HIV/AIDS AND FOOD SECURITY IN RUFIJI DISTRICT, TANZANIA

BY

KIM ABEL KAYUNZE

A THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

2008

ABSTRACT

Although the prevalence of HIV/AIDS and food insecurity were relatively high in Rufiji District in the mid-2000s, the extent to which they were linked was empirically unknown. Therefore, a research for this thesis was done with the ultimate objective to determine the linkage between HIV/AIDS and food security at the household level. The main indicator of HIV/AIDS was a household having lost an adult member due to AIDS from January 2003 to December 2005; the main indicator of food security was dietary energy consumed (DEC) per adult equivalent per day. Data were collected among 225 households between November 2005 and October 2006 through Participatory Rural Appraisal (PRA), Household Income and Expenditure Survey (HIES) and structured interviews. Binary logistic regression was used for analysis and the dependent variable was food security in terms of food insecure (0) and food secure (1) based on kilocalories consumed per adult equivalent per day. The independent variables included having been affected by HIV/AIDS in terms of not affected (0) and affected (1). The results reveal that the odds for households affected by HIV/AIDS to be food secure were 0.705 times as high as the odds for households not affected by HIV/AIDS to be food secure. This means that households affected by HIV/AIDS were less likely to be food secure in comparison with those not affected by HIV/AIDS. The B statistic for having been affected by HIV/AIDS was negative (B = -0.350) meaning that being affected by HIV/AIDS had negative impact on food security. However, the Wald statistic that shows the magnitude of impact was small (0.251) and not significant (p = 0.617) implying little impact of HIV/AIDS on food security. Based on these findings, it is concluded that although being affected by HIV/AIDS has negative impact on food security, it does not automatically make households food insecure, especially in a short run, and that some non-HIV/AIDS factors have bigger impact than that of HIV/AIDS on food security. On the basis of the

conclusion, it is recommended that efforts to improve food security among households affected by HIV/AIDS should consider both HIV/AIDS and non-HIV/AIDS factors.

TABLE OF CONTENTS

DECLARATION

I, Kim Abel Kayunze, declare to the Senate of Sokoine University of Agriculture that this thesis is my own original work and that it has neither been nor is concurrently being submitted for a higher degree award in any other university.

Kim Abel Kayunze

(PhD Candidate)

21/11/2008

Date

The above declaration is confirmed

Prof. Eleuther Alphonce Mwageni

(Supervisor)

21/11/2008

Date

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ACKNOWLEDGEMENTS

The success of this PhD owes much to the Rockefeller Foundation which through Sokoine University of Agriculture (SUA) funded the Food Security and Nutrition Monitoring (FSNM) Project that had one training opportunity at the PhD level which I benefited from. Therefore, I profoundly thank the Rockefeller Foundation for the financial support. Immensely, I thank my supervisor, Professor Eleuther Alphonce Mwageni, who guided me throughout the study from development of the research proposal to writing-up of the thesis. Moreover, I thank the Rufiji Health and Demographic Surveillance System (HDSS) Staff who helped me collect data for the research. I also thank leaders of 12 villages who organised some villagers to take part in Participatory Rural Appraisal (PRA) for this research and Mr. Rasel Madaha and Ms. Sarah Novaty who were note-takers during the PRA. Besides, I thank the participants in the PRA. Further, I thank respondent households whose members spared their precious time responding to questions for this research during Household Income and Expenditure Survey (HIES) and during structured interviews. Besides, I thank all staff at the Development Studies Institute (DSI) of SUA for their good cooperation which was an input to the success of this thesis. In a special way, I thank my colleagues Dr. Jonathan S. Mbwambo and Mr. Justin K. Urassa who gave me invaluable comments on the conceptual framework of the PhD research and on the preliminary draft of the thesis respectively, thereby giving me opportunities to reflect on the same for amelioration.

During the PhD programme, SUA-UMB Programme for Agricultural and Natural Resources Transformation for Improved Livelihoods (PANTIL) sponsored me to pursue a five-month young professional programme at the Norwegian University of Life Sciences (UMB) at Ås in Norway. This enabled me to attend doctoral lectures at UMB

and get new knowledge which enabled me to enrich my PhD thesis with new literature. Therefore, I greatly thank PANTIL for the scholarship and Prof. Jairo. A. Matovelo and Prof. Eik O. Lars who were coordinating the programme and saw to it that my stay at UMB was a success. I also thank Prof. Tor A. Benjaminsen of UMB for reading my two paper manuscripts from the thesis, which were titled "Various Methods of Food Security Determination with a Case Study from Rufiji in Tanzania" and "Entitlement to Food and Food Insecurity in Rufiji District, Tanzania". Lastly, but not least, I thank every one else who contributed to the success of the thesis in one way or another. However, I bear all responsibility to any shortcomings that may be found in the thesis.

DEDICATION

This thesis is dedicated to my wife Sarah and our sons Innocent, Felix and Aneurin whom I urge to emulate my success. It is also dedicated to my father, the Late Mr. Abel Ruhokeye Kayunze, who passed away on 30 September 2004, only three weeks after I had started my PhD study programme on 9 September 2004. May the Almighty God rest his soul in eternal peace. Moreover, it is dedicated to my mother Mrs. Lessa Halugwa Kayunze whose moral support and prayers for my studies have contributed to the success.

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

AIDS	-	Acquired Immunodeficiency Syndrome
ANOVA	-	Analysis of Variance
ART	-	Anti-retroviral Treatment
BMI	-	Body Mass Index
BoT	-	Bank of Tanzania
BS	-	Bureau of Statistics
CBO	-	Community-Based Organisation
CHF	-	Community Health Fund
CHGA	-	Commission on HIV/AIDS and Governance in Africa
CSW	-	Commercial Sex Worker(s)
CWFS	-	Committee on World Food Security
DEC	-	Dietary Energy Consumed or Consumption
DEI	-	Dietary Energy Intake
DfID	-	British Government's Department for International Development
DHS	-	Demographic and Health Survey
FAD	-	Food Availability Decline
FANR	-	Food, Agriculture and Natural Resources
FAO	-	Food and Agriculture Organisation
FBO	-	Faith-Based Organisation
FFSA	-	Forum for Food Security in Southern Africa
FHH	-	Female-Headed Household (s)
FINCA	-	Foundation for International Community Assistance
FSNM	-	Food Security and Nutrition Monitoring
GRA	-	Guardian Reporter and Agencies

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H/A	-	Height for age
HAHA	-	Household(s) Affected by HIV/AIDS
HBS	-	Household Budget Survey
HDSS	-	Health and Demographic Surveillance System
HIES	-	Household Income and Expenditure Survey
HIV	-	Human Immunodeficiency Virus
HNAHA	-	Household(s) not Affected by HIV/AIDS
IGA	-	Income-Generating Activity or Activities
IMF	-	International Monetary Fund
LGA	-	Local Government Authority
MDC	-	Makete District Council
MDG	-	Millennium Development Goal(s)
MHH	-	Male-Headed Household(s)
MoH	-	Ministry of Health
MSF	-	*Médecins sans Frontières*, i.e. Doctors without Frontiers
NACP	-	National AIDS Control Programme
NBS	-	National Bureau of Statistics, Tanzania
NCPI	-	National Consumer Price Index
NFA	-	Non-farm Activity or Activities
NGO	-	Non-Governmental Organisation(s)
NMSF	-	National Multi-Sectoral Framework on HIV/AIDS
NVF	-	New Variant Famine
OI	-	Opportunistic Infection(s)
OSSREA	-	Organisation for Social Science Research in Eastern and Southern Africa

