence of food insecurity). Average daily caloric intake in East Africa ranges from 1960 to 2360 and the undernourished population is approximately 30% in Kenya (FAO, 2003).

2.1.2 ROLE OF VEGETATION IN FOOD SECURITY

According to Panagides *et al.*, (2007) East Africa region is mostly rural and relatively sparsely populated. The population tends to be poor with low per capita income especially in terms of agriculture despite the fact that the main economic activities are agriculture-related. Most inhabitants depend on subsistence farming and greatly rely on the climatic seasons since there is an insignificant level of irrigation. Apart from acting as water catchments, forests contribute to the quality of rural people's diets indirectly by providing a habitat for wild animals and fish, providing livestock, fodder, a supply of medicines and fuel wood for food processing.

Researchers have noted that fuel wood supply may influence the amount of food supplied/cooked (FAO, 1989) hence also quality of food processed. In addition fuel wood shortages may indirectly affect food security forcing women to spend more time in search of fuel wood and less time at income generating activities. Therefore fuel wood supply might influence amount of food supplied / cooked and quality of the food (as fuel wood gathering takes increasing amounts of time, less is time taken in cooking) hence the overall nutritional quality of the prepared food (FAO,1989).

Studies have also indicated that women play essential roles in agricultural production and household cash income contribution (Table 2.1). Therefore forests accessibility reduces time spent gathering fuel wood hence more input in productive activities since time constraint is a major factor limiting women's engagement in income generation, hence food security.

Table 2.1: Females as a percentage of the total agricultural labour force (Mean percent by region)

Region	Percent
East Africa	45.2
West Africa	46.6
North Africa	26.3
Southern Africa	47.8

Source: FAO, 1989

Therefore the higher vegetation cover exhibited in the highlands (as compared to the lowlands) acts as water catchment thus sustaining higher food productivity. Adequacy in supply of wood fuel would also indirectly give the highlanders an upper hand in obtaining household food as compared to the lowlanders.

2.2 HIV / AIDS

Sub Saharan Africa has over 10% of the world's population but is home to more than 60% of all people living with HIV (Panagides *et al.*, 2007). However this region has also produced resourceful information in understanding the immune response to HIV-1 especially from "long term non progressors" who have indicated consistently low levels of HIV-1 RNA and little or no loss of the primary target of HIV, the CD4 + T-cells.

2.2.1 MECHANISM OF HIV INVASION AND CONSEQUENCES

The most important leucocyte the HIV (a retro virus) attaches itself to, is the T-lymphocyte which activates and coordinates other cells of the immune system. These lymphocytes have receptor protein, CD4 in their outer membrane (CD4+). Once inside CD4 + lymphocyte, the virus turns its RNA into DNA by means of enzyme reverse transcriptase which is incorporated into the DNA of the infected lymphocyte. Therefore the lymphocytes' own machinery synthesizes replica of the virus which finally destroy the cell, causing lysis hence releasing thousands of new viruses that infect another cell (Burton *et al.*, 2006).

Current ARV act by inhibiting two critical viral enzymes – reverse transcriptase and protease, used in replication. Destruction of CD4 + lymphocytes weakens the body's immunity. With adequate diet, the body increases production of T-cells and B-cells to keep the infection under control. Since the CD4 + lymphocyte count in blood determines level of immunity, it is used as a measure of the severity of damage by HIV infection. Healthy individuals have a CD4+ lymphocyte count of 800 to 1300 cells / microgram. Between 40 – 60% of the cells are destroyed in the first four months of infection before the entire steady decline (Moyle and Back, 2001).

Opportunistic infections develop when CD4 + lymphocyte counts fall below 200 cells / microgram e.g. Pneumocystis carinii pneumonia (PCP) and progress as invasion proceeds. A count below 50 cells / microgram is critical as rapid weight loss, blindness or death ensue. Treatment and management therefore entails control of viral load (Phair *et al.*, 1990).

2.2.2 STAGES OF HIV INFECTION

Staging of HIV infection can be generally done into four distinct groups (WHO, 2003).

Stage 1: Primary HIV infection: Lasts for a few weeks and always accompanied by short flu-like illness. However diagnosis is always missed if HIV antibody test is done before sero-conversion is complete.

Stage 2: Clinically asymptomatic Stage: May last for an average of 10 years while free from major symptoms. Activity of HIV-1 is high in the lymph nodes and low in other body tissues. Level of HIV peripheral blood drops but HIV antibodies are detectable.

Stage 3: Symptomatic HIV infection: this stage is characterized by weakening of immune system due to damaged lymph nodes, increase in invasion of HIV mutatically and decrease in CD4 + lymphocytes; hence opportunistic infections ensue, resulting into multi system disease. Some of the infections commonly experienced in this stage are indicated in Table 2.2

Stage 4: Progression of HIV to AIDS: Severity of symptomatic stage due to progressive invasion by opportunistic infections. Extensive wasting syndrome is experienced. The main symptoms are those of specific opportunistic infections and cancers that develop. Death is caused by cumulative effects of wasting, dementia, opportunistic infections or cancers. AIDS is diagnosed when the CD4 + lymphocytes fall below 200 cells / microgram of blood.

Table 2.2: Common opportunistic infections associated with AIDS

System	Opportunistic infections	Symptoms
Respiratory	Candida esophagitis	Painful swallowing Burning chest
	Pneumocystis carinii pneumonia (PCP)	Difficulty in breathing, cough and fever
	Tuberculosis (TB)	Cough, fevers, night sweats, weight loss, chest pain.
GIT	Cryptosporidiosis	Diarrhea, abdominal pain, weight loss
	Mycobacterium Avium Complex (MAC)	Fever, weight loss, diarrhea
	Cytomegalovirus (CMV)	Diarrhea, weight loss
Skin	Kaposi's Sarcoma	Cancer that appears as painless, red purple raised patches on the skin
Nervous system	Non Hodgkin's lymphoma	Confusion, personality changes, memory loss
	Toxoplasmosis	Headache, confusion, lethargy, seizures
	Cryptococcal meningitis / Cryptococcus	Headache, confusion, lethargy, seizures
	Progressive Multifocal Leucoencephalopathy (PML)	Weakness on one side of the body, loss of coordination or balance
Sensory	CMV	Blindness

Source: (WHO, 2003)

2.2.3 NON NUTRITIONAL MITIGATIVE FACTORS AFFECTING HIV PROGRESSION

Genetic factors may also mitigate HIV progression in individuals resulting into natural resistance or decreased rate of manifestation of the virus. This could be a major inherent confounding factor contributing to development of hypothesis for this research that de-links HIV severity from household food security situation. Three major biochemical moieties participate in natural HIV mitigation (Yeni *et al.*, 2004):

Human leucocyte antigens (HLA):

Concordance or discordance in HLA class I alleles between HIV transmission pairs has been shown to reduce the likelihood of viral transmission. (Yeni *et al.*, 2004)

Possession of specific HLA alleles has been implicated in reducing HIV transmission and progression e.g. a prospective study of HIV-exposed – uninfected commercial sex concepts/workers in Kenya found that possession of HLA gene group, A2/6802 was significantly associated with reduced risk of HIV sero-conversion (Moore and Chaisson, 1996). This was explained that intense immune pressure gave rise to HIV variants that are not easily eliminated by the antiviral repertoire, resulting into immune mediated viral mutational response called viral escape.

Chemokine and chemokine receptor polymorphisms:

Initially HIV-1 needs two receptors to gain entry into human cells. CD4 receptor found in some cells of the immune system and the chemokine binding receptor, co-receptor (CCR5). Over 95% incidence of HIV-1 infections are M-tropic subtypes that use CCR5 co-receptors. Once the HIV has bound to these two components, an area of the virus is

exposed that can fuse with the human cell and permit entry of viral genetic material into the cell. Therefore variations in the genes encoding chemokines and chemokine receptor have been found to be important for both susceptibility to HIV infection and rate of disease progression following HIV infection. A specific type of polymorphism in gene produce encoding the CCR5 chemokine receptor CCR5- Δ 32 which in homozygous state yields non functional CCR5 receptors hence develop natural resistance to R5 strain of viruses.

Cytokines:

Like chemokine, IL-4 is known to differently regulate the HIV co-receptors CCR5 and CXCR4 i.e. it decreases levels of CCR5 on the surfaces of CD4 – bearing cells and increases CXCR4 levels on the same or other cells. This decreases replication of R5 strain.

Therefore the HLA, CCR and cytokines in individuals are the main confounding factors that delink HIV manifestation from the direct level of household food security. However the synthesis of these moieties is dependent on optimal nutritional status and nutrient supply.

Ecological impacts mentioned earlier contribute towards HIV mitigation through its effect on food security as attributed by climatic and edaphic conditions. The two study areas have been selected based on difference in ecological conditions hence household

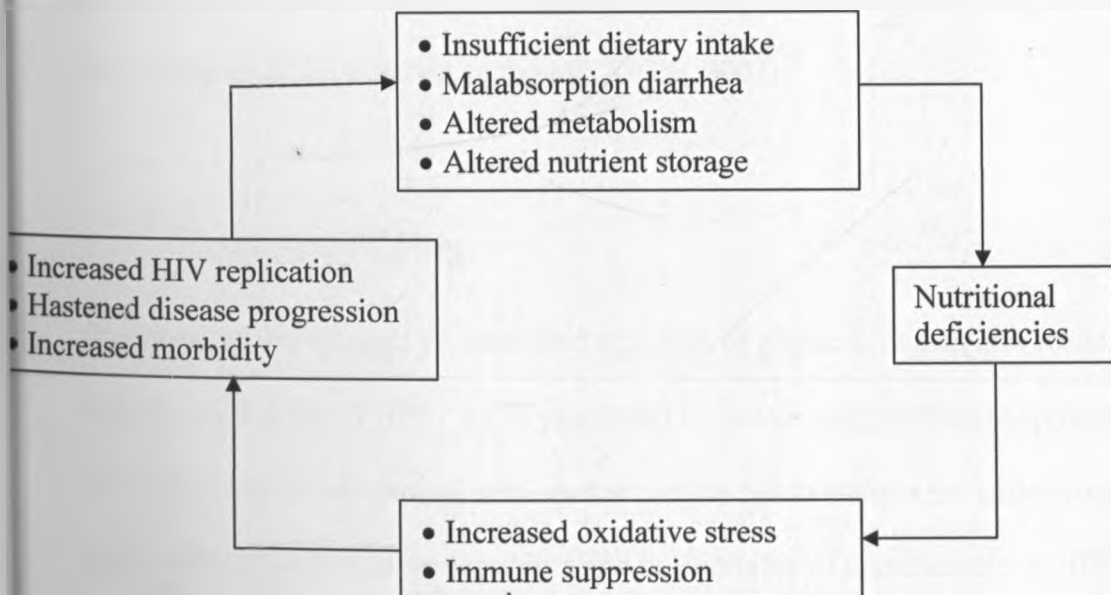
food security (study design). These variations will therefore implicitly recognize any effect of food and nutrition security situation of households on HIV / AIDS mitigation.

2.3 HIV / AIDS AND FOOD SECURITY

Impact of HIV / AIDS on nutritional status and food security is exhibited at different levels: biological, individual and community.

2.3.1 BIOLOGICAL LEVEL

HIV induced immune impairment and heightened risks of infections can worsen nutritional status, lead to nutritional deficiencies through decreased food intake, malabsorption and increased utilization and excretion of nutrients. This hastens progression of HIV to AIDS (WFP, 2005). Therefore HIV and malnutrition interact in a vicious cycle (Figure 2.1)



Source: Semba and Tang, 1999.

Figure 2.1: HIV and malnutrition vicious cycle

Therefore nutritional interventions are essential in HIV mitigation for adequate utilization of ARV's, alleviation of malnutrition – related weight loss and related malnutrition syndrome (WHO, 2003)

2.3.2 INDIVIDUAL LEVEL

HIV / AIDS prevalence is an important determinant of food security. In the short and medium term, the epidemic impoverishes households through:

- Loss of labour in agriculture and other livelihood activities.
- Increased cost of health care and funerals
- Diminished capacity to care for children and other vulnerable individuals.
- Erosion of asset base.

In the long term, HIV / AIDS affect social and economic system. It reduces the inter-generational transfer of skills and knowledge of agriculture and erodes the human resource base of institutions required to address the sectoral and cross-sectoral impacts of epidemics. This eventually reduces the availability of labour and knowledge that in turn affects household level access to food (NAADS, 2003).

2.3.3 COMMUNITY LEVEL

Communities are ravaged by continued depletion of physical, human and economic resources as a result of HIV / AIDS pandemic. However, interventional approaches done have only centered on medical services that largely fail to address the underlying and basic causes of increased susceptibility and vulnerability of communities to HIV / AIDS and malnutrition. The realities of the HIV and AIDS pandemic in Africa must be more fully integrated into famine, food security and vulnerability studies and interventions.

2.4 NUTRITIONAL MANAGEMENT AND OUTCOME ON HIV

Nutritional care and support is critically important in preventing or forestalling nutritional depletion. Relevant specific objectives might include improving quantity and quality of diet, to build or replenish body stores of micronutrients, to improve/stabilize weight loss, to preserve and gain muscle mass, to prevent diarrhea and other digestive discomforts associated with fat malabsorption, speed recuperation from HIV-related infections, prepare for and manage AIDS-related symptoms that affect food consumptions and dietary intake (WHO, 2005).

Nutrition support has the potential of significantly prolonging the life of individuals for their own benefit and the benefit of those who are dependent on them for care, thus in a sense postponing mitigation and reducing vulnerability to impacts. Interventions may also be targeted at communities with the objective of preventing and or mitigating impact through the reduction of the interactions of HIV/AIDS with malnutrition, either upstream or downstream of HIV infection.

Affected communities may be targeted for the following types of interventions:

- Nutrition counseling in health facilities, community setting, or at home to change dietary habits.
- To increase consumption of key foods and nutrients or manage anorexia and other conditions that affect eating patterns.
- Water hygiene and food safety interventions to prevent diarrhea.
- Supplementing food baskets for home preparation.

2.5 CURRENT HIV MANAGEMENT APPROACH EMPLOYED IN KENYA

Patients with newly diagnosed HIV infection at asymptomatic stage are always biochemically and clinically assessed by carrying out CD4 count and viral load test and total lymphocyte counts. Routine vaccines are always carried out against viral infections, but prophylaxis against P. jiroveci, I. gondi and M. avium complex infection is not done at early stages. Measurement of CD4 cell counts and plasma HIV-1 RNA levels would determine the start of ARV therapy (MoH, 2001).

ARVs initially entail non-nucleoside reverse transcriptase inhibitor (efavirenz, tenofovir and emtricitabine). This is coupled with close follow up to watch for side effects of therapy and monitoring of plasma HIV-1 RNA levels and CD4 cell counts.