PANTIL	-	Programme for Agricultural and Natural Resources Transformation for Improved Livelihoods
PHAC	-	Public Health Agency of Canada
PLWHA	-	People Living with HIV/AIDS
PRA	-	Participatory Rural Appraisal
PRS	-	Poverty Reduction Strategy
RDC	-	Rufiji District Council
RDHSS	-	Rufiji Health and Demographic Surveillance System
REPOA	-	Research on Poverty Alleviation
ROSCA	-	Rotating Savings and Credit Association
RUDIDEA	-	Rufiji District Development Association
RUTESCCO	-	Rufiji Teachers' Savings and Credit Cooperative Society
SADC	-	Southern African Development Community
SIDA	-	Swedish International Development Cooperation Agency
SPSS	-	Statistical Package for Social Sciences
SUA	-	Sokoine University of Agriculture
TACAIDS	-	Tanzania Commission for AIDS
TB	-	Tuberculosis
TFNC	-	Tanzania Food and Nutrition Centre
UMB	-	*Universitetet for Miljø-og Biovitenskap*, i.e. Norwegian University of Life Sciences
UN	-	United Nations
UNAIDS	-	Joint United Nations Programme on HIV/AIDS
UNGA	-	United Nations General Assembly
URT	-	United Republic of Tanzania
USA	-	United States of America

USAID	-	United States Aid for International Development
VA	-	Verbal Autopsy
VAC	-	Zambia Vulnerability Assessment Committee
VCT	-	Voluntary Counselling and Testing
VEO	-	Village Executive Officer(s)
W/A	-	Weight for age
W/H	-	Weight for height
WB	-	World Bank
WHO	-	World Health Organisation

CHAPTER ONE

1.0 INTRODUCTION

1.1 Overview

In this chapter, general information on HIV/AIDS and food security globally, regionally and nationally is given to show the magnitude of the problems of HIV/AIDS and food insecurity as background information. Moreover, the problem for the research is stated; justification of the research is given; the objectives and hypotheses of the research are stated; the conceptual framework of the research is described and illustrated; and the limitations of the research are explained. The conceptual framework has deliberately been introduced early in the thesis since it guides not only the results and discussion but also literature that is reviewed in the subsequent chapter.

1.2 Background Information on HIV/AIDS and Food Insecurity

HIV/AIDS and food insecurity are dreadful problems which mainly affect the least developed countries. The high proportions of people affected by the two problems in the least developed countries show the dreadfulness of the problems. With respect to HIV/AIDS, since the first AIDS victims were clinically diagnosed in the United States of America in 1981 and in Uganda in 1982 (Willis, 2002; Fan *et al.*, 2000), the proportion of people living with HIV/AIDS (PLWHA) has been increasing relentlessly despite efforts to contain the HIV/AIDS pandemic. For example, by December 2006, there were about 47.1 million PLWHA (UNAIDS/WHO, 2006) while the proportions of such people were 45.3 million in 2005, 44.3 million in 2004, 43.0 million in 2003, 42.0 million in 2002, 39.0 million in 2001, and 35.4 million in 2000 (UNAIDS and WHO, 2007). However, using an advanced methodology for estimating HIV/AIDS prevalence in 2007, the estimated number of PLWHA worldwide in 2007 was 33.2 million, which

was less by 16% vis-à-vis the estimate published in 2006 (UNAIDS/WHO, 2007). However, the qualitative interpretation of the severity and implications of the pandemic changed little, with Sub-Saharan Africa continuing to be the region most affected by the pandemic. Of the 33.2 million PLWHA worldwide in 2007, 22.5 million (about 68%) were living in Sub-Saharan Africa (UNAIDS and WHO, 2007).

In Tanzania, the first three AIDS cases were diagnosed in Kagera Region in 1983. They were followed by so rapid spread of the pandemic that by 1986 all the regions of Tanzania Mainland had reported AIDS cases, and by 2003 there were about 1 820 000 PLWHA (TACAIDS, NBS, and ORC Macro, 2005). According to the same source of information, HIV/AIDS prevalence in sexually active adult population (15 to 49 years) was 7.0% in 2004, but according to (URT, 2003) the prevalence was 12% in 2002. This implies that the prevalence of HIV/AIDS has been declining.

With regard to food insecurity, globally, food security has been improving. For example, according to FAO (2007b), the proportion of undernourished people in developing countries decreased from 37% in 1969–71 to 17% in 2002–04 due to increased per capita food production and consumption. FAO (2007b) also reports that the number of undernourished people in the developing world declined from 960 million in 1969–71 to 830 million in 2002–04. However, the situation is still worse in Sub-Saharan Africa where 25% of the undernourished people in the developing world live, and where one-third of the people suffer from chronic hunger.

In Tanzania, 19% of Tanzanians were living below the national food poverty line of TSh 5295 per adult equivalent for 28 days and below a caloric poverty line of 2200 kCal per adult equivalent per day in 2000/01 (NBS, 2002). These figures of food

insecurity and HIV/AIDS prevalence are high. Accordingly, and in line with the Millennium Development Goals (MDGs), Tanzania has formulated policies to reduce food insecurity as well as halt and reverse HIV infection. The policies have been included in the priority issues for development in the light of the Poverty Reduction Strategy (PRS). On food insecurity, the objective is to reduce the proportion of food insecure people from 19% in 2000/01 to about 14% by 2010 (URT, 2005c), in line with the second part of MDG Number One, which is to "reduce by half the proportion of people who suffer from hunger by 2015". With regard to HIV/AIDS, in 1999, the pandemic was declared a national disaster to be fought against with concerted efforts. Accordingly, a National Policy on HIV/AIDS (URT, 2001a) and a National Multi-sectoral Strategic Framework (NMSF) on HIV/AIDS (2003-07) (URT, 2003) have been formulated to guide the war against the disaster.

The fight against HIV/AIDS is partly based on the fact that it impinges negatively on various development issues, including food security. According to Topouzis (1999), the linkage between HIV/AIDS and food security includes on-farm labour quality and quantity being reduced; reduction of land area under cultivation due to shortage of resources; reduction in the ability to control crop diseases, pests and weeds; and loss of soil fertility due to abandoning traditional farming practices that are labour-intensive. Moreover, the linkage includes decline in the range of crops grown per household; changes in cropping patterns and shift from cash crop production to subsistence production; decline in crop yield due to delay in carrying out certain agricultural activities; and spending money that would be used to buy agricultural inputs or food on treatment of diseases associated with HIV/AIDS and mourning of relatives passed away due to AIDS. HIV/AIDS is also linked to food security by leading to decline in livestock production due to labour shortage and loss of agricultural knowledge and farm

management skills due to death of one or both parents due to AIDS hence younger members of the family lack necessary agricultural knowledge and family members and other relatives of HIV/AIDS victims use considerable amount of time to take care of the victims, especially when they are seriously ill.

Despite the above linkages between HIV/AIDS and food security being widely accepted, literature claiming that there is no linkage between HIV/AIDS and food security is increasing. For example, Scott (2003, cited by Bolton, 2003) asserts that the exaggeration of the linkage between HIV/AIDS and food insecurity is just a way for the HIV/AIDS people at the UN to get food security money and for the food security people to get HIV/AIDS money; and Broemmelsiek (2003, cited by Bolton, 2003) argues that the debate over the link between HIV/AIDS and food security is largely an academic one which distracts attention from the very real victims of both these problems.

Rufiji District in the Coast Region in Tanzania is one of the places where the prevalence of HIV/AIDS and food security is relatively high. For example, the prevalence of HIV/AIDS was 8.0% in 2004 (RDC, 2005) while the Coast Region and national HIV/AIDS prevalence figures were 7.3% and 7.0% respectively in the same year (TACAIDS *et al.*, 2005). The presence of food insecurity in the district is indicated by information available in the Coast Region Socio-Economic Profile which says that all the districts of the Coast Region do not produce adequate food for feeding their populations (NBS and URT, 1997). The presence of food insecurity is also indicated by information obtained from one of the local leaders in the research area before starting the research, which was as follows: "From March to August after harvesting maize in March and rice in June, we have abundant food, but for about five months from August

to December about 65% of the households in this village (Kibiti A Village) have food shortage" (Ramadhani Idd Manyema, Kibiti Ward Executive Officer, Personal Communication, May 2005). Besides food insecurity, malnutrition in the district is a common underlying cause of mortality among under-five-year old children. Accordingly, though the under-five-year-old children are only 17% of the population, they account for 48% of mortality (MoH, 2004).

1.3 Problem Setting

1.3.1 Problem statement

Rufiji District has relatively high prevalence of HIV/AIDS while it has few visitors and is rather landlocked in comparison with the headquarters of Coast Region in which it is located and where the traffic of heavy duty vehicles is light. Moreover, although the district has vast land including Rufiji River Basin that is fertile and Rufiji River water that could be used for irrigation to produce much food by the residents of the district, most of whom are food producers, food insecurity is there. Although the two problems of food insecurity and HIV/AIDS prevail, the extent to which they were linked was not empirically known because no research had been done to gauge the extent.

Since the district has vast land, fertile Rufiji River Basin and Rufiji River water that can be used for irrigation, one would expect the area to have high food security since the land and water could be used to produce surplus food. Moreover, since the area is located where the traffic of heavy-duty vehicles is relatively light and where there are relatively few visitors, little prevalence of HIV/AIDS would be expected since places without heavy duty vehicles workers and where drivers of such vehicles and their assistants do not rest on transit have been found to have lower prevalence of HIV/AIDS than places with such vehicles and many visitors (Kulis *et al.*, 2004).

1.3.2 Research justification

Some previous researches on the linkage between HIV/AIDS and food security have been criticised for describing the linkage between the two problems rather than quantifying it. For example, Scicchitano and Whitlock (2002) criticize Rugalema (1999) for describing effects of HIV/AIDS on agriculture in Kenya as being alarming in lieu of quantifying the situation with numbers. In other researches, the authors have admitted the fact that quantifying the linkage between HIV/AIDS and food security is not easy. For example, Barnett *et al.* (1995) caution that it is difficult to disentangle AIDS impact on food security from impacts of other factors. Therefore, the research for this thesis was part of academic efforts to quantify the effects of HIV/AIDS and differentiate them from effects of non-HIV/AIDS factors.

The research was in line with Millennium Development Goals (MDGs) Numbers 1 and 6, which are to: "Eradicate extreme poverty and hunger" and "Combat HIV/AIDS, malaria and other diseases", respectively (Martín-Hutardo *et al.*, 2002). The above MDGs are also reflected in the Tanzania's National Strategy for Growth and Poverty Reduction (NSGRP) which, in its Second Cluster of poverty reduction outcomes, states as follows: "Improvement of quality of life and social well-being depends on the provision, affordability and access to quality food and services like education, information, health, water, HIV and AIDS treatment and prevention, and social protection programmes" (URT, 2005c).

The research was important to generate empirical information on linkages between HIV/AIDS and food security on which planning development projects at the village, ward and district levels in the light of the MDGs and NSGRP cited above might be based to solve the problems of food insecurity and HIV/AIDS. Not only that, but also

the research aimed at contributing to the attainment of one of the objectives of the Rufiji Food Security and Nutrition Monitoring (FSNM) Project, which, in collaboration with Rufiji Health Demographic Surveillance System (HDSS), was collecting longitudinal demographic data linking them with food security and health in the research area from 2004 to 2007. The objective of the project that this research addressed was analysing linkages between HIV/AIDS and food security, as part of the efforts of the project to determine linkages between food security and health.

1.4 Objectives of the Research

1.4.1 General objective

The general objective of the research was to examine the linkages between HIV/AIDS and household food security.

1.4.2 Specific objectives

The specific objectives of the research were to:

(a) Assess qualitatively the prevalence of HIV/AIDS and food security;

(b) Examine the status of food security;

(c) Establish the association of the amounts of food produced, assets owned, dietary energy consumed, and under-five-year old children's anthropometrics with having lost a household member due to HIV/AIDS;

(d) Identify food insecurity coping strategies; and

(e) Establish the level of poverty in the households.

1.5 Null Operational Hypotheses

(a) The amounts of food produced do not differ significantly between households affected and those not affected by HIV/AIDS and in households with different non-HIV/AIDS factors.

(b) Dietary energy consumption per adult equivalent per day does not differ significantly between households affected and those not affected by HIV/AIDS, in households affected by HIV/AIDS before and after being affected, and in households with different non-HIV/AIDS factors.

(c) The odds of households affected by HIV/AIDS to be food secure are the same as the odds of households not affected by HIV/AIDS to be food secure.

1.6 Conceptual Framework

The linkage between HIV/AIDS and food security was analysed hypothesizing that HIV/AIDS and food security are mutually related and that some other non-HIV/AIDS factors also affect food security concurrently. Fig. 1 helps to discern the linkages of various variables. The mutual relationship between HIV/AIDS and food security was conceived of existing by HIV/AIDS affecting food security through decreased agricultural production and productivity and in turn food insecurity influencing HIV/AIDS through poor nutrition and doing survival activities that are risky for HIV infection. In the light of the conceptual framework given in Fig. 1, attaining food security in terms of dietary energy consumed (DEC) depends on breaking a vicious cycle of interaction between HIV/AIDS and non-HIV/AIDS factors on one hand and proxy indicators of food security on the other hand which are food supply, food entitlement and coping with food shortage factors.