Therefore at later stages (WHO HIV stage III and IV) nutrition is the most significant for maintenance of body weight, boosting of immunity and enabling proper functioning of ARV's.

2.6 GAP IN KNOWLEDGE

Not only does skewing HIV management to clinical measures compromise the immune system and body weight but it also deprives adequacy in proper functioning of ARV's administered at symptomatic stages III and IV.

More emphasis has been put on clinical mitigation with little attention paid on impact of household food security on disease progression, yet it is clear that the main issue that

sustains life and productivity of PLWHA is nutritional condition. Challenge still exists on effecting the most appropriate intervention in addressing HIV/AIDS severity. Currently stakeholders and NGO's have strived to introduce food supplementation at health facilities as a combating strategy, a non-household strategy that is not economically sustainable in the long run. There is little documentation of the role played by household food security in HIV/AIDS mitigation. This research therefore attempts to determine the extent of mitigation by household food and nutrition security in progression of HIV to AIDS.

CHAPTER 3: METHODOLOGY

3.1 STUDY SETTING

The study was conducted in Wundanyi division, Taita District, which is one of the eight districts in the Coast Province. It occupies the south west part of the province and borders Tana River, Kitui and Makueni Districts to the north, Kwale and Kilifi Districts to the east, Kajiado District to the north –west and Republic of Tanzania to the south and south-west. The district lies between latitudes 2° 46'S and 4° 10'S and longitudes 37° 36' East, and 30° 14' East and covers approximately 16,959 square kilometers (GoK, 2001).

The altitude of the district varies between 500m above sea level for the lowlands to 2200m above sea level for the highlands, giving two distinct weather and climatic characteristics , with the hills experiencing lower temperatures (as low as 18°C) compared to the lower zones with average of 28° C (Table 3.1). The district is basically divided into three major topographical zones: '

Upper Zone: altitude above 1500m above sea level and comprises of dominating hill masses of the Taita, Sagalla and Kasigau. Below the hills are valleys which are fertile for horticultural farming.

Lower Zone of Nyika Plateau: altitude below 1000m above sea level and is basically characterized by non-dissected erosional and sedimentary plains, with residual hills formed as a result of weathering and erosion. '

Volcanic Foothill: lies in the western part of the district and has high potential especially for agriculture.

The district is a dry area, unsuitable for agriculture except in rain catchment areas in the hills and their foothills. The high elevations (hills) are included in the lower highland zones and are characterized by steep slopes and shallow soils with wetter valley bottoms in which vegetables are cultivated. The lower zones are suitable for early maturing cereals- millet, sorghum. The district experiences two rainy seasons; the long rainy season which falls between the months of March and May and the short rains between November and December.

The lowland areas are only suitable for early maturing crops such as sorghum, millet and early maturing maize varieties and also ranching. A large portion is occupied by Tsavo East and Tsavo West National parks, home to various types of wild animals thus making this area ideal for tourism industry.

The forestry and agro-forestry play a crucial role in the economic growth of the district. There is adequate supply of fuel wood for communities living adjacent to forests with higher consumption rate in the highlands as compared to the lowlands, since 99% of households use wood fuel for domestic purposes. However, the ecological condition in the lowland is unable to withstand the human pressure of deforestation.

Agro forestry has become a very important component of forestry. In the highlands, farmers to a large extent are almost self sufficient in domestic timber requirements. Agro

forestry accounts for nearly 85% of their requirements, with most trees used in the high premium as sales (timber, poles, and posts). In the lowlands, trees found are basically suitable for fuel wood production. Therefore there is a very busy exchange of forestry products between the two zones.

Most of the road network consists of earth roads which require constant maintenance due to erosion especially in the highlands with steep terrain. These areas become impassable during rainy seasons which results into wastage of horticultural crops and milk as access to market outlets is hampered (GoK, 2001).

The district has inadequate health facilities most of which have limited equipment and staff. Most of the facilities are over utilized despite inadequacy of equipment. In fact, introduction of user fee has not affected the rate of utilization; some private facilities have generally lower attendance due to high charges.

Wundanyi division has one hospital which serves a higher population than the rest of the other district facilities, 2 health centers, 1 sub-health centre and 6 dispensaries. General nutritional status of the population has been constant over the short rain periods with the number of malnourished children at 5.5%. A total of three meals are consumed on the hill masses (highlands) and 1-2 meals in the lowlands, with average food groups of 2-3 consisting of carbohydrates, vegetables and animal proteins or pulses. Prevalence of HIV/AIDS in all public hospitals has been decreasing, basically by clinical measures annually (5.4% and 2.8% in 2005 and 2007 respectively) (KFSSG, 2008)

Table 3.1: Major geographical differences between the study areas.

Sub location	Zone	Altitude	Mean temp. °C	Rainfall	Area (sq km)
Wundanyi	Low highland	2000-2200	18-20	900-1200	7.7
Paranga	Lowland	500-800	>28	Spatial / unreliable	100

Source (GoK, 2004)

3.2 STUDY DESIGN

With reference to the study setting that targeted two different agro-ecological zones, a cross sectional study was conducted at sampled households to establish and compare the level of household food security in the zones.

Documentation of average household food security in the zones gave an opportunity to analyse HIV progression between the two populations (zones) on the basis of varying level of household food situation. To obtain a quick result, a retrospective study on rate of HIV progression, was done on classified PLWHA (on the basis of geographical locality) who were registered clients at the health facilities within the district that offered comprehensive care services.

Generally, the highlands depict higher food potential zones than the lowlands. This variation which was also expected to concur with household food security situation was documented to form the basis of the design. Thereafter HIV/AIDS progression trend was recorded as case study profile from health facilities within the district.

To address the objective of the study, HIV/AIDS manifestation in the highland inhabitants was then compared to that in lowlands using weight trend and WHO staging as indicators.

3.3 STUDY POPULATION

The two study sites: Wundanyi and Paranga were based in rural setting with relatively similar household size and composition as indicated in Table 3.2.

Table 3.2 Population, number of households and HIV prevalence in the study zones

Sub location	Population size	Household size	HIV prevalence
Wundanyi	3096	621	8.0
Paranga	2200	383	5.0

Taita-Taveta District Statistics Office, 2008.

The major health facilities within the district that offer the Comprehensive Care Center (CCC) services provided the relevant information concerning the HIV progression trend for 18 months in clients originating from the study sites (Wundanyi and Paranga). These facilities were: Wesu District hospital, Moi hospital in Voi, Mwatate dispensary and St. Joseph's Center of Hope dispensary.

3.4 SAMPLE SIZE DETERMINATION

Number of households sampled in each location was calculated based on HIV prevalence as follows (Chow *et.al*, 2003):

$$N = \frac{Z^2 pq}{d^2}$$

N: Number of households

Z: Desired confidence level of 95%

p: HIV/AIDS prevalence of 5% and 8% in lowlands and highlands respectively (KFSSG, 2008)

q: (1-p)

d: Desired degree of accuracy (0.05)

Therefore N in lowlands and highlands was 73 and 113 respectively.

Adding 10% to cater for attrition, the actual sample in lowlands and highlands was 80 and 124 households respectively.

All the clients' files from the various health facilities that qualified for inclusion were examined and recorded as indicated in Table 3.3.

Table 3.3 Distribution by gender, of clients' files examined

Gender	Zone		Total N=768
	Highlands N=404 %	Lowlands N=364 %	
Males	60.4	65.8	79.2
Females	39.6	34.2	20.8

3.5 SAMPLING PROCEDURE

Household Food Security

On the basis of relatively food productivity as compared to other regions in the same study zone (KFSSG, 2007), specific villages were chosen for household sampling from each sub-location (study population), as tabled (Table 3.4). A two stage sampling was done in each zone that entailed identification and listing of households having children between age bracket of 6-59 months, before conducting a systematic sampling by selecting every 3rd house from the list by aid of the relevant field guides.

Table 3.4 Sampled villages in the study zones.

Village	Number of households sampled
Sub location: Wundanyi	
Mwatungu	23
Msidunyi	24
Mkororo	24
Wuchichi	24
Maghororo	25
Sub location: Paranga	
Kati	13
Mwabengu	13
Mbaramghondi	14
Kisima	15
Mtungunyi	13
Mwangoko	13

HIV Progression trend

At the various health facilities that offered CCC services (Wesu, Voi, Mwatate, St. Joseph's dispensary), clients' files were obtained for extraction of relevant information on the basis of the following criteria:

- Inhabitants of the study sites: Paranga, Wundanyi.
- Registered clients at the Comprehensive Care Centre (CCC) clinic and accessible to the antiretroviral treatments (ART).
- Have been registered and maintained regular visits to the health facility for a period of 18 months.
- Have not been put under micronutrient supplements during the 18 month period by the respective health facilities.

3.6 RECRUITMENT AND TRAINING OF FIELD ASSISTANTS

Two research assistants were recruited to assist in questionnaire administration and nutritional assessment. Applications were sorted from those who have completed at least secondary school and were able to communicate in the local language (Taita). Training was conducted according to the following schedule:

Table 3.5 Enumerators' training schedule

Subject matter	Teaching method	Teaching aid	Day
-study title, objectives, aims and purpose. - questionnaire content (questions and codes)	-lecture -discussion	-chalk board, chalk, notes -questionnaire	1
Sampling procedure	-demonstration -lecture	-chalkboard, chalk	2
Anthropometric assessment	Demonstration	-Salter scale -height board	
Dietary assessment	Lecture	-weighing scales -24 hr recall form -dietary diversity score sheet	
Interviewing skill and questionnaire administration: creating rapport with respondents.	-discussion -role play	-questionnaire	3

3.7 PRE-TESTING OF TOOLS

After training of the research assistants, the research tools (questionnaire, anthropometry, 24 hr recall form and food diversity score), were pre- tested in the field (study area). This established the effectiveness of achieving specific objectives by the research tools before their multiplication for actual data collection. Each research assistant conducted two interviews and anthropometric measurements on randomly selected households containing at least a child less than 5 years. The experience with the tools during the

pre-testing was discussed to improve the understanding of the tools as well as the administration process.

3.8 DATA COLLECTION METHODS

Each parameter was determined using different data collection tools before comparison:

The randomly sampled households were interviewed using a structured questionnaire to collect information on:

- Demographic characteristics
- Socioeconomic status
- Food and nutrition security indicators including-
 - ✓ Food productivity
 - ✓ Dietary diversity
 - ✓ Food handling and preservation methods
 - ✓ Anthropometric measurements
- Sanitation and hygienic practices

At the health facility level data were collected on HIV progression trends among clients hailing from the two study zones.

3.8.1 DEMOGRAPHIC CHARACTERISTICS

The household head was interviewed using a structured questionnaire to obtain the following information on individuals who had been part of sampled household for duration of 3 months before the study:

- Gender

- Age
- Marital status
- Occupation
- Education level

3.8.2 SOCIOECONOMIC STATUS

Through the interviewing process, the household heads addressed their major sources of income. Household monthly expenditure on major items; food, medical, school fees, fuel, farm inputs and other expenditures were also recorded.

3.8.3 FOOD AND NUTRITION SECURITY INDICATORS

Food productivity

To compare levels of food productivity in both zones, the household heads were interviewed to determine and record proportions of crop produce in the last season and the main source of food for the household. Main reason for selling subsistence produce by the household was also verified as well as the coping strategies employed during food scarcity.

Dietary diversity

Number of food groups consumed by the households within the 24 hours prior to the interview was quantified to give dietary diversity scores that could be compared averagely between the zones. The households were interviewed systematically to recall and describe foods eaten a day prior within the household. Foods eaten outside the homes were excluded. The foods were then classified and using 15 food groups household

dietary diversity score sheet (WFP,2005): cereals, vitamin A rich vegetables, tubers white tubers and roots, dark green leafy vegetables, other vegetables, vitamin A rich fruits, other fruits, meat, eggs, fish, legumes and seeds, milk and milk products, oil and fats, sweets, spices/caffeine/alcoholic beverages.

Food handling and preservation methods

A detailed interview was conducted on the households to establish:

- Mode of handling excess cooked food/food left over.
- Preservation methods employed for local unprocessed foods.

Anthropometric measurements

Nutritional status of an index child aged 6-59 months from each household was assessed by determining the indices: weight, length/height and age. Each of these indices was measured as follows:

Age

It was important in converting child's weight and height into the standard indices (UN, 2004). The child's age was inquired from the mother and recorded in months after cross-checking done using documentary evidence (immunization card).

Length/height

Length and height were measured for children 6-23 months and children above 23 months respectively.

Length: lying flat and centrally on a measuring board placed on a hard flat surface with a perpendicular sight to the ground, the child's length was correctly read to the 0.1 cm (head and feet against the base of the board and foot piece respectively).

Height: standing straight on a measuring board placed on a hard flat surface against a wall with line of sight perpendicular to the horizontal surface, the child's height was determined by gradual lowering of head piece on top of the head. The distance between head piece and base of the board measured to the nearest 0.1 cm

Weight

The child put in the weighing pants was gently lowered on the standardized Salter scale (adjusted to zero) with the strap of the pants in front. The scale hanging from a secure position, the child's weight was read to the nearest 0.1 Kg after the scale needle stabilized.

These recorded indices were used to establish respective indicators (WHO, 2005) in terms of Z scores:

- Weight for height (wasting)
- Weight for age (underweight)
- Height for age (stunting)

3.8.4 SANITATION AND HYGIENE PRACTICES

The households were interviewed on level of hygienic practices employed. The information obtained entailed:

Water

- Mode of treatment before use
- Storage conditions

Waste disposal

- Method of disposal of domestic refuse

- Availability and condition of toilet/latrine (general cleanliness and implicit assessment of the pit's depth) in the household.

3.8.5 HIV PROGRESSION

The major health facilities offering CCC services in the district (Wesu hospital, Moi hospital (Voi), St. Joseph's Center of Hope dispensary and Mwatate dispensary) were visited and patient's files for targeted clients (originating from the study locality and regular attendant for a period of 18 months) examined and the following information collected as primary data, retrospectively:

- Anthropometry: client's weight as per the registration on regular monthly basis by the hospital was recorded after every 6 months.
- Clinical conditions: client's CD4 and TLC counts as having been taken semi-annually by the health facility was also recorded together with WHO classification of stage of development (HIV/AIDS).

This information was recorded on case profile sheet and clients grouped according to agro-ecological zones of habitation hence food potentiality, before analysis.

3.9 DATA QUALITY ENHANCEMENT

For precise and valid information, adequate training and supervision of field assistants was done. In addition, filled questionnaires were checked on a daily basis. The enumerators' suitability was evaluated after pre-testing of the initial questionnaires so as to incorporate only competent research assistants.