The variables for this research which are presented in Fig. 1 are in three categories of background, independent and dependent variables. The background variables are in two sub-categories of HIV/AIDS variables (whose main indicator in this research was adult death due to AIDS) and non-HIV/AIDS variables (whose main indicators in this research were socio-demographic and agro-ecological ones). The independent variables are mainly indicated by proxy indicators of food supply (including amounts of food harvested and stored), entitlement to food (including assets owned and cash used to buy food), indicators of reciprocal relationships between HIV/AIDS and food security (including those by which HIV/AIDS affects food security and vice versa), and indicators of strategies for coping with food insecurity.

The dependent variable is indicated by dietary energy consumed (DEC). The main indicator of HIV/AIDS used in this research is death of an adult household member due to AIDS. It was chosen since it was a more objective indicator of HIV/AIDS at the household level and Rufiji HDSS was dealing with HIV/AIDS very confidentially. Identification of households affected by HIV/AIDS for this research was easy since Rufiji HDSS was ascertaining objectively deaths due to AIDS by using verbal autopsy (VA) questionnaire copies filled out by clinicians working in the area. The information on the questionnaire copies was being interpreted by two independent physicians. The other household level indicators of HIV/AIDS, namely chronic illness, opportunistic infections and presence of orphans due to AIDS were sparingly used because of high confidentiality in dealing with HIV/AIDS in the Rufiji HDSS Area and because they are less objective.

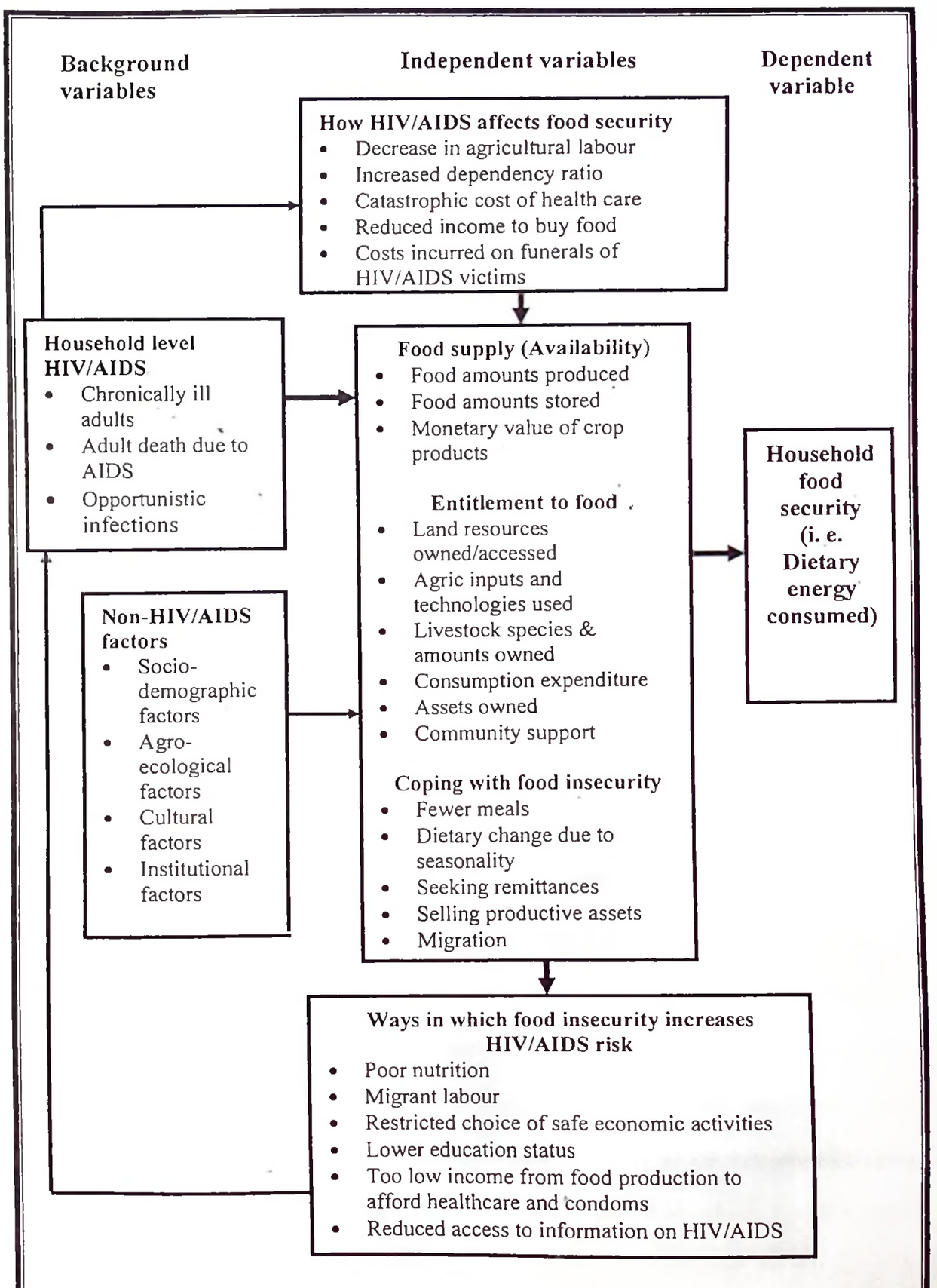

Figure 1: The conceptual framework of the research

1.7 Limitations of the Study

The research had two main limitations, namely using mainly one indicator of HIV/AIDS at the household level and using enumerators to collect all the quantitative information. The main indicator used for being affected by HIV/AIDS at the household level was having lost a household member due to AIDS between January 2003 and December 2005. Relying on the indicator was influenced by the reality that in the Rufiji HDSS Area where the research was done HIV/AIDS was being dealt with confidentially. Using the other indicators of HIV/AIDS was avoided so that the confidentiality about HIV/AIDS that Rufiji HDSS was maintaining could not be leaked out. If that had not been the case, all the four indicators of HIV/AIDS at the household level indicated in Fig. 1 could have been used. The reliability of the indicator was improved by ensuring that all the households recorded as affected by HIV/AIDS had indeed lost an adult member due to AIDS according to Verbal Autopsy information translated by two independent physicians, which was in the Rufiji HDSS database.

Collection of quantitative data using household income and expenditure survey and questionnaire copies which was done by enumerators of the Rufiji HDSS Area and their supervisors was influenced by the reality that the Rufiji HDSS staff were experienced in data collection in the area and the people in the area were used to the staff hence they trusted them and so they could cooperate well with them. The people of the area, due to being interviewed at least thrice a year by Rufiji HDSS staff and some other researchers, were already exhausted with repeated interviews hence they were likely to dodge an interview or give hasty answers, especially to new researchers. This limitation was mitigated by the author training the enumerators on data collection for this research and staying in the research area during the data collection exercise to supervise the data collection process and clarify any difficulties.

CHAPTER TWO

2.0 LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Overview

In this chapter, literature that is related to the issues conceptualised in Section 1.6 and Fig. 1 is reviewed. The concept of HIV/AIDS, its indicators, levels of its prevalence in various places and determinants of HIV infection are reviewed in Section 2.2. The concept of food security, its conceptual and theoretical determinants and how to cope with food insecurity are reviewed in Section 2.3. Theoretical and contentious issues regarding the linkage between HIV/AIDS and food security are reviewed in Section 2.4. In the last section of this chapter, Section 2.5, a review of the status of research on HIV/AIDS and food security in Tanzania is given together with the paucity in literature that this study fills in.

2.2 Human Immunodeficiency Virus and Acquired Immunodeficiency Syndrome

2.2.1 HIV/AIDS: An epidemic and a pandemic

HIV is an acronym for the Human Immunodeficiency Virus which causes the Acquired Immunodeficiency Syndrome (AIDS) (Fan *et al.*, 2000). The virus attacks the immune system, the body's "security force", which fights off infections. When the immune system breaks down, the victim loses this protection and can develop "opportunistic infections" (OI), which are deadly and include cancers (Willis, 2002). According to Willis (2002), HIV/AIDS is both an endemic and a pandemic because it exhibits characteristics of both of the following definitions. An epidemic is a disease affecting a great number of people in communities in a certain time moving from place to place, while a pandemic is a widespread endemic.

About 50% of HIV victims become infected before they reach 25 years of age, and about 50% of the victims die before reaching 35 years of age (Willis, 2002). On average, 65% to 85% of Africans suffering from AIDS die within 3 years due to failure to treat appropriately opportunistic diseases associated with AIDS, which ruin the immune system. Tuberculosis, pneumonia, meningitis, diarrhoea, or other opportunistic diseases, depending on which immune system is ruined first, mainly cause the deaths. People of other countries, especially in developed countries where medical services are better, die within 10 years (Willis, 2002).

2.2.2 Indicators of HIV/AIDS

In order to measure the linkage between HIV/AIDS and food security, one has to have indicators of both HIV/AIDS and food security. Because of this prerequisite, indicators of HIV/AIDS have been developed to ease activities of measuring it universally. Some ways of measuring HIV/AIDS have been developed by WHO and UNAIDS (2000), whereby the indicators of HIV/AIDS are divided into three categories of biological, behavioural, and socio-demographic indicators. Biological indicators include: (a) HIV prevalence; (b) STI prevalence; (c) TB prevalence; (d) number of adult AIDS cases and (e) number of paediatric AIDS cases. Behavioural indicators include: (a) sex with a non-regular partner in the last 12 months; (b) condom use at last sex with a non-regular partner; (c) age at first sex among youths; (d) reported sharing of unclean injecting equipment among drug abusers and (e) reported number of clients in the last week among sex workers. Socio-demographic indicators of HIV/AIDS include: (a) age; (b) sex; (c) socioeconomic and educational status; (d) an indication of residence or migration status and (e) marital status. Such basic socio-demographic variables are recommended for attaching with specimens for HIV testing to allow for comparison of

those tested with the clinic population as a whole as well as for comparison with the population from which the sample was drawn.

The above indicators are more suitable at the individual level, but at the household level, which is the level for HIV/AIDS measurement in this research, O'Donnell (2004) argues as follows: "in reality there are three main ways in which a household can be affected by AIDS: (a) chronic illness; (b) death of a household member and (c) support of orphans. Being chronically ill is conventionally defined as "an adult aged 15-49 years being ill for at least three consecutive months during the last 12 months that received external unpaid help in caring for the patient or replacing the lost income" (USAID/UNAIDS/UNICEF/ WHO/CDC, 2006). However, this variable was not much used to avoid its use increasing stigma because HIV/AIDS was being dealt with confidentially in the Rufiji HDSS Area where the research was conducted. Moreover, using chronic illness is subjective since it might not be possible to distinguish between AIDS and other chronic illnesses, especially at the HIV stage unlike at the AIDS stage (due to the symptoms rather than formal testing). Therefore, in the absence of formal knowledge of HIV status, proxy indicators are most commonly used. Some common proxy indicators of HIV/AIDS are described below, with their shortcomings, according to O'Donnell (2004).

One of the proxy indicators of HIV/AIDS at the household level is the presence of a chronically ill adult in a household whose shortcomings have just been explained. Another proxy indicator of HIV/AIDS at the household level is recent adult death. It is advisable to qualify the death with the words "following chronic illness" and specify the date of death to understand effects over time. This indicator is more objective, especially if it is ascertained medically. Orphanage is another indicator of HIV/AIDS at

the household level, whereby specification of sex and age of the orphan and whether he/she lost only his/her mother, father or both parents must be done and whether the orphan is part of the nuclear family or has come from another family. Child household headship is also a proxy indicator of HIV/AIDS at the household level, which is reliable since it is less likely to have other causes.

2.2.3 Levels of HIV/AIDS based on some indicators

Levels of HIV/AIDS can be recorded based on all the indicators reviewed in Sub-section 2.2.2. However, it is rare to find HIV/AIDS data recorded using all the indicators; the most commonly used indicators are: (a) people living with HIV/AIDS (PLWHA); (b) people newly infected with HIV; (c) HIV/AIDS prevalence among adults and (d) adult and child deaths due to AIDS. Based on these indicators, the levels of HIV/AIDS in the world, comparing worldwide and Sub-Saharan African statistics, are given in Table 1.

Based on the data presented in Table 1, one finds that in 2007 about 68% of all People Living with HIV/AIDS (PLWHA) in the world were living in Sub-Saharan Africa (SSA). The figure has been calculated by taking the number of PLWHA in SSA in 2007 (22.5 million), dividing it by that of all PLWHA in the world in 2007 (33.2 million), and multiplying it by 100, i.e. $22.5/33.2 \times 100 \approx 68\%$. It was in the same region where more than three quarters (76%) of all AIDS deaths globally occurred in 2007 (UNAIDS and WHO, 2007). In the SSA region, a sub-region of eight Southern Africa countries in which HIV/AIDS prevalence exceeds 15% is the one that has been hit the hardest by HIV/AIDS in the world. The sub-region accounted for 35% of all people living with HIV/AIDS and almost one third (32%) of all new HIV infections and AIDS deaths

globally in 2007. The countries are Botswana, Lesotho, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe (UNAIDS and WHO, 2007).

The data in Table 1 also show that there were some improvement and worsening of HIV/AIDS levels between 2001 and 2007 based on various indicators. Worsening conditions were with regard to the proportions of adults and children living with HIV whereby worldwide the proportion increased by about 14%, while it did so by about eight percent in Sub-Saharan Africa. Worsening was also with respect to the proportion of adult and child deaths due to AIDS, which increased by about 24% worldwide but by about 14% in Sub-Saharan Africa. Unlike the worsening situations pinpointed above, it is heartening to learn that there was improvement with regard to the proportion of adults and children newly infected with HIV whereby worldwide it decreased by about 22% but by about 23% in Sub-Saharan Africa. Improvement was also with respect to the proportion of HIV/AIDS prevalence among adults, which decreased by about 14% in Sub-Saharan Africa but remained the same (0.8%) worldwide.