Sensitive variables like anthropometry were measured more than once in a respondent to verify level of accuracy. All weighing scales were calibrated before the exercise and on a daily basis using a standard 1 kg stone.

3.10 ETHICAL CONSIDERATIONS

Research permit was obtained from the Government of Kenya in the context of the main project (*Irish Aid*) in which food security and HIV severity is a component. All the information collected was treated with high confidentiality and analysis done at population level.

3.11 DATA MANAGEMENT

The data was entered, cleaned and analyzed using SPSS and EPI info software packages. It basically involved interpreting the statistical software outputs into objective oriented conclusions. Basic statistics included descriptive analysis (mean, frequencies, graphs, cross tabs, ratios). Comparing means (independent sample T- test), non parametric test (Chi square) and linear regression was also employed (at confidence interval of 95%) to determine strength of relationships between the two parameters- household food security and HIV progression. The resulting outputs were evaluated critically before discussing the relationships and finally concluding.

CHAPTER 4: RESULTS

This chapter presents study results with reference to the specific objectives targeted.

4.1 DEMOGRAPHIC AND SOCIOECONOMIC STATUS

4.1.1 Demography

Similar age group composition existed between the highland and lowland inhabitants, allowing for comparison of some parametric indicators dependent on age. There was no significant difference in the mean age between the study sample from the lowlands and in the highlands (Mean age =24years±14.2, Independent *t* test, *p*= 0.797). Figure 4.1 shows categorized age groups in each population.

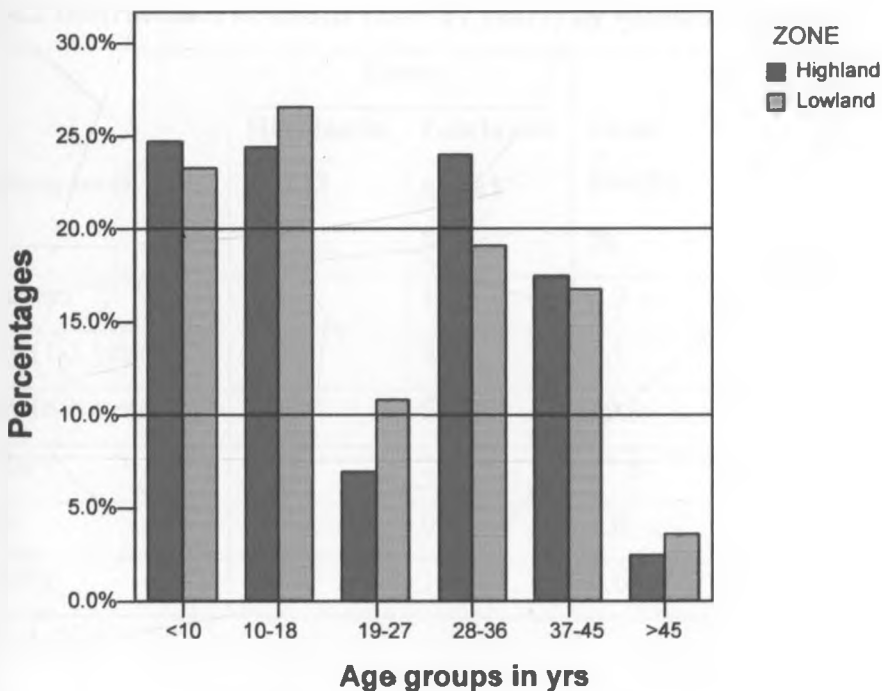


Fig.4.1 Distribution of household members by age and zone

On average inhabitants aged 6-17 years were considered to be occupied in education whereas those aged above 17 years had developed their profession. There was significant difference in distributions on number of school going children and level of education attained between the two populations, with the highlands having higher proportion of both occupants (Chi square, $p= 0.00$). Tables 4.1 and 4.2 indicate the distributions of the study populations by schooling and level of education, respectively.

Table 4.1 Distribution of inhabitants aged 6-17 years by school enrolment status

School enrolment status	Highlands	Lowlands	Total
	n=189 %	n=166 %	N=355 %
In school	99.4	94.3	96.9
Not in school	0.6	5.7	3.1

Table 4.2 Distribution of adults (over 17 years) by education level

Education level	Zones		Total N=384 %
	Highlands n=223 %	Lowlands n=161 %	
	Uneducated	3.7	
Primary (1-5 years)	4.6	5.8	5.1
Primary (6-8 years)	44.0	58.0	49.9
Secondary	44.5	23.9	35.9
College	2.3	0.7	1.6
University	0.9	1.4	0.6

As showed in Table 4.3, a significant difference in distribution by marital status was noted between the zones with single, divorced, and widowed inhabitants aged above 18 years being more prevalent in the lowlands (Chi square, $p=0.02$).

Table 4.3 Distribution of adults (over 18 years) by marital status

Marital status	Zone		Total N=384 %	Chi square p value for the difference
	Highlands n=223 %	Lowlands n=161 %		
Single	8.3	13.4	10.4	0.02
Married monogamously	86.2	75.7	81.8	0.62
Divorced	2.8	5.9	4.1	0.03
Widowed	2.7	5.0	3.7	0.04

4.1.2 Socioeconomic status

A significant disparity in occupation distribution, as showed in Table 4.4, was observed between the zones, with lowlands venturing on unskilled casual labour as unemployment prevailed. Although most of the inhabitants from both zones were self employed (farming) higher proportions existed in the highlands due to favourable climatic conditions for agricultural production.

Table 4.4 Distribution of inhabitants (over 18 years) by occupation type

Occupation	Zone		Total N=384 %	Chi square p value for the difference
	Highlands n=223 %	Lowlands n=161 %		
Directly employed regularly (salaried)	4.3	1.2	4.9	0.25
Directly employed temporarily (waged)	8.3	4.0	6.5	0.43
Self employed	72.5	57.6	66.3	0.67
Casual labourer	7.5	18.6	12.2	0.04
Unemployed	5.9	15.9	8.5	0.03
Student	1.5	1.7	1.6	0.73

There was a significant disparity on average household expenditure in the highlands and lowlands which showed figures of KShs.7387.50 and KShs. 5860.90 respectively (KShs.6624±1079.5, Independent sample *t* test, $p=0.04$). The average household size in both zones was 5.

As showed in Figure 4.2, lowlands had significantly higher proportion of income expenditure on food (59.6%) than highlands (41.6%), at a p value of 0.002, Chi square.

Variation of significance was also noted in expenditure proportions in: fuel, medical and school fees, with the highland's households channeling higher proportions of their income expenditures on these activities.

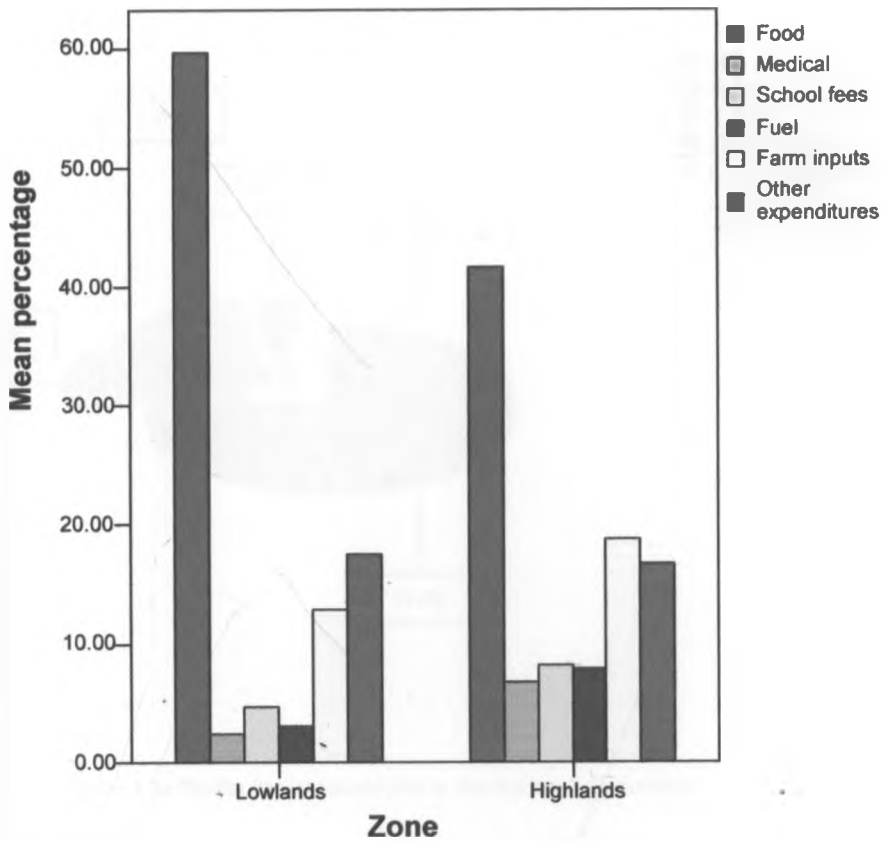


Fig 4.2 Income expenditure in the zones

4.2 HOUSEHOLD FOOD AVAILABILITY AND ACCESSIBILITY

The household produce was of similar food basket (maize, beans, kales, sweet potatoes) in both study populations. However, the lowlands relied more on maize than highlands due to limited capacity to produce other more nutritive crops, as illustrated in Figure 4.3.

Majority (87%) of the sampled lowland households had experienced food shortage at least 3 months before the interview, as compared to only 30% in the highlands. However a general food coping strategy was noted whereby changing to less preferred meals was common in the highlands characterizing food selectiveness that was not significant in the lowlands. The general strategy that was commonly employed by both study groups was purchasing food on credit (Table 4.5).

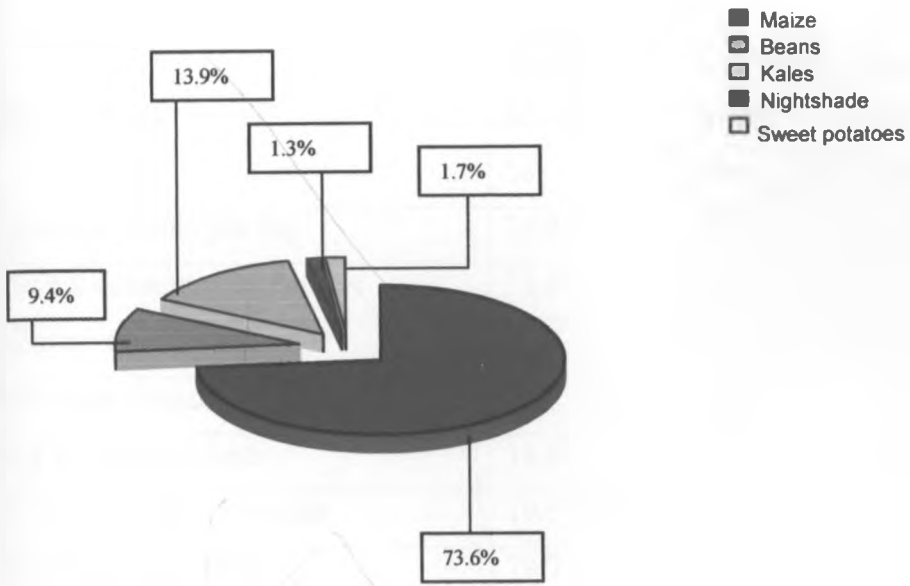


Figure 4.3a Distribution of households in the highlands by produce

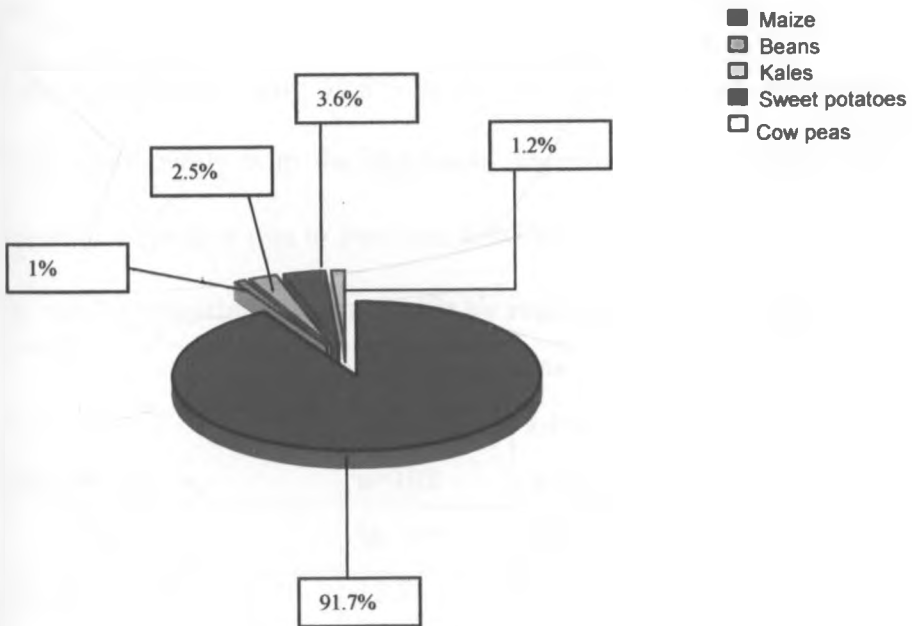


Figure 4.3b Distribution of households in the lowlands by produce

Table 4.5 Household distribution by food coping strategy during times of scarcity

Coping strategy	Zone		Chi square, p value (for the difference)
	Highlands n=118 %	Lowlands n=80 %	
Reduction of meals per day	22.9	17.3	0.33
Skip meal consumption per day	11.0	19.5	0.09
Reduction in meal size	28.8	31.7	0.66
Restrict adult consumption	2.5	9.8	0.03
Change to cheaper meals	14.4	1.2	0.01
Food borrowing from friends	19.5	26.8	0.22
Food purchase on credit	79.7	81.7	0.72
Consume wild foods	1.7	3.7	0.38
Consume immature crops	16.1	3.7	0.06
Sale household goods	1.7	1.2	0.79

As indicated in Table 4.6, 86.4% of highland households sold part of their subsistence produce compared to only 38.8% in the lowlands. Reasons for sale of produce further differed significantly with the highlands targeting purchasing of seeds unlike lowlands whose main objective was to purchase food not grown.