Table 1: Regional HIV/AIDS statistics in 2001 and 2007

Indicator of HIV/AIDS	Worldwide		Sub-Saharan Africa	
	2001	2007	2001	2007
Adults and children living with HIV (millions)	29.0	33.2	20.9	22.5
Adults & children newly infected with HIV (millions)	3.2	2.5	2.2	1.7
Adult HIV prevalence (%)	0.8	0.8	5.8	5.0
Adult and child deaths due to AIDS (millions)	1.7	2.1	1.4	1.6

Source: UNAIDS and WHO (2007)

Looking closely at the changes in the above regional HIV/AIDS statistics between 2001 and 2007, one finds that where there was worsening of the situation worldwide, it was

less so in Sub-Saharan Africa and where there was improvement worldwide it was more so in Sub-Saharan Africa. This shows that, albeit currently Sub-Saharan Africa is the region having the greatest proportions of people affected by HIV/AIDS based on various indicators, it is making promising strides towards attainment of the sixth Millennium Development Goal "to halt and begin to reverse the spread of HIV/AIDS by 2015." The promising strides have been a result of concerted efforts to control HIV/AIDS. For example, in recent years most countries in Sub-Saharan Africa have conducted population-based HIV surveys to get data to inform strategies to control HIV/AIDS. Some of the data from the surveys are given in Table 2, with the aim to compare the situation in those countries with the situation in Tanzania.

In Table 2 "adult" means 15 to 49 years old. The data in Table 2 show that Tanzania is among the 10 countries most affected by HIV/AIDS not only in Sub-Saharan Africa but also in the world. This is known among Tanzanian leaders and academicians since it is documented in working documents. For example, URT (2005b) documents as follows: "...Tanzania is among the 12 countries worst affected by HIV/AIDS in the world." However, in comparison with the eight countries that have most been affected by HIV/AIDS as seen above, Tanzania, with 7.0% HIV/AIDS prevalence in 2004, has much less HIV/AIDS prevalence. The Sahel countries have the least HIV prevalence in Sub-Saharan Africa; for example, in Niger and Senegal the prevalence is as low as 0.7%.

Although the prevalence of HIV/AIDS in South Africa is lower than that in neighbouring countries of Swaziland, Botswana, Lesotho, and Zimbabwe, the situation is actually worse in South Africa since its higher population than the populations of the neighbouring countries translates into more PLWHA. Unlike the high prevalence of

HIV in Sub-Saharan Africa, there are some developing countries in other continents where the situation is much better. For example, HIV prevalence in Cambodia was 0.6% in 2005, while it was 0.3% in India in 2005–06 (UNAIDS and WHO, 2007).

In Tanzania, data on levels of HIV/AIDS at the time of writing this thesis were documented in the *Report of Surveillance of HIV and Syphilis Infections among Antenatal Clinic Attendees 2005/06* (URT, 2006); *A New Look at the HIV and AIDS Epidemic in Tanzania* (TACAIDS, 2005b); and *Tanzania: HIV/AIDS Indicator Survey, 2003-04* (TACAIDS, NBS, and ORC Macro, 2005). According to URT (2006), HIV prevalence is 8.2% among women attending antenatal clinics, with the lowest prevalence in Kigoma Region (3.5%) and the highest prevalence in Iringa Region (18.2%). Since the URT (2006) report analysed the prevalence of HIV in only 15 selected regions out of the 21 regions of Tanzania Mainland, Coast Region (the region for this research) HIV/AIDS prevalence data among women attending antenatal clinics are not readily available since the region was not selected for data collection for the URT (2006) report. The findings of TACAIDS *et al.* (2005) show that HIV prevalence in Tanzania is 7.0% for both men and women, 6.0% for men, and 8.0% for women. The 8.0% is comparable with the 8.2% prevalence among women attending antenatal clinics. Therefore, the data are consistent.

With regard to HIV prevalence among adults aged 15 to 49 years in 2004, the six least affected regions in Tanzania were Kigoma (2.0%), Manyara (2.0%), Singida (3.2%), Mara (3.5%), Lindi (3.6%), and Kagera (3.7%). Kagera used to be one among the regions with the highest prevalence of HIV/AIDS. However, due to change in sexual behaviour as a result of campaigns to control HIV/AIDS, nowadays it is among the regions with the least HIV/AIDS prevalence. This implies that we can stem HIV/AIDS

in Tanzania. In 2004, the six regions with the highest prevalence rates of HIV/AIDS in Tanzania were Mbeya (13.5%), Iringa (13.4%), Dar es Salaam (10.9%), Mtwara (7.4%), Coast (7.3%), and Kilimanjaro (7.3%) (TACAIDS *et al.*, 2005). The disparities in the prevalence of HIV/AIDS in various regions of Tanzania are partly explained by determinants of HIV/AIDS infection that apply to different extents in the regions. The determinants are reviewed in Sub-section 2.2.4.

Table 2: Adult HIV prevalence in some SSA countries

Country	HIV prevalence (%) among adults	Year of the prevalence
Swaziland	25.9	2006–07
Botswana	25.2	2004
Lesotho	23.5	2004
Zimbabwe	18.1	2005–06
South Africa	16.2	2005
Zambia	15.6	2001–02
Malawi	12.7	2004
Uganda	7.1	2004–05
Tanzania	7.0	2003–05
Kenya	6.7	2003
Central Africa	6.2	2006
Cameroon	5.5	2004
Côte d'Ivoire	4.7	2005
Burundi	3.6	2002
Chad	3.3	2005
Equatorial Guinea	3.2	2004
Rwanda	3.0	2005
Ghana	2.2	2003
Burkina Faso	1.8	2003
Guinea	1.5	2005
Sierra Leone	1.5	2005
Ethiopia	1.4	2005
Mali	1.3	2006
Benin	1.2	2006
Niger	0.7	2006
Senegal	0.7	2005

Source: UNAIDS and WHO (2007)

2.2.4 Determinants of HIV/AIDS infection

Literature on the determinants of HIV infection is enormous, but it can be grouped into macro-environment, micro-environment, cultural and biological factors (CHGA, 2004).

Corno and de Walque (2007) add social and sexual behaviour to the above groups of determinants. The classification of HIV/AIDS infection determinants into the above six categories facilitates description of the determinants; hence it is applied to the description in the following sub-sections.

2.2.4.1 Macro-environment determinants of HIV/AIDS infection

According to CHGA (2004), macro-environment determinants of HIV/AIDS infection include wealth, income distribution, legal framework, and governance. Wealth and income enable people to afford buying protective gears like condoms; hence wealthier people may be less infected by HIV/AIDS. However, this is not always so; to the contrary, the wealthier people may easily engage in sexual promiscuity because they have much money to spend on luxurious items, including sex. This is supported by findings of a study in Tanzania which showed higher prevalence of HIV among the wealthiest quintile of respondents (10.5%) while prevalence was 3.4% among the poorest quintile (TACAIDS *et al.*, 2005).

Lack of legal frameworks providing for severe punishment against people spreading HIV maliciously or practising violence against women is also among the factors fuelling HIV infection. In some countries such legal frameworks are either lacking or not enforced. For example, IOM *et al.* (2003) report that in Beitbridge, which is a very busy town in Zimbabwe on the border between Zimbabwe and South Africa, one of the factors that was exacerbating HIV infection among female commercial workers and female informal traders was forced sex in exchange for transport from taxi and truck drivers, but there were no programmes advocating for reduction of the incidents of violence. Where good governance prevails, CHGA (2004) argues, such legal

frameworks are there and are enforced to check HIV infection and safeguard human rights.