Table 4.6 Distribution of households by reasons for sale of farm produce

Reason for sale	Zone		Total N=133 %	Chi square p value for the difference
	Highlands n=102 %	Lowlands n=31 %		
Paying school fees	13.7	19.4	15.0	0.38
Purchasing of livestock	0.0	3.2	0.8	0.02
Purchasing of food not grown	24.5	51.6	30.8	0.04
Purchasing of seeds	61.8	25.8	53.4	0.03

4.3 FOOD UTILIZATION

4.3.1 Household food utilization

Table 4.7 shows that even though a large majority stored and later ate their left over food, there was still a significant difference in level of wastage with 39% of lowland households converting to non human utilization as compared to 23.7% of the highland households, (Chi square, $p=0.047$)

Table 4.7 Distribution of households by mode of handling excess cooked food

Excess food handling	Zone		Total N= 198 %	Chi square p value for difference
	Highlands n=118 %	Lowlands n=80 %		
Animal feed	22.0	36.6	27.8	0.02
Discard	1.7	2.4	2.0	0.04
Store and eat later	76.3	61.0	70.2	0.68

Due to limited skills and techniques, the households were only able to preserve stable foods that are conventionally known to contain moisture content below 50%. This was evident in both zones, without any significant difference in preservation techniques, as in Table 4.8 (Chi square, $p=0.61$).

Table 4.8 Distribution of households by maize preservation methods

Preservation method for raw maize	Zone		Total N=198 %
	Highlands n=118 %	Lowlands n=80 %	
Sun drying	50	53.7	51.5
Chemical	50	46.3	48.5

Cereals, oil and fats, dark green leafy vegetables, spices/caffeine/alcoholic beverages and sweets were the major food groups in both zones consumed at household level. Significant differences only existed in the level of consumption of white tubers and roots, vegetables, milk and milk products. Based on this variation, average household dietary diversity score in the highlands and lowlands was 7 and 5 respectively, which showed a significant difference at p value of 0.02 (Chi square). The lowlands further had 36% of the households having HDDS of below 5 as compared to 15% in the highlands, as indicated in Table 4.9

Table 4.9 Distribution of household by dietary diversity score below 5 in the study zones.

Household Dietary Diversity Score	Zone		Total N=200 %
	Highlands n=118 %	Lowlands n=80 %	
1	0	2	1
2	0	8	4
3	3	10	5.8
4	12	16	13.5

4.3.2 Nutritional status of children aged 6-59 months

There were no differences of significance in stunting, wasting and underweight in children of 6-59 months old from both study zones. Level of significance on variation of nutritional status between the zones indicated $p > 0.05$ for the following Z-scores: Weight for Height (WHZ), Weight for Age (WAZ) and Height for Age (HAZ); as in Tables 4.10, 4.11 and 4.12.

Table 4.10 Distribution of children aged 6-59 months by WHZ.

Nutritional status: WHZ	Zone		Total N=198 %	Chi sq. p value
	Highlands n=117 %	Lowlands n=81 %		
Normal (> -2 Z Score)	96.6	95.1	96.0	1.00
Moderately malnourished (-3 to -2 Z Score)	3.4	4.9	4.0	0.91
Severely malnourished (< -3 Z Score)	0.0	0.0	0.0	1.00
Global malnourishment	3.4	4.9	4.0	0.91

Table 4.11 Distribution of children aged 6-59 months by WAZ.

Nutritional status: WAZ	Zone		Total N=197 %	Chi sq. p value
	Highlands n=118 %	Lowlands n=79 %		
Normal (> -2 Z Score)	88.1	82.3	85.8	0.92
Moderately malnourished(-3 to -2 Z Score)	11.0	12.7	11.7	1.00
Severely malnourished (< -3 Z Score)	0.8	5.1	2.5	0.66
Global malnourishment	11.8	17.8	14.2	0.86

Table 4.12 Distribution of children aged 6-59 months by HAZ.

Nutritional status: HAZ	Zone		Total N=186 %	Chi sq. p value
	Highlands n=116 %	Lowlands n=70 %		
Normal (> -2 Z Score)	74.1	71.4	73.1	0.99
Moderately malnourished (-3 to -2 Z Score)	21.6	20.0	21.0	0.99
Severely malnourished (< -3 Z Score)	4.3	8.6	5.9	0.52
Global malnourishment	25.9	28.6	26.9	0.77

4.3.3 Sanitation and hygiene

The major sources of drinking water in both zones were streams and rivers. However there was significant difference in mode of handling and treating drinking water between the study groups (Fig 4.4), with boiling majorly practiced in highlands unlike lowlands that employed decantation.

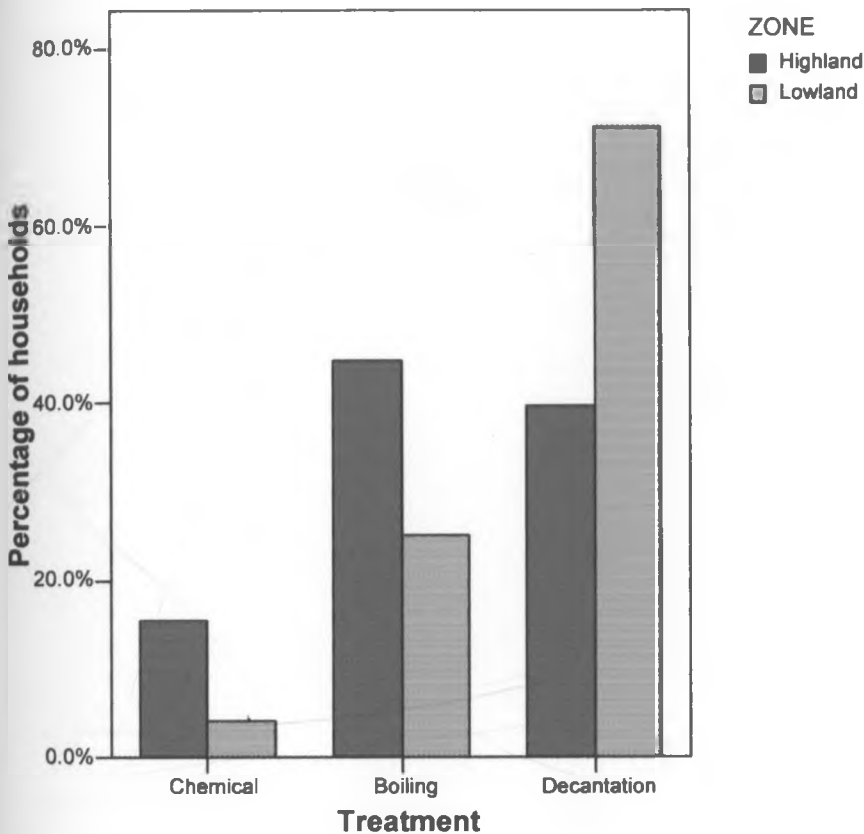


Figure 4.4 Household distributions by mode of water treatment

Methods of handling and disposal of both kitchen and human wastes, which affects level of sanitation, were similar between the zones. Every sampled household from both zones had at least a structure for disposing human waste (latrine) whose condition was assessed in terms of cleanliness and depth of the pit. Figures 4.5 and 4.6 illustrate distribution in

methods of handling kitchen and human waste respectively. (Chi square p values for comparison of level of significance in difference between the zones for disposal of kitchen and human wastes were: 0.17 and 0.06 respectively).

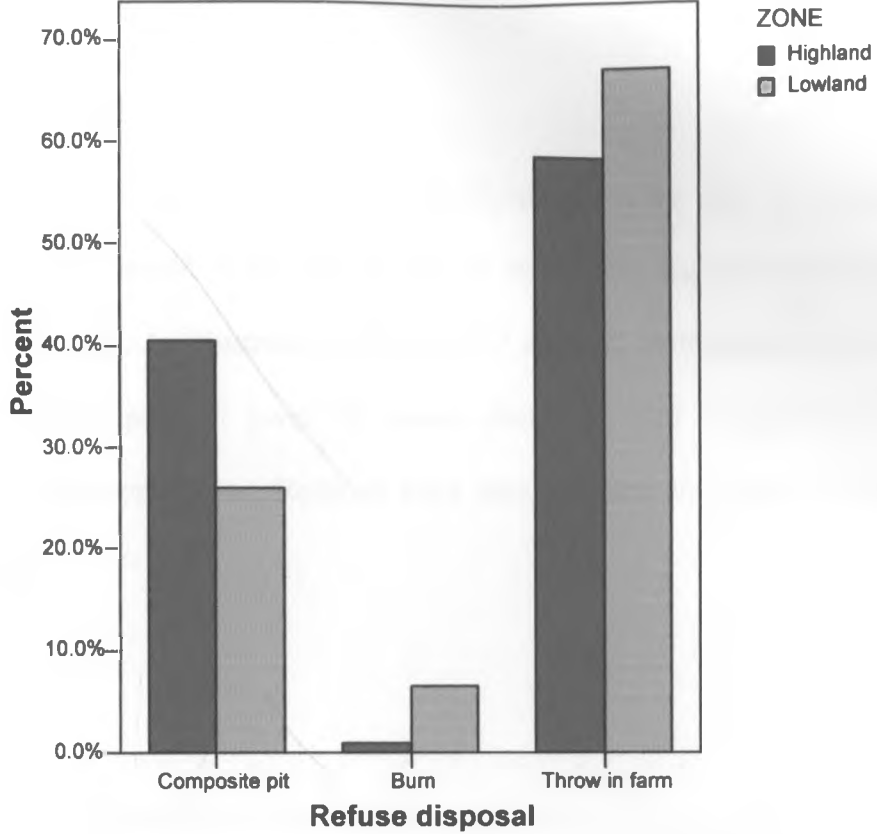


Figure 4.5 Household distributions by method of refuse disposal

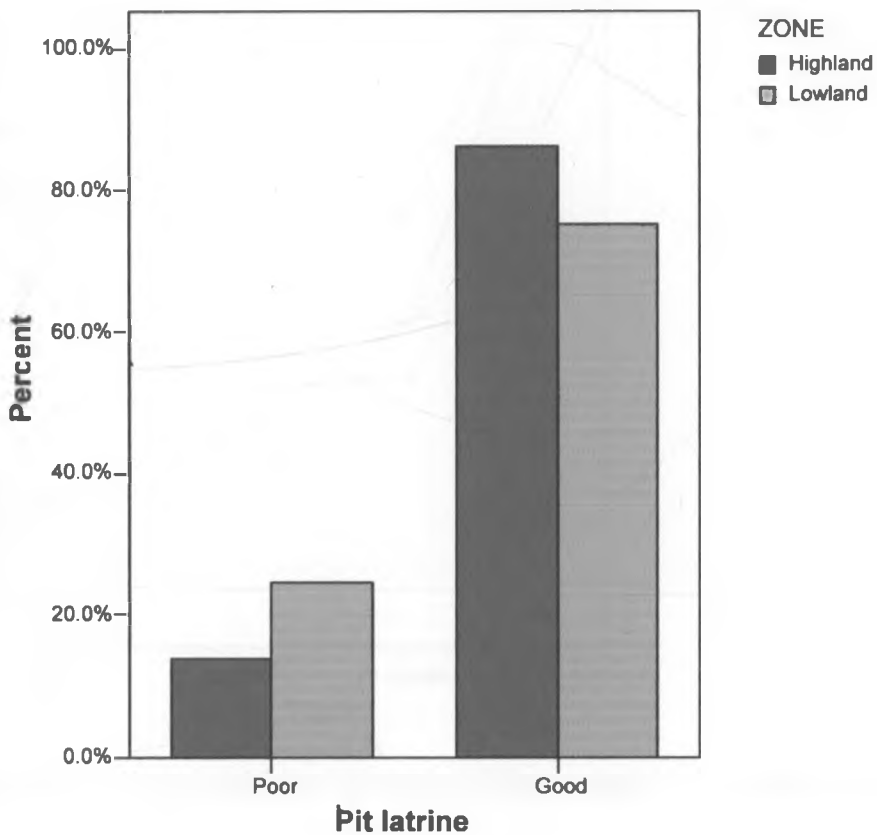
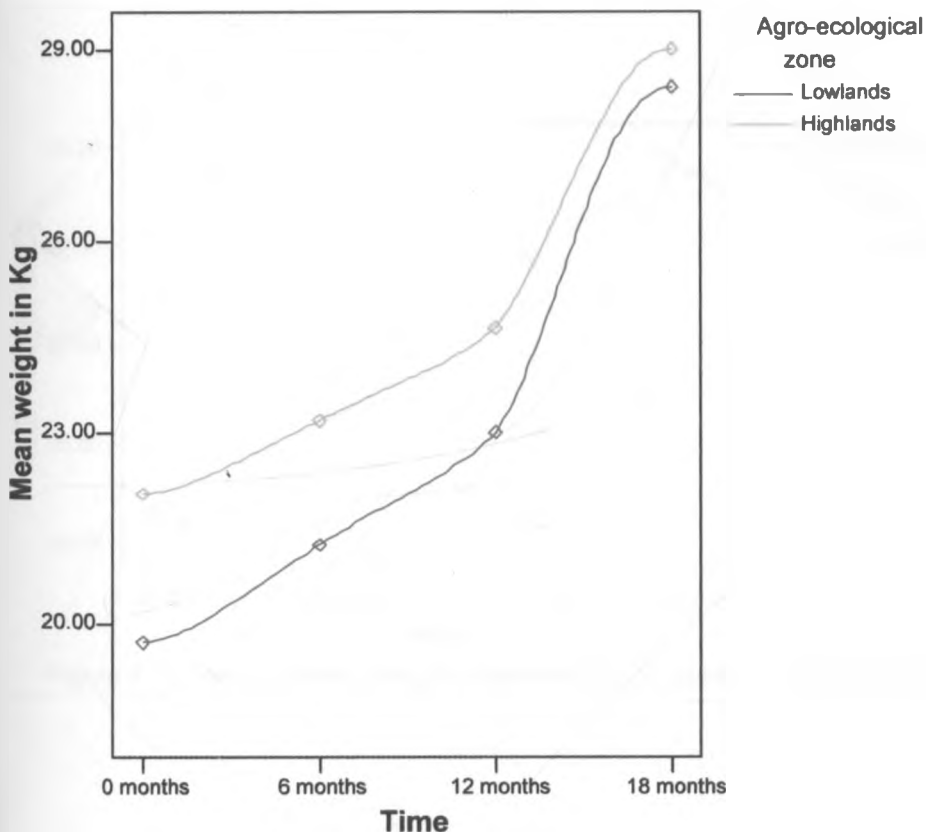


Figure 4.6 Household distributions by toilet condition

4.4 HIV PROGRESSION

The trend in mean weights of HIV infected clients (from the time of registration with CCC clinic) for a period of 18 months had no significant disparity between the zones (ANOVA, $p > 0.05$). As illustrated in Figures 4.7 and 4.8, both the dependant (under 19 years) and non dependant (over 18 years) clients showed insignificant differences between the two populations. Refer to error bars for each line graph in the Annexes (pages 76-78).