2.2.4.2 Micro-environment determinants of HIV/AIDS infection

Micro-environment determinants of HIV/AIDS infection include mobility, migration, access to health care, and levels of violence (CHGA, 2004). Mobility as a factor influencing HIV infection is widely known. Studies on this have included long distance truck drivers and youth migration from rural to urban areas. About long distance truck drivers, Chaturvedi *et al.* (2006) report that there is high prevalence of HIV and STDs among truck drivers and residents of stop-over towns because the drivers and their assistants have sex with multiple partners since they are almost always away from home; they have very difficult working conditions; most of them consume excessive alcohol; they do not use condoms consistently because to them condoms are not readily available; and sex is the most lucrative business for some women in these towns. This is supported by empirical findings of a study in India which showed that out of 162 truck drivers who gave history of commercial sex workers (CSW) exposure only 6.8% had used a condom every time they visited CSW while 60.5% of them had never used a condom while visiting CSW (Chaturvedi *et al.*, 2006).

About migration, the focus of many studies has been on highly mobile communities including male and female informal traders, sex workers, other vulnerable women such as domestic workers, migrant labourers, farming communities, mine workers, and construction workers. It is argued that low and or irregular income creates an environment that encourages labour migration. Women in such situations may be easily tempted to exchange sex for money; this puts them and their spouses at risk for HIV. A study which was conducted in Southern Africa among the above groups of people found

that farm workers' knowledge of HIV prevention and STI recognition and treatment was very low (IOM *et al.*, 2003). In Makete District, Tanzania, labour migration to work in timber processing, tea plantations in Njombe and Rungwe districts, mining and trade activities is also reported to be one among factors for HIV infection (MDC, 2005).

2.2.4.3 Cultural determinants of HIV infection

Although some cultural values are positive, there are a number of traditions and cultural practices that contribute to the spread of HIV through the subordination of women. These include female genital mutilation, wife inheritance, and forced and early marriages, especially when the husband is a much older man (CHGA, 2004). The major cultural elements that are linked with HIV transmission risk in Tanzania, according to MoH and NACP (2002), are as follows: (a) male dominance; (b) nude (naked) dancing; c) 'three cooking stones'; (d) widow inheritance (levirate); (e) casual marriages; (f) limitations within the traditional youth initiation processes and (g) alcoholism.

Male dominance is exercised by men and boys being given an upper hand over girls and women in all important issues in society, including sex. This may increase chances of HIV/AIDS spread by encouraging boys to engage in sex early and with a number of partners, and engaging in sexual risks and reckless behaviour like rape, drug abuse, unsafe sex and violence, to prove that they are 'real men'. Nude or naked dancing practices in some communities are performed, and involve women who perform the dancing by jumping into the arena lifting up their clothes or stripping them naked at the height of excitement. This is normally done late in the night when more or less everyone is drunk. This type of dance encourages people to engage in unsafe sex, predisposing them to the risk of contracting HIV.

'Three cooking stones' is a message, usually given to young girls during their initiation, exhorting them not to depend on one man alone, but at least three men. It is based on the traditional cooking pot that cannot balance on only one firestone. This gives the impression that a housewife needs not depend on her husband alone for livelihood. This is dangerous for HIV transmission. Widow inheritance, which is also called levirate, may make a HIV-negative man inherit a HIV-positive widow without knowing. This may result in contracting HIV/AIDS. Casual marriages are usually abruptly reached or sometimes non-consensual, forcing two non intimate people to live together as husband and wife. This may have implications on faithfulness between the partners, with either side likely to engage in extra marital sexual relationships. This increases the danger of HIV infection.

Limitations within the traditional youth initiation processes whereby girls' attainment of sexual maturity and boys' circumcision are celebrated to prepare them to cope with adulthood responsibilities including sexuality, are sometimes deficient in various ways including adolescents being taught about sexuality without being equipped with education for protection against HIV, such as using tools which are sterile for circumcision and female genital mutilation. Alcoholism may contribute to unsafe sex and violence, thereby transmitting HIV, if either of the partners is HIV-positive.

2.2.4.4 Biological determinants of HIV/AIDS infection

One of the ways by which HIV spreads is mother-to-child transmission (MTCT). World Bank (2000) says that the vast majority of seropositive children acquire the virus as a result of mother-to-child transmission which can occur during pregnancy, delivery, or breastfeeding. Other biological factors influencing HIV transmission are a person's genetics, immune system and biological history. About these factors, O'Malley (1996)

argues that some individuals may have increased susceptibility due to these factors. He supports this argument with a story of one man who used to get sexually transmitted diseases (STDs) through insertive oral sex, and claimed to have been infected with urethral gonorrhoea in the same way. From this talk, O'Malley (1996) believes that either due to the man's genetics, immune system, or some other biological factors, the man was not sufficiently resistant to STDs, including HIV, when exposed during insertive oral sex.

Another biological factor predisposing people to HIV infection is STD infection, especially gonorrhoea and other genital discharges. Studies have found that patients with STDs are two to nine times more likely to be infected with HIV (TACAIDS, 2006). However, (TACAIDS, 2006) argues that because HIV and other STDs are both highly associated with high-risk sexual behaviour it is difficult to show the extent to which STDs alone enhance infection of HIV.

Unsafe blood transfusion is another major determinant of HIV transmission. HIV transmission rate through transfusion of contaminated blood is almost 100%. For this reason, in Tanzania, all centres rendering this service are equipped with facilities to ensure safe blood transfusion (TACAIDS, 2006).

For biological reasons, particularly the broad internal surface areas of the female genitalia that are susceptible to abrasion, women are more vulnerable than men to HIV infection. A study that was conducted in Canada reports that male-to-female transmission of HIV is twenty-four times as efficient as female-to-male transmission (PHAC, 2005). However, it is cautioned in the study that women's biological susceptibility to HIV/AIDS is exacerbated by their social and economic circumstances,

including lack of economic resources that forces some of them into survival sex even where condom use is difficult to negotiate.

Another biological factor that is linked with HIV transmission is circumcision. Due to circumcised penises having less chances of undergoing abrasion during sexual intercourse in comparison with uncircumcised ones, circumcision is said to minimize HIV infection. For example, Nyaruhirira (2008, cited by Musoni, 2008) says: "It is a fact that men who are circumcised are 60% more likely to be protected against HIV during sexual intercourse." Accordingly, in Rwanda where male circumcision was rare, the Government started in 2007 a campaign to get all men circumcised, and the secretary of state for AIDS prevention in the country said: "We will start this campaign with the new born and young men in universities, the army and police" (Musoni, 2008). However, Corno and de Marque (2007) argue that whether circumcision minimizes HIV infection or not depends on how it is done and the sexual behaviour of circumcised people after circumcision. They corroborate their argument with a case they confirmed anecdotally in Lesotho where HIV infection was higher among circumcised men because circumcision was being done in accordance with the Basotho people's culture whereby teenagers were being circumcised by leaving a portion of the prepuce, not the whole prepuce as recommended medically, and the teenagers were soon thereafter being engaged in sexual promiscuity.