ANOVA, $p = 0.06$

Figure 4.7a. Trend in Mean Weight of Clients aged 5-18 years by agro-ecological Zone

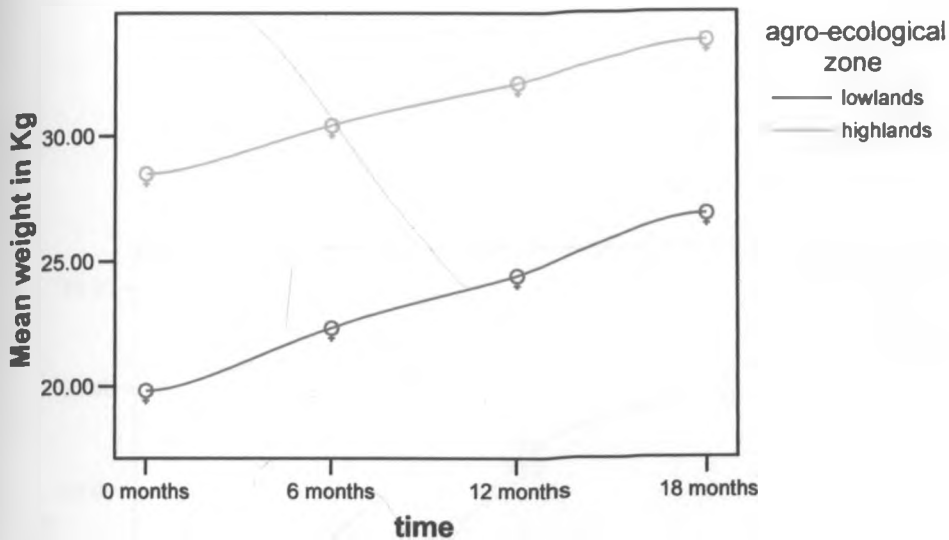


Figure 4.7b Trend in Mean Weight of male Clients aged 5-18 years by zone

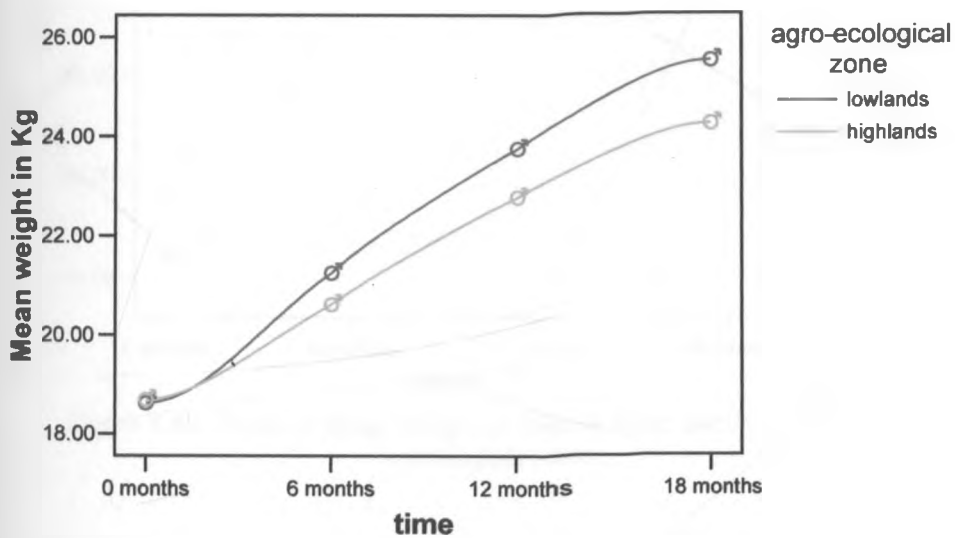


Figure 4.7c Trend in Mean Weight of female Clients aged 5-18 years by zone

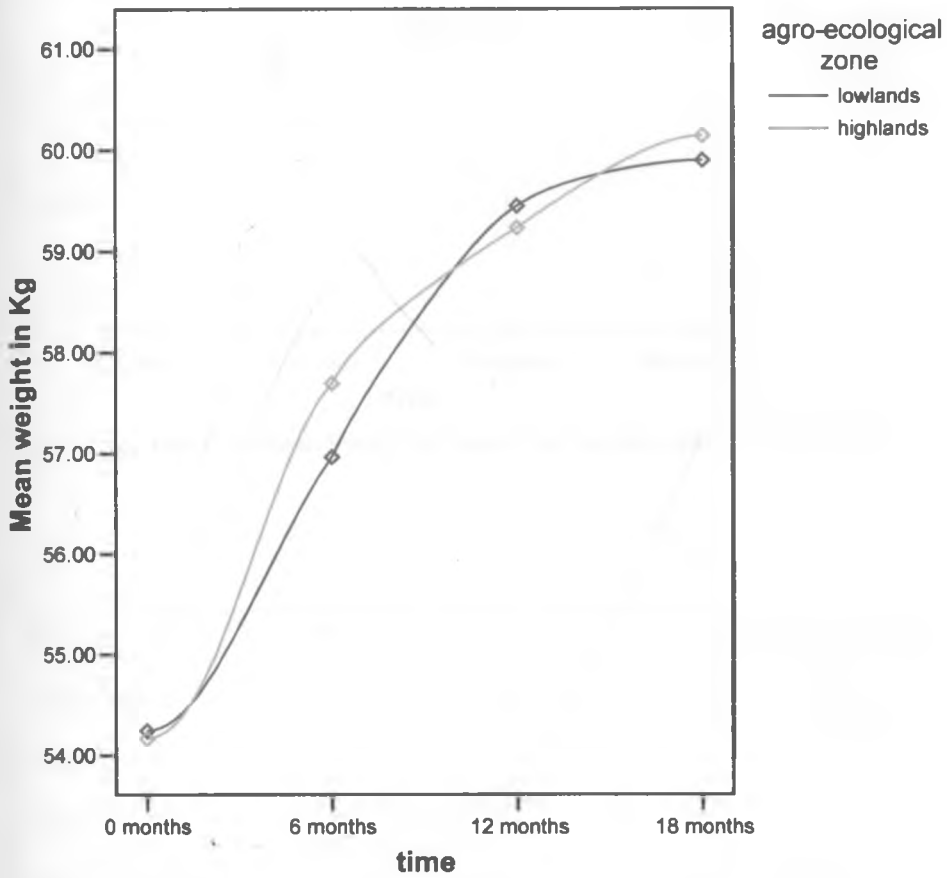


Figure 4.8a. Trend in Mean Weight of Clients aged above 18 years by agro-ecological zone.

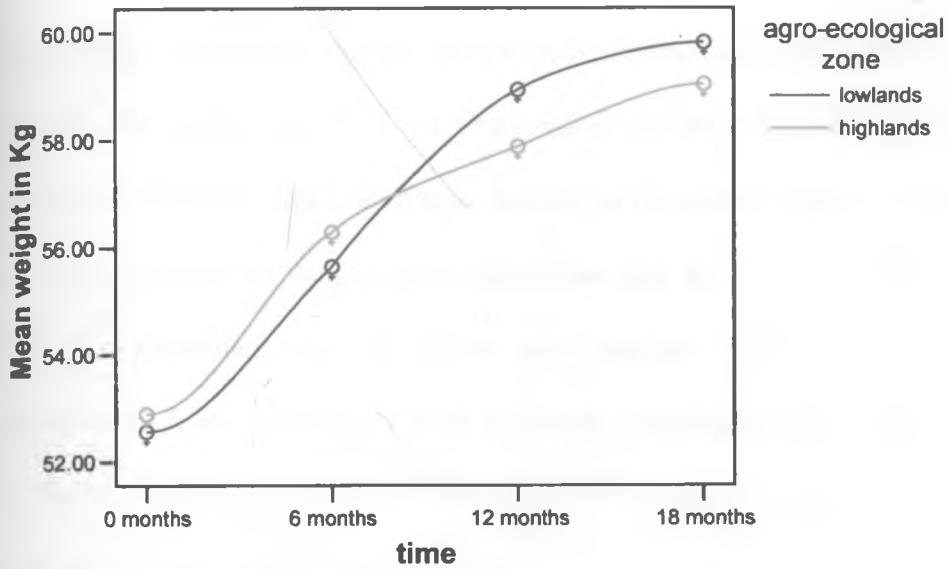


Figure 4.8b. Trend in Mean Weight of male Clients aged above 18 years by zone.

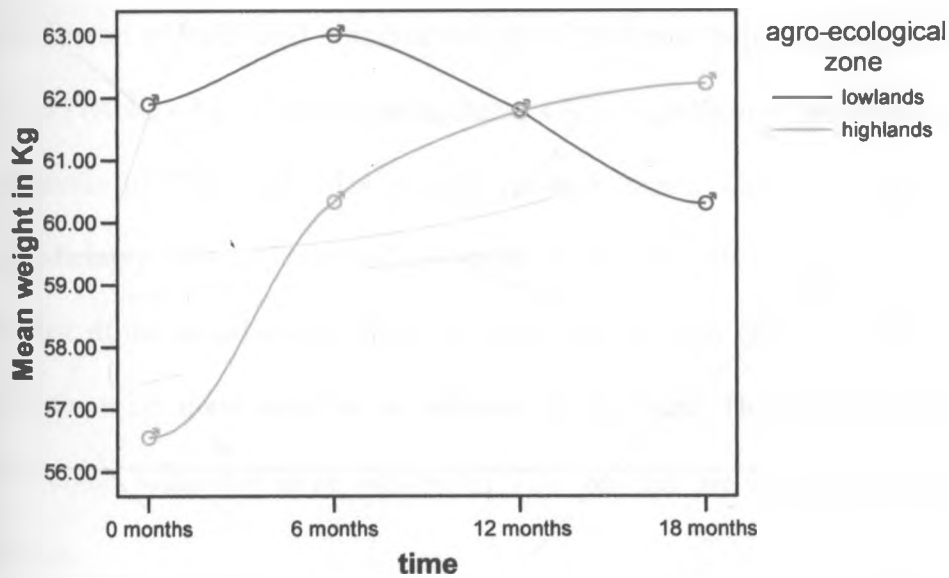


Figure 4.8c. Trend in Mean Weight of female Clients aged above 18 years by zone.

Further comparison of periodic mean weight based on gender yielded similar trends for dependant age group.

Female above 18 years occupying the lowlands seemed to gradually deteriorate in weight 6 months after registration. This was as a result of household burden bestowed upon them in search of food and water (extrinsic factors) as revealed by the key informants. Adult male variation trend in weight after registration with the CCC remained similar in both zones. For dependant age, 48 males were sampled from both zones and females constituted 39 from lowlands 55 from highlands. Highland clients comprised of 196 and 105 males and females respectively while lowlands had 192 and 85 males and females respectively, for non dependant age group.

Comparison of both total lymphocytes and CD4 count trend between the zones yielded $p > 0.05$ (ANOVA). As illustrated in figure 4.9, no significant correlation existed between the levels of TLC and CD4 counts, in both zones. The TLC seemed to fluctuate unpredictably, with increase in CD4 counts above 210 cells/ml, after maintaining a steady increase at the initial phase. However there was no clear cut link between the TLC and CD4 count i.e. none could be an indicator of the other. The overall trend was: a higher CD4 count suggested large number of TLC but not the converse. The result was not explicit.

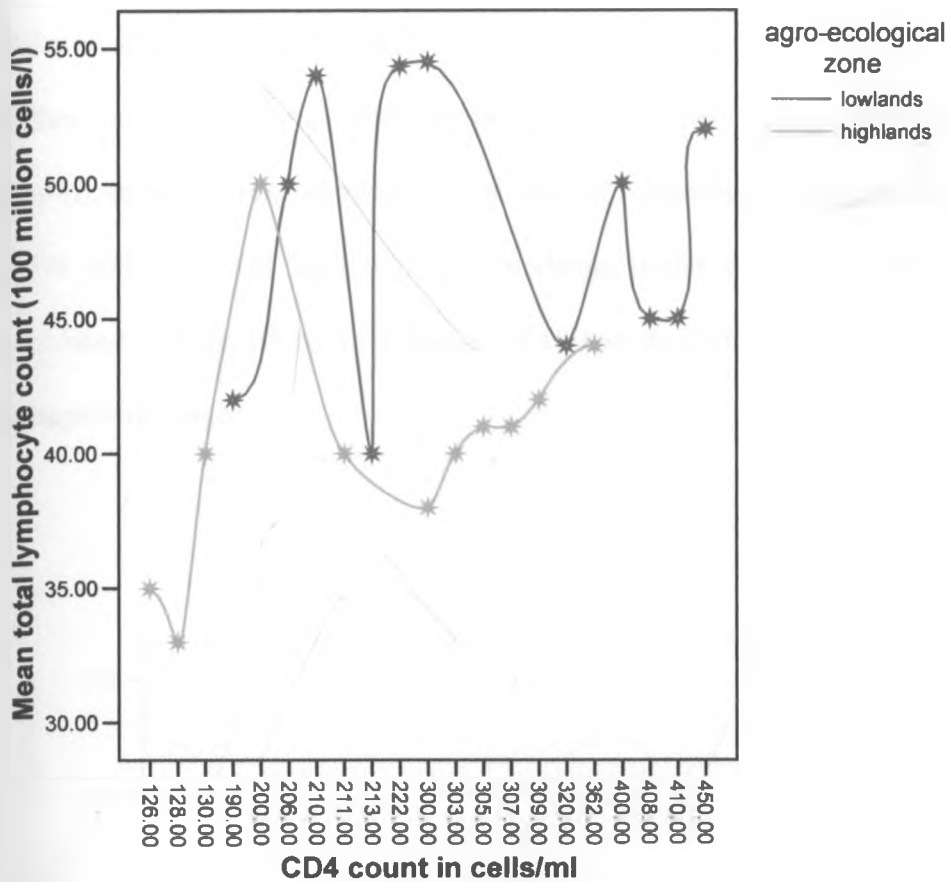


Figure 4.9 Trend in fluctuation of Total Lymphocyte Count against CD4 counts between the zones

Figure 4.10 illustrates *average* stage classification of HIV progression on registration at local CCC clinics, using WHO- Staging tool (2005). PLWHA usually reported at the clinics when the symptoms had just initialized (stage II) from both study populations. The graph basically illustrates the progression trend from stage II to stage III within a period of 18 months.

Time (duration of infection after registration) had significant positive correlation ($p=0.00$) with the stage of development unlike agro-ecological zone whose correlation

(with the progression) was insignificant ($p=0.48$). Therefore similar progression trend of HIV was observed in both zones.

Further verification by establishing proportion of clients progressing from stage II to stage III, in both zones, showed similar trend of insignificant comparison ($p>0.05$).

33.7% and 32.7% of highlands and lowlands initial clients at stage II respectively, progressed to stage III within a period of 18 months (Table 4.13). Refer to error bars in the appendix (page

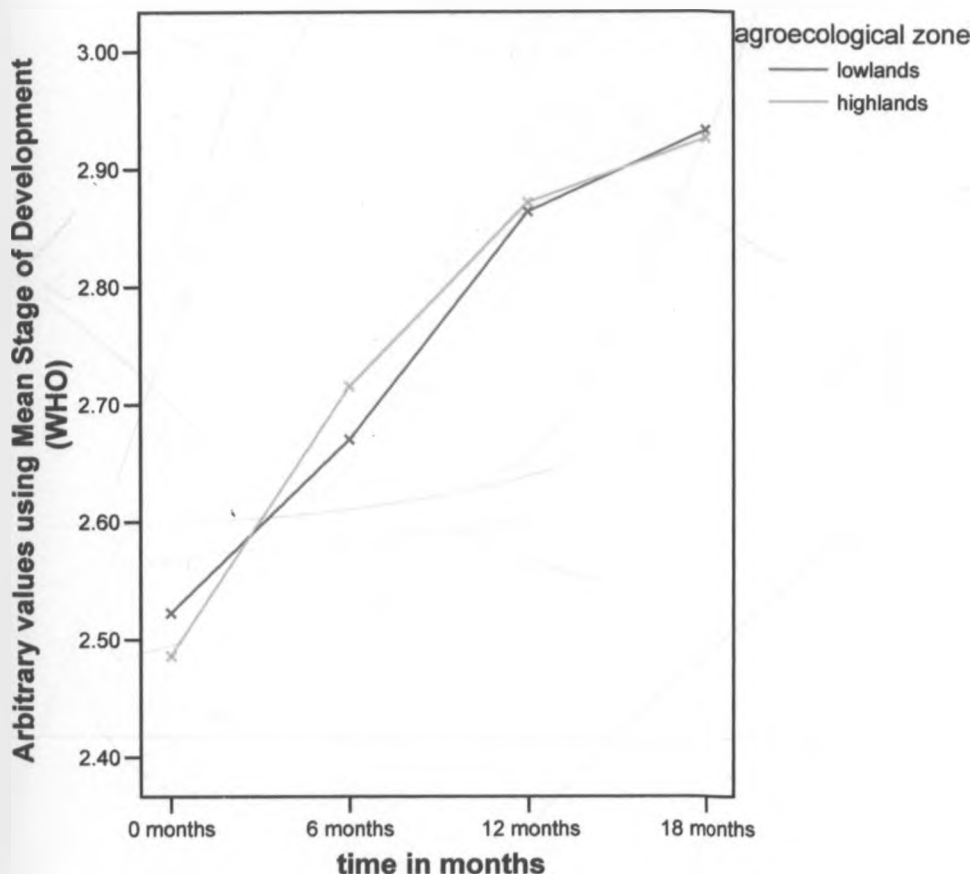


Figure 4.10 Mean HIV Progression trend of CCC clients in the zones

Table 4.13 Proportion of Clients at stages II and III between 0-18 months in the zones

Duration in months	Stage II		Chi sq. p value	Stage III		Chi sq. p value
	Highlands N=404 %	Lowlands N= 364 %		Highlands N=404 %	Lowlands N= 364 %	
0	63.7	52.1	0.86	36.3	47.9	0.72
6	42.8	41.1	0.66	57.2	58.9	0.96
12	32.6	22.5	0.22	67.4	77.5	0.68
18	30.0	19.4	0.07	70.0	80.6	0.19

CHAPTER 5: DISCUSSION

5.1 DEMOGRAPHIC AND SOCIOECONOMIC STATUS

The study populations have similar age distributions with age bracket under- 18 years constituting about 50%. The graphical presentation shows a predominantly youthful population (under 35 years) in the study areas calling for allocation of resources for the implementation of projects and programmes catering for the youths, especially schools and training facilities for preparation towards industrialization (GoK, 2001)

Higher enrolment exists in the highlands compared to lowlands as indicated by the larger percentage of children in school basically due to the former's proximity to urban area . This condition is also reflected in education level of adults with higher proportion of uneducated prevailing in lowlands than highlands. On the same trend, fewer individuals complete their education up to secondary level (higher school drop out rate in lowlands), due to limited resources. It means a greater deal will have to be done to ensure that a greater proportion of children who should be in school, in lowlands, are actually enrolled.

The variation in agro-ecological condition has also affected the distribution in composition of marital status of the households between the zones. The main underlying causes for existence of single-headed households that initially constituted a couple (highlands: 5.5%; lowlands: 10.9%) are death and divorce, that increases greater chances for HIV incidence in the lowlands as compared to highlands.

Socioeconomic status has been determined"by the welfare indicators appropriate in indicating level of development and quality of life. Occupation indicates inhabitants'

effective participation in development. Agriculture contributes the highest percentage of employment (highlands: 72.5%, lowlands: 56.7%) in the study population. Unskilled labour is mainly concentrated in the lowlands (18.6%) with higher levels of unemployment reflecting lower level professional training as compared to the highlands. The spatial/unreliable rainfall may contribute to the lower percentage of self employment in lowlands. It should be noted that employment (direct and indirect) is higher in the highlands (Wundanyi) due to the fact that the locality encompasses Wundanyi town that has more small and medium scale industries besides having better infrastructural facilities.

The study populations' majority are highly dependent on agriculture as the main source of income. Other sources include livestock production activities and wages from public sector and small scale business in the informal sector which are concentrated in towns (highlands) and rural trading centres. Average monthly household expenditure in the zones is the same: Ksh.5900-7400. However the lowland households channel higher income expenditure on food (59.6%) than highland households (41.6%) indicating a lower household food security (expenditure above 50%). Due to higher turnout for education, the highlands households spend more on school fees and medical bills.

As explained in District Development Plan (2001-2009) about 99% of households in the district use fuel wood for domestic purposes.' In the highlands there is a large extent of self sufficient domestic timber production but the farmers are reluctant to use their trees for fuel wood needs. This is because of high premium on the sales as timber, poles and posts. In the lowlands, the trees are suitable for fuel wood production hence higher

deforestation. This explains the reason for higher household fuel expenditure in the highlands than in the lowlands.

5.2 HOUSEHOLD FOOD AVAILABILITY AND ACCESSIBILITY

The study design has been based on selection of two district agro-ecological zones to capture significant levels in variation of household food security. Therefore the assessment and comparison of food security situation is a documentation process.

The major food crops in the study sites include: maize, beans, kales and sweet potatoes. However, the lowlands being a rain fed zone, the households depend mainly on maize production to sustain their livelihoods. On average, cereal production constitutes about 82.7% of total food basket produced per household in both zones.

The wetlands (Wundanyi) having continuous short rains (as from KFSSG, 2008, 70% of produce depend on short rains) have the tendency to shift to less preferred meals as a coping strategy to food shortage. This is least applicable in the lowlands where households are less selective due to limited diverse food basket. In both zones, the general coping strategy employed is food purchase on credit.

Therefore the general food security is stable in the wetlands (Wundanyi) but deteriorates in the rain fed lowlands (Paranga). The major causes of food deficit in the lowlands as explained by KFSSG-2008, include: poor /unreliable rainfall and overdependence on rain fed agriculture, slow adoption of modern farming technology, inadequate farming inputs-

only 40% of farmers use certified seeds and fertilizers, destruction of crops by wildlife in areas adjacent to the national park and lack of markets and marketing strategies.

A vivid depiction in food potentiality between the zones is indicated by the significant difference in distribution by sales of subsistence produce (highlands: 86.4%, lowlands: 38.8%). Being agriculturally productive zone, the highlands sell produce mainly to purchase certified seeds and fertilizers. The lowlands mainly substitute their subsistence for foods not within the household basket, indicating limited diversity of food produce. Much economic constraint in educating individuals in lowlands is also exhibited by higher proportion selling produce to pay fees in the lowlands (13.7%) than highlands (19.4%).

5.3 HOUSEHOLD FOOD UTILIZATION

Inadequate skills and techniques for food preservation is a major factor affecting food security, in both zones. This is depicted by limited foods under preservation i.e. those that are stable (Cereals-moisture content above 50%). Ineffective preservation is a major cause of food wastage in the study site. Climatic difference has contributed to the higher losses in produce in the lowlands (39%) than the highlands (23.7%), as pests and microbial activities are accelerated by the high temperatures.

The major food groups consumed in both zones include: cereals, oils and fats, dark green leafy vegetables, spices/caffeine, alcoholic beverages and sweets. The significant difference in household dietary diversity score between the highlands and lowlands is

basically as a result of favourable climatic conditions and proximity to urban centre hence to accessibility to variety of food groups, to the former. Apart from the major food groups mentioned earlier, majority of the highlanders also have access to white tubers and roots, other vegetables (cowpeas) and milk/milk products. High prevalence of HDDS below 5 is prominent in the lowland households: Paranga (30%), Wundanyi (12%). This limited diversification in food groups can pose a threat to nutritional adequacy depending on specific food groups available and mode of preparation.

An important indicator that expressed the overall nutritional status of the households was the anthropometric assessment of an index child (per household). There is no significant difference in the distribution for acute under nutrition (wasting), assessed by weight for height. This is always a result of the same length or height (WHO, 2005) and is mainly caused by: inadequate food intake, incorrect feeding practices, diseases and infection or, more frequently, a combination of these factors. There is no severe malnourishment exhibited by wasting from both zones, indicating average short term availability of food. However despite being statistically insignificant in overall distribution (global), the lowlands have higher proportion of severely malnourished as indicated by weight for age (underweight): 5.1 % as compared to the highlands: 0.8%. This having been a composite measure of stunting and wasting, (underweight), indicates indifference in the magnitude of malnutrition over time.

The most pronounced indicator in the study sites is height-for-age that reflects proportion of severe malnutrition as 4.3% and 8.6% in highlands and the lowlands respectively, indicating the percentage of households whose children have undergone a past growth

failure that could be as a result of a number of long term factors. These include: chronic insufficient protein and energy intake, frequent infection; sustained inappropriate feeding practices and poverty (UN, 2004). However statistical comparison between the zones; X^2 test indicates there is no significant difference in the overall distributions; normal, moderate and severe malnutrition for each indicator (wasting, underweight and stunting).

Disease, sanitation and hygiene in the households can affect adequacy of food utilization at the biological level since infections increase demand for nutrients in the body (WHO, 2003). Poor sanitation/hygiene can also pose hazard as a source of biological and chemical deterioration of food.

..

The major sources for drinking water in both zones are springs and streams, with a large number of households traveling long distances of 2-3 kilometers to the nearest water points, in the lowlands. However in the highlands, this distance is less than a kilometer (GoK, 2001). All the households have a distinct way of handling water before use, a physical treatment specific to each zone. The lowlands generally decant (54%) unlike in the highlands where a majority boils (52%), water before drinking. This increases the vulnerability of the lowlands (Paranga) to water borne infections and opportunistic infections for PLWHA thus compromising food utilization. In comparison, effectiveness in handling wastes is considered the same in both zones.

5.4 HIV PROGRESSION

The development of HIV infection in clients from the study sites was evaluated retrospectively for a period of 18 months. The clients were further subjected to highly active antiretroviral therapy, when necessary, at the respective health facilities accessible. Weight being an important indicator for HIV progression, the study indicates no significant difference in the trend of the mean weights of HIV infected clients from both zones (highlands, lowlands) changes. Further classification of clients into those depending on support from duty bearers (<19 years) and the independent lot (>18 years) yields no difference in weight change between the zones despite slightly higher rate of weight gain for the dependent group. Segregation of clients by gender does not yield much difference in the progression trend. However females in the lowlands are frequently burdened by active involvement in strenuous search for water and food at long distances (women are the backbone in attaining most household livelihoods at the Kenyan coast – GoK, 2001). Therefore this study indicates a slow and steady decline in weight of female lowlanders, 6 months after registration at the local CCC.

Wasting during HIV infection tends to be in the form of lean tissue, such as muscle unlike for starvation that depletes fat mass (WHO/UNAIDS, 2006). The possible causes of weight loss/growth failure include:

- i. Increased energy expenditure by over 10% due to high metabolic activities.
- ii. Decreased energy intake likely aggravated by the weakened immune system which results into various infections, some of which can affect appetite (anorexia) e.g. mouth sores, diarrhea, nausea all that affect normal eating patterns. Other possible causes include stress and psychological issues.

- iii. Malabsorption e.g. of fat because HIV or other infections has damaged the lining of the gut. Diarrhea can also be a major cause.

A challenge in deriving conclusive statement from weight assessment alone is the fact that since the HIV infected tend to loose lean tissue, there maybe changes in the make up of the body e.g. accumulation of fat, even if the overall weight stays the same. The study clients having been on HAART (from both sides) could have contributed in the weight stability (prevention of severe wasting). However other long term effects of HAART are not related to weight changes: lipodystrophy, rising of Low density lipoprotein (LDL) cholesterol, lowering of High density lipoprotein (HDL) cholesterol and raising triglycerides levels in the blood.

The study groups interestingly have similar trends for both TLC and CD4 count fluctuation. A plot of TLC against steadily increasing CD4 level, at CD4 counts below 210 cells/ml is observed. Comparison of CD4 and TLC variation is informed by the realization that the burden of HIV in the resource poor countries is extensive and a large proportion of HIV patients rely on accessing health care services in rural and underserved areas that do not have the capacity or capability to determine CD4 count. Furthermore, the current WHO guidelines only commit to using TLC in conjunction with clinical data (WHO, 2005) as a criterion to initiate highly active antiretroviral therapy (HAART). TLC is inexpensive and simple to perform and has been shown to be reliable in the HAART native population but its value may not only be in its ability to identify the need to start HAART but to monitor patients' progress and immune status during HAART as well (Mwamburi *et al.*, 2005)

In general, few studies have compared the utility of TLC as a predictor for CD4 count during and in absence of HAART, or have examined the collective impact of using haemoglobin, weight, presence of an AIDS defining illness and gender to improve the TLC's predictive performance. Mwamburi *et al.*, (2005), further indicates that the TLC performs well in predicting CD4 count less than 2000 cells/ml. Although better in those off HAART, the performance of TLC is good for both: in absence and during HAART. The result being not explicit therefore forms a basis (hypothesis) for future studies.

In applying the WHO staging of HIV progression (stages I to IV), the averaging of stage of development semi-annually for each cohort group has yielded arbitrary figures that portray the general trend /rate of progression. The rate of HIV progression in clients from both zones is the same, with the infected mainly registering at the CCC at clinically asymptomatic stage when the HIV-1 is high in the lymph nodes (stage II). At large, the clients are normally put on HAART at stage III (symptomatic HIV infections), signifying time at which the viral load and susceptibility of clients to AIDS related condition is more pronounced coupled with initial severe wasting. Similarly there's no disparity between the zones' clients rate of progression from stage II to stage III using WHO staging, i.e. 22.5% p.a and 21.8% p.a in highlands and lowlands respectively.

5.5 ROLE OF NUTRITION ON HIV PROGRESSION

During this research process, a health facility: St Joseph's Centre of Hope remarked in a key informant interview that on subjecting their clients to a supplement: *Ensure*, for a period of 6 months, there was a surprising increase in body weight during the

intervention period, significantly higher than weight trend without supplements. The following findings are also documented in Drugs by Condition (2009):

- In Malawi, 2004 patients with mild malnutrition were twice as likely to die in the first 3 months of treatment. Severe malnutrition had even a 6 times greater risk than for those of healthy body weight.
- A trial involving a thousand HIV positive pregnant women in Tanzania (2003) found that daily multivitamins benefited both the mothers and their babies, compared to placebo. After 4 years, multivitamins were found to reduce the women's risk of AIDS and death by around 30%.
- A large trial in Thailand also found that multivitamins led to fewer deaths, but only among people in the advanced stages of HIV disease.

Basically micronutrient supplementation is only useful in combination with adequate and well balanced diet and can never replace the need for adequate food intake .Therefore micronutrient supplements are best taken as an addition to the daily dietary intake, which serves to promote nutritional adequacy, specifically in individuals who are nutritionally deprived.

The purpose of the supplements is to:

- Prevent micronutrient deficiencies and their complications.
- Prevent malnutrition and nutrient deficiency-associated complications

Worth noting, even the activity of HAART depends on nutritional condition of the individual as micronutrient deficiencies may make the drugs less effective or may worsen its side effects.

Therefore nutritional status plays a crucial role in mitigating HIV manifestation in the infected. PLWHA have showed low levels of vitamin A, vitamin B12, vitamin C, carotenoids, selenium, zinc and iron in the serum (WHO, 2003). As stated earlier the nutritional status of the infected determines the level of immunity and normal physiological performance, hence the coastal highlands, however looking to be more food secure than the lowlands, this variation has not attained a “threshold” in level of food security to impact a significant difference in inhabitants’ nutritional status. This is evident by the similarity in nutritional status of the index children in the two zones. However, the findings are based on an indirect linkage between the HIV infected clients studied and sampled households as a limitation to the study design.

CHAPTER 6:

CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The highlands being a wetland region is more food secure than the lowlands at household level due to higher and reliable productivity apart from having a lower income expenditure on food. Further indications include: more food selectiveness in the highlands as coping strategy to food shortage, and selling of farm produce mainly as a trade off to acquire farm inputs unlike the lowlands that substitute produce for food not grown. The highlands generally have higher HDDS (7) than lowlands (5). Therefore the null hypothesis, “household food and nutrition security in the highlands is not different from lowlands in the coastal region”, is rejected.

A retrospective study on HIV infected subjected to HAART, at the required stage of development, in the highlands and lowlands show no significant difference in HIV progression rate, using indicators: weight, WHO staging. Under regular intake of HAART, the viral manifestation in the coastal highlands and lowlands is relatively the same. Therefore the null hypothesis: “the rate of HIV progression for clients on HAART in the coastal highlands is not different significantly from the lowlands”, is accepted

This study has established that the two regions being in a rural setting that majorly relies on farm produce, the households consumption basically comprise of staple foods (cereals, vegetables, white tubers and roots, milk). The household food security although being an important foundation to HIV mitigation, can not affect the rate of progression without proper depiction on nutritional adequacy. Therefore emphasis need to be put not only on

quantity (food security) but also on quality of households food (nutritional sufficiency) in order to mitigate HIV impact, support HAART and slow the rate of spread of the epidemic. In the foregoing nutritional HIV mitigation is not directly related to the agro-ecological zone (acceptance of the null hypothesis).

In summary, the variation in food potential between the zones does not merit a “threshold” to trigger significant difference in nutritional status of the inhabitants, as depicted by similar distributions by household index children in nutritional condition. Therefore the prognosis was poor, being based on the general assumption that the ordinal difference in household food security between the study zones would directly influence the magnitude of mitigation of HIV progression. This further put the emphasis that the overall improvement of household food security cannot work independently as a novice intervention for nutritional HIV mitigation without articulation and incorporation of the household nutrition security.

6.2 RECOMMENDATIONS

Having verified that the linkage between the agro-ecological zones hence household food security and HIV mitigation is nutritional adequacy, the general implication for successful outcome on HIV mitigation should involve a sustainable interventional programmes gearing towards improving nutritional adequacy of PLWHA.

Due to incapability of most households to store unstable food produce (those with moisture content above 50%), adequate training on simple and affordable preservation

techniques e.g. sun drying, canning, dehydration of farm produce to minimize wastage is necessary to increase food consumption and utilization.

As clearly indicated in this comparison outcome, despite the ordinal variation in level of food security between the agro-ecological zones, the inhabitants' nutritional status (as indicated by the index child examined per house) remained the same. This implies that with the complexity and diversity of the overall definition of food security, the mitigation of HIV progression needs direct addressing of nutritional context of the infected. A prospective study involving direct assessment of food and nutrition security of households belonging to the clients can yield a better result. Therefore interventions should focus towards improving the overall nutritional status of PLWHA from both zones to attain successful mitigation (for slow progression of HIV to AIDS in PLWHA under HAART). Various projects that could be targeted include:

- i. The actors should devise sustainable approach that would initiate accessibility of micronutrient supplements at the major health facilities: Wesu district hospital, Moi hospital (Voi), St Joseph's Center of Hope clinic, and Mwatate dispensary to boost nutritional status of the clients.
- ii. Establish community based organizations that would spearhead fortification of the main staple foods e.g. flour, vegetables and oil with micronutrients to accelerate mitigation.
- iii. Since micronutrient supplementation is only useful in combination with adequate and well balanced diet, small projects like vegetable gardens and animal rearing should be promoted in the zones.

Since a large proportion of HIV patients on accessing health care services in rural and underserved areas that do not have the capacity or capability to determine CD4 counts, I recommends an extensive trial to configure a conclusive and agro-ecological zone specific (in relation to level of household food and nutrition security) correlations between TLC and CD4 counts. This would validate the combination of TLC and symptomatic staging (WHO) only, to develop clinical decision making tool in the underserved resource-poor setting, during HAART (TLC is affordable/inexpensive and simple to perform). The finding shows similar trends of linear relationship between CD4 counts and TLC for CD4 counts below 210 cells/ml.

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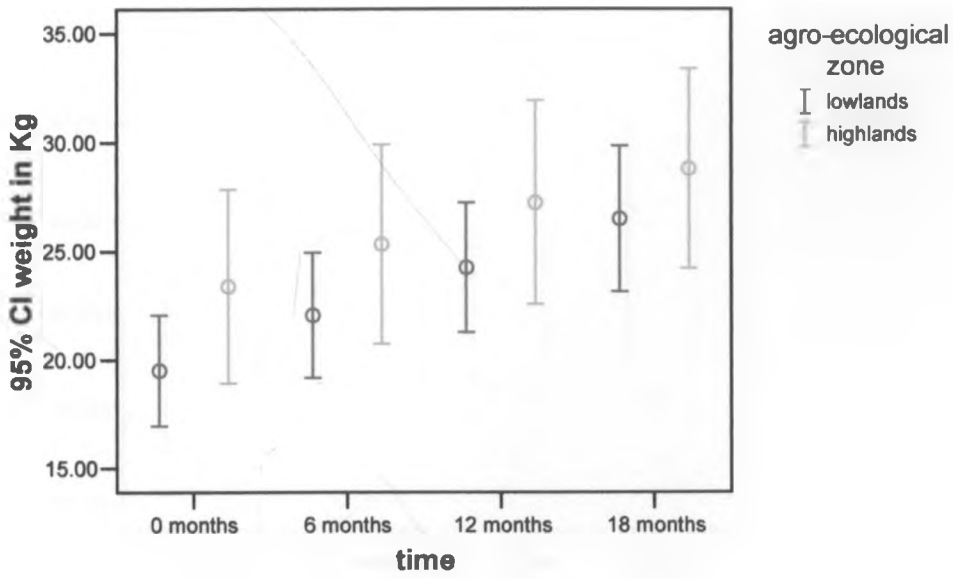
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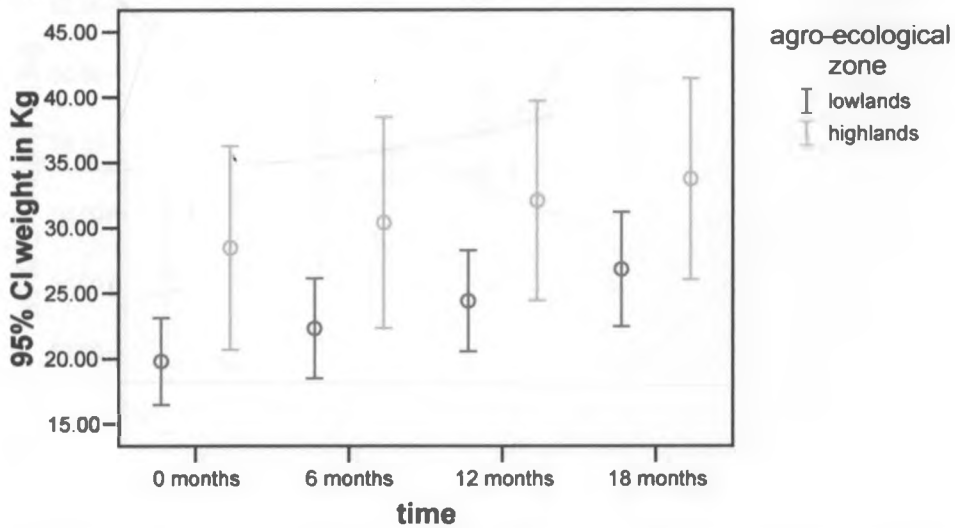
ANNEXES

Annex 1



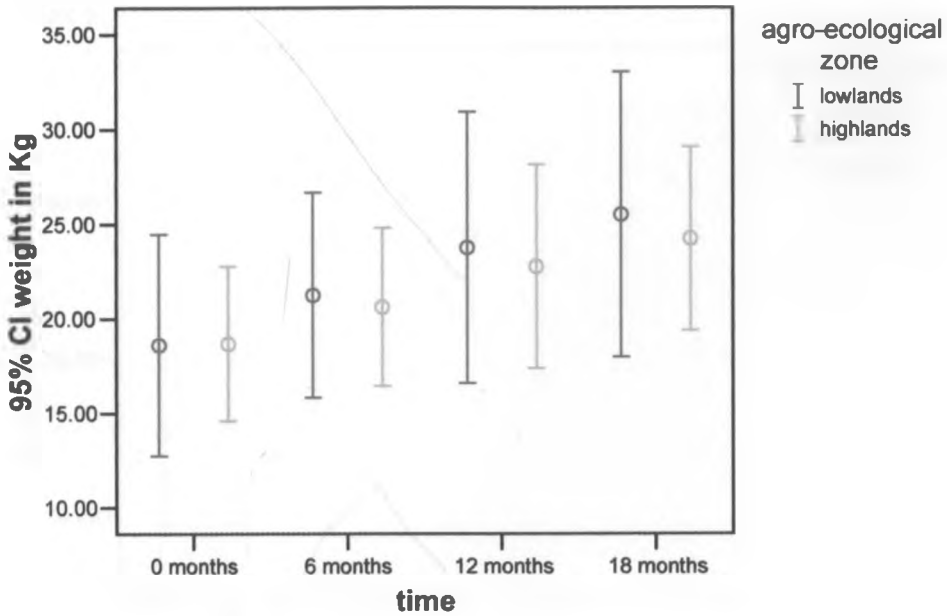
Trend in mean weight of clients aged 5-18 years by agro-ecological zone

Annex 2



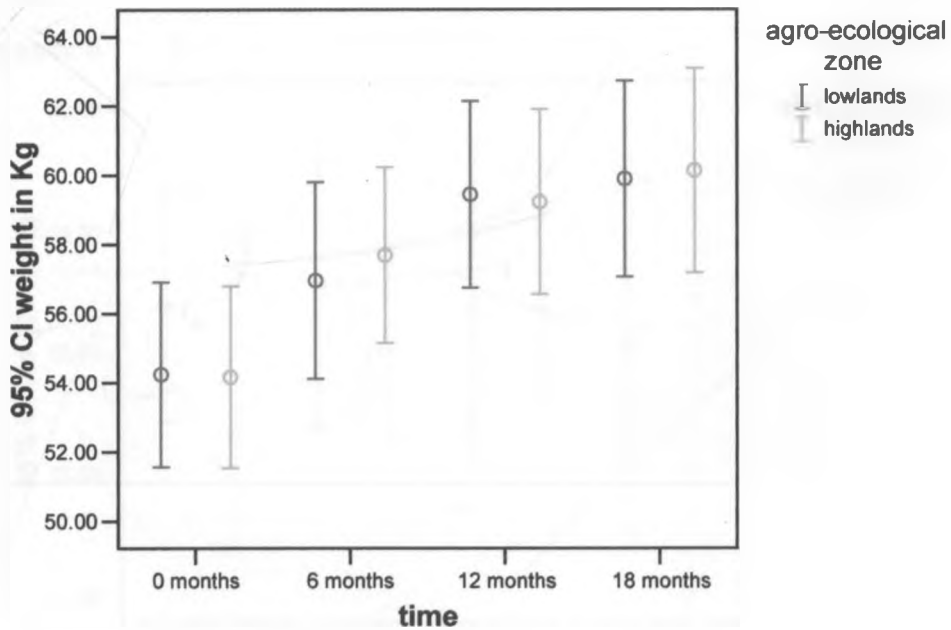
Trend in mean weight of male clients aged 5-18 years by agro-ecological zone

Annex 3



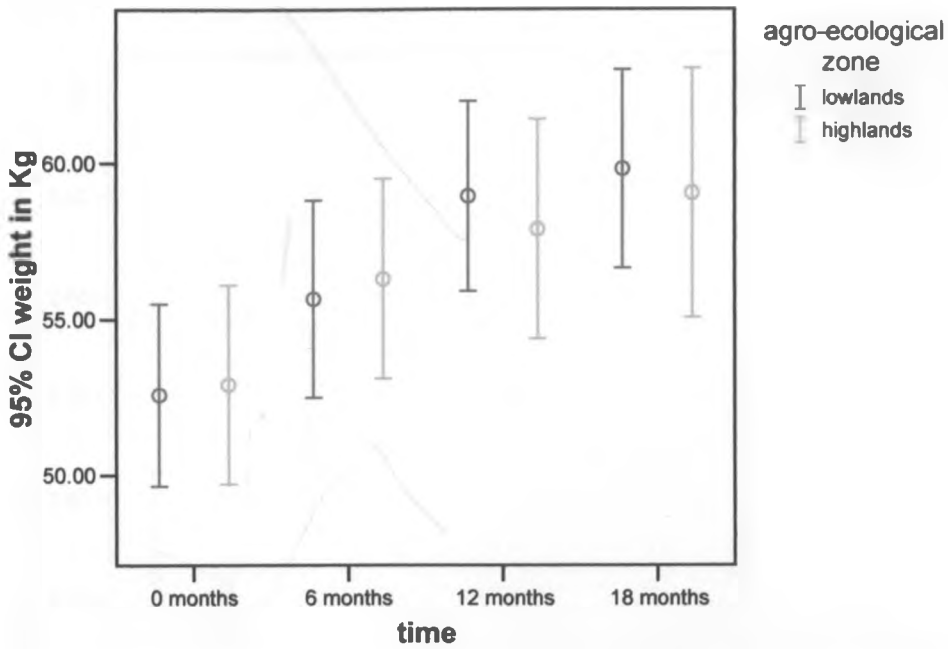
Trend in mean weight of female clients aged 5-18 years by agro-ecological zone

Annex 4



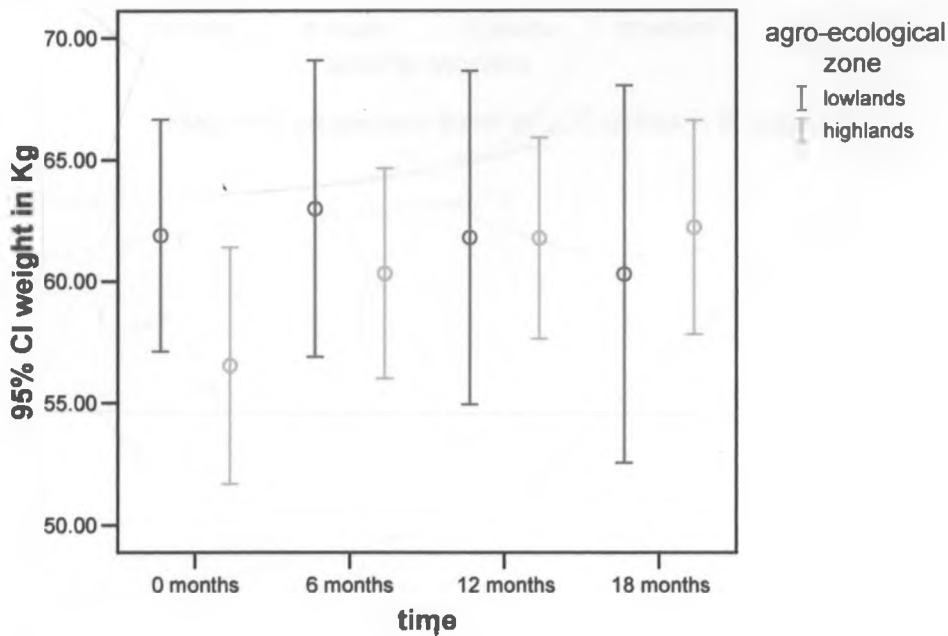
Trend in mean weight of clients aged above 18 years by agro-ecological zone.

Annex 5



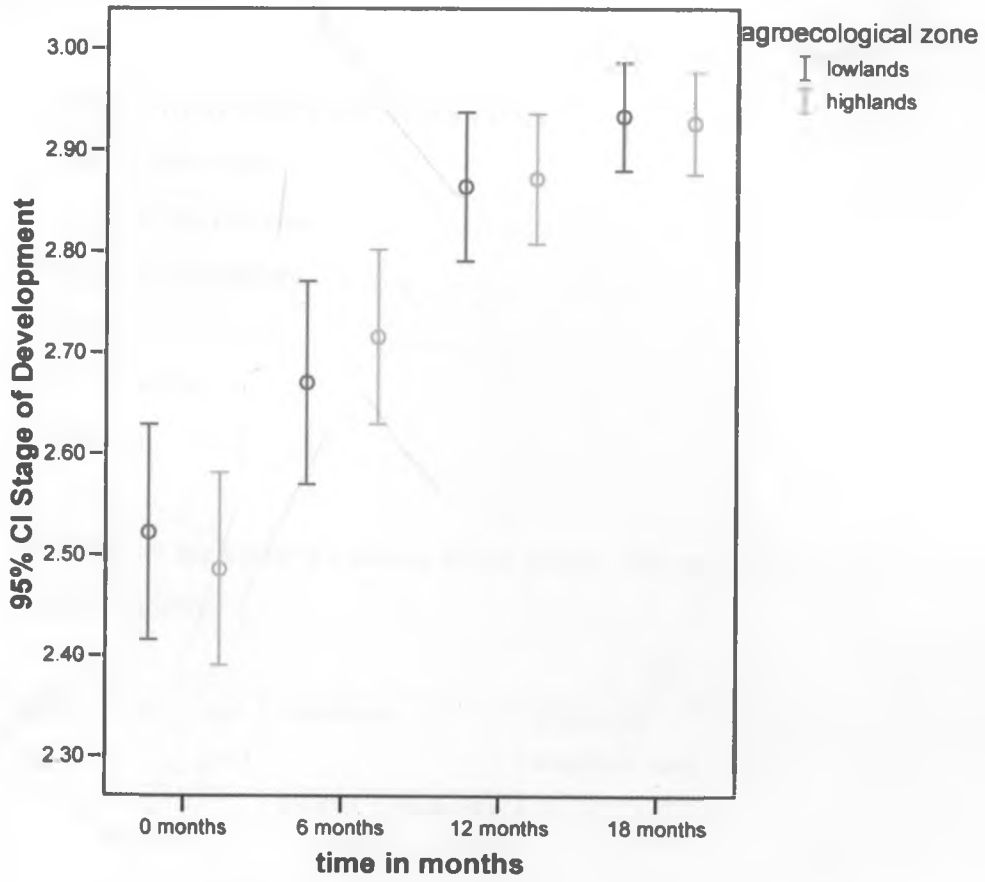
Trend in mean weight of male clients aged above 18 years by agro-ecological ...

Annex 6



Trend in mean weight of female clients aged above 18 years by agro-ecological ...

Annex 7



Mean HIV progression trend of CCC clients in the zones

CODES

SEX 1=Male 2=Female	MARITAL STATUS 1= Single 2=Married monogamously 3=Married polygamously 4=Divorced 5=Widowed	OCCUPATION 1=Regularly employed 2=Temporarily Employed 3=Self employed 4=Casual laborers 5=Unemployed 6=Student 7=None 8=Other (Specify)
RESIDENTIAL TIME 1=Full Time 2=Regularly Absent 3=Non-Resident 4=Other (Specify)		
REASON 1=Farming elsewhere 2=Working elsewhere 3=Looking for work 4=Schooling 5=with relative 6=Taken to street 7=Other (Specify)	RELATION TO HOUSEHOLD HEAD 1=Household head 2=Spouse 3=Daughter / Son 4=other relative 5=Friend 6=Other (Specify)	EDUCATION LEVEL 1= None 2=1-5 years 3=6-8 years 4=Secondary 5=College 6=University

3 ECONOMIC STATUS

a) Assets:

1. Do you own the house you live in? _____.

1=Self owned 2=Rented 3=Inherited 4=Others (specify)

2. House description

1=Grass thatched 2=Iron sheet + cemented 3=Tiles 4=Others (specify)

4 3. Do you own the land?

1=Self owned 2=Rented 3=Inherited 4 = Public 5=Others (specify)

4. Other properties owned and their descriptions.

(i) _____

(ii) _____

(iii) _____

(iv) _____

b) Incomes and Expenditures:

5. What are your other sources of income in order of importance (1-4)?

Employment Business (Specify) Farm produce Other (Specify)

6. How much do you spend on the following items per week, month or year?

(Estimates)

Expenditure	Kshs/ weeks	Kshs/months	Kshs/year
Food			
Clothing			
Rent			
School fees			
Medical			
Transport			
Fuel			
Water			
Wages			
Farm inputs			
Others (Specify)			

7. Source of cooking fuel in the household (rank according to level of usage)

--	--	--	--	--	--

1=Fuel wood 2= Charcoal 3=Paraffin 4=Electricity 5=Gas 6=Other (specify)

8. Source of fuel for lighting (rank according to level of usage)

--	--	--	--	--	--

1=Tin and wick 2=Candle 3=Hurricane 4=Gas lamp 5=Electricity
6=Other (Specify)

SECTION 2

Food Security

I. Crops

1. How much land did you cultivate last season? _____ .acres
2. How much land is at disposal of this household for use / farming _____ .acres
3. Record the following information concerning crops harvested in the last season in terms of amount in kgs.

Crops	Amount harvested	Amount purchased	Amount received in gifts	Amount given out as gifts	Amount sold	Amount now in storage

5. At harvest, what is the main reason for selling food crops? To obtain money for:

1. School fees
2. Purchasing livestock.
3. Purchasing food which I did not grow.
4. Purchasing seed.
5. Other (Specify)

6. In the past one month has your household done any of the following due to lack of food availability?

1. Reduction of the number of meals per day
2. Skip food consumption for an entire day
3. Reduction in size of meals
4. Restrict consumption of adults to allow more for children
5. Feed working members at the expense of non working
6. Swapped food consumption to less preferred or cheaper meals
7. Borrow food from a friend or relative
8. Purchase food on credit
9. Consume wild foods (normal wild food)
10. Consume immature crop
11. Consume decomposed fish
12. Consume toxic / taboo foods (acacia pod / bitter fruit)
13. Food consumption of seed stock
14. Send household members to eat elsewhere.
15. Withdraw child(ren) from school
16. Begging or engaging in degrading jobs.
17. Individual migration out of the area.
18. Household migration out of the area
19. Sale of farm implements
20. Sale of milking livestock
21. Sale of household goods

7. At this moment what is the main source of food for the household?

1. Own produce
2. Purchased food.
3. Remittances from relatives and friends.
4. Relief food
5. Others (Specify)_____.

II. Food Preservation and storage

a) Prepared foods

1. How do you handle leftover food in the household?

1=Animal feed 2=Donate 3=Discard 4=Store and eat later 5=Other (specify)

2. Which foods are frequently prepared in excess / not consumed fully and how long are they stored? (By which method of preservation)

Food	Storage duration	Preservation method

b) Unprocessed foods:

3. Method of storage and preservation used and types of food involved (if any)

Food stuff	Storage method / facility	Preservation method

Preservation Methods

1=Smoking

2=Salting

3=Pasteurization

4=Canning

5=Cooling

6= Chemicals

7= Any biological mechanism

8= Other (specify)

3. Sanitation / Hygiene, Morbidity and Nutritional status:

a) Sanitation / Hygiene:

1. Where do you obtain your water?

1= River 2=Tap 3=Borehole 4=Well 5=Other (Specify)

2. Do you do anything to the water before use?

1=Yes 2=No

3. M

ode of treatment

1=Chemical 4=(2 and 3)

2=Boiling 5=(1 and 3)

3=Decantation 6=Other (Specify)

4. H

ow do you store your drinking water_____

5. H

ow do you clean household utensils?

1=Cold water only 3=(1 and soap)

2=Warm water only 4=(2 and soap)

5 = Other(Specify)

6. H

ow do you dispose refuse?

1=Composite pit 3=Bury

2=Burn 4=Throw in farm

7.

i)

Availability of toilet in the household and hygienic condition

1=Yes 2=No

ii)Condition of the toilet _____

8.

C

children (6-59 months) information

Name of child.....				Date of birth.....				Sex.....			
Immunization									Vitamin A last 6 month	Deworming in the last 6 months	
BCG	OPV0	DTP1	OPV1	DTP2	OPV2	DTP3	OPV3	Measles			

9.

M

orbidity experience within the last two weeks

Symptom / sign	Experienced (Tick of X)
Constipation	
Abdominal pain	
Oral thrush	
Ulcers	
Cough	
Fever	
Diarrhea	
Skin rashes	
Bone pains	
Retarded growth	
Anemia	
Poor	

Anthropometry

No.	Weight(Kg)	Average	Height (cm)	Average

10. HOUSEHOLD DIETARY DIVERSITY SCORE

Please describe the food (meals and snacks) that you or anyone else in the household ate yesterday during the day and night, starting with the first food eaten in the morning.

[Note for enumerator: excluding food purchased or eaten outside the home.]

Question number	Food group	Example	Yes or No
1	Cereals	Bread, noodles, biscuits, cookies or any other food made from millet, sorghum, maize, rice, wheat plus insert local foods e.g. ugali, nshima, porridge or pastes or other locally available grains.	
2	Vitamin A rich vegetables and tubers	Pumpkin, carrots, squash or sweet potatoes that are yellow or orange inside + other locally available vitamin A rich vegetables.	
3	White tubers and roots	White potatoes, white yams, cassava, or foods made of roots, green bananas also.	
4	Dark green leafy vegetables	Pepper, dark green / leafy vegetables including wild ones + locally available vitamin A rich food e.g cassava leaves, amaranths (mchicha) e.t.c	
5	Other vegetables	Other vegetables including wild vegetable	
6	Vitamin A rich fruits	Ripe mangoes, papayas, other locally available vitamin A rich foods, bananas	
7	Other fruits	Other fruits including wild fruits.	
8	Meat	Beef, pork, lamb, goat, rabbit, wild game, chicken, duck or other birds, liver, kidney, heart or other organ meats or blood based foods.	
9	Eggs		

10	Fish	Fried or dried shell fish	
11	Legumes and seeds	Beans, peas, lentils, nuts, seeds or foods made from these	
12	Milk and mil products	Milk, cheese, yoghurt and other milk products	
13	Oil and fats	Oil, fats or butter added to food or used for cooking.	
14	Sweets	Sugar, honey, sweetened soda or sugary foods such as chocolates, sweets or candies	
15	Spiced and caffeine or alcoholic beverages	Spices, coffee, tea, alcoholic beverages or local examples	
A	Do you or anyone in your household eat anything (meal or snack outside of the home yesterday)?		

11. FOOD SUPPLEMENTATION AND DRUG INTAKE:

Show description of any current intake of supplements / drugs by any member of the

household.....
.....
.....
.....
.....

CASE SHEET: HIV PROGRESSION IN THE INFECTED

Questionnaire No.

Date.....

Health facility.....

Code of patient.....

Patient's village.....

Patient's sub location.....

Date	Weight (Kg)	CD4 count (cells / ml)	TLC	Therapy administered	Stage of development