2.2.4.5 Social determinants of HIV/AIDS infection

The main social determinants of HIV infection, which are described in this sub-section, are education, marital status and area of residence. People with more formal education are expected to follow up better and practise in better ways messages about HIV infection than people without or with low formal education can do, to avoid HIV

infection. However, empirical information has mixed results, for example TACAIDS *et al.* (2005) report that in 2004 HIV/AIDS prevalence in Tanzania was 5.3% among people with no formal education but 8.2% among people with secondary school and higher education, which implies that HIV infection was positively associated with formal education. However, a study which was conducted in India showed results that were in stark contrast with the above ones: it showed that among drivers who always used a condom 63.6% had studied more than class 10, and 27.8% had studied between class six and class 10. It also showed that among drivers who had never used a condom 24.5% had studied less than class 6, 69.4% between class six and class 10, and 6.1% more than class 10. Inferential analysis of the data showed that formal education was significantly associated with condom use (Chaturvedi *et al.*, 2006). Similarly, Corno and de Walque (2007) also found that formal education was negatively associated with HIV infection in Lesotho, albeit the association was not always significant.

Another social factor that is linked with HIV infection is failure of parents to institute traditional values and discipline to their children for lack of time (TACAIDS, 2006). Moreover, according to the same source of information, increased use of the Internet and sudden mushrooming of television programmes and other mass media in Tanzania have contributed negatively to social indiscipline by the youth emulating bad sexual practices they see in the Internet and on TV screens.

With regard to marital status, it has been found that married women who have extra-marital relationships are less likely to use a condom than non-married women (Corno and de Walque, 2007). This increases chances of their getting HIV infection relative to unmarried women who are likely to use condoms always. Corno and de Walque (2007) report as follows: "*Ceteris paribus*, being formerly married increases the probability of

being HIV positive by 13.9% for men and 26.2% for women. The observation that being married is more associated with HIV infection is also supported by findings in Tanzania in 2004 which showed that only 4.6% of unmarried women who had ever had sex were HIV-positive while 7.3% of married women were HIV-positive, albeit 8% of the couples who had been affected by HIV/AIDS were discordant (TACAIDS *et al.*, 2005). Couples affected by HIV being discordant, which means that only one of the couple members is HIV-positive while the other one is HIV-negative, is also reported by Corno and de Walque (2007) who found that 41% of the couples affected by HIV in Lesotho were discordant.

With regard to area of residence (rural or urban), the dominant thinking has been that HIV infection is more prevalent in urban areas based on the belief that urban areas have higher human sexuality than rural areas. However, these days some rural areas are more affected by HIV than some urban areas. For example, in 2004 HIV prevalence in Makete, which is a rural district in Tanzania, was 18% (MDC, 2005) while the prevalence was 13.4% in Iringa Region in which the district is located (TACAIDS, NBS, and ORC Macro, 2005). Lack of association between the area of residence and HIV infection is also reported by Corno and de Walque (2007) in a study which they conducted in Lesotho and concluded as follows: "It is interesting to note that HIV infection and urban locations are not significantly associated, contrary to what is often found in other African countries." One of the reasons that explain lower HIV infection in urban areas is that people living in urban districts are generally more exposed to information campaigns promoting the use of condoms and higher availability of condoms in urban areas (Corno and de Walque, 2007).

2.2.4.6 Sexual behaviour determinants of HIV/AIDS infection

The major sexual behaviours that are linked with HIV infection are abstinence, fidelity in marriage, and use of condoms. The more these are practised the less the chances for HIV infection, and vice versa (Corno and de Marque, 2007). UNAIDS (2007) insists that condom use should be consistent for it to be effective against HIV infection. Abstinence is refraining from sexual intercourse which unmarried people and married people who are away from their spouses are urged to observe. Fidelity is seeing to it that one who is in marriage does not go to bed with anybody else apart from his/her spouse. It is normally measured by asking if any member of couples has had extra-marital sex in the last 12 months. This is normally asked to married people since others have only non marital sex, if they are sexually active. Higher infidelity is associated with higher risk of HIV infection.

Other sexual behaviour determinants of HIV infection include age at first sexual intercourse, having unprotected sex, drug abuse, and having sex with prostitutes. The linkage between age at first sexual intercourse and HIV infection is that the younger one starts sexual intercourse the higher the likelihood for one to be infected with HIV, especially young girls whose genitalia are still too narrow in comparison with the genitalia of sexually and physically mature men (TACAIDS *et al.*, 2005). Although this is not automatic or always so, at an early age one is likely to have little knowledge on the prevention of HIV infection; hence one is likely to have unprotected sex. Therefore, chances of his/her being infected are high.

Unprotected sex as a sexual behaviour behind HIV infection is normally practised by some men who claim that they do not enjoy sex with a condom and they want to get value for their money they pay for sex by having sex without a condom (TACAIDS,

2005). As seen in Sub-section 2.2.4.2 that people like long distance truck drivers and their assistants have multiple partners and rarely use condoms, the adverse effects of unprotected sex are likely to be higher in towns with stop-over centres for long distance trucks since unprotected sexual behaviour among such mobile people with multiple partners makes people (women and men) living at the centres vulnerable to HIV infection.

With regard to drug abuse, researchers have associated HIV infection with intravenous drug use whereby the abusers may share unsterilised injections and infect one another. However, this relationship has been criticized as being less empirical; for example PHAC (2006) argues that researchers on this relationship do not take the next step backward to associate drug abuse with the emotional pain and poverty that often contribute to this drug use, while the addiction often originates from unhappiness.

Having sex with prostitutes is another sexual behaviour that is very risky for HIV infection (TACAIDS *et al.*, 2005). Although HIV prevalence has been found to be lower among unmarried women than married ones as seen in Sub-section 2.2.4.5, women prostitutes are a group of people who are more at risk since their main occupation is sexual intercourse, and they are likely to go to bed with any man on various terms, including using various routes of sex (vaginal, anal, oral, etc.) even without using condoms.

2.3 Food Security

2.3.1 Food security: The concept

The concept of food security came increasingly in the focus, especially of the food and nutrition policy debate, in the mid-1970s, following a world food crisis in the early

1970s. The crisis prompted the Food and Agriculture Organisation (FAO) of the United Nations (UN) to organise the World Food Conference in 1974, which, among other deliberations, recommended an international undertaking on World Food Security, which was adopted by the United Nations (UN) General Assembly the same year (Eide, 2005). The main concern of the 1974 World Food Summit was secure flows of basic foodstuffs at stable prices. Therefore, the Summit defined food security as: "Availability at all times of adequate world supplies of basic foodstuffs...to sustain a steady expansion of food consumption...and to offset fluctuations in production and prices" (United Nations, 1975, cited by Pottier, 1999).

In 1986 a World Bank report defined food security heeding the same challenges as those of the 1970s, that is guaranteeing access to food and hence the report defined food security as: "Access of all people at all times to enough food for an active healthy life" (World Bank, 1986, cited by Pottier, 1999). The European Union took this approach too, but emphasised the importance of household food security hence defined food security as: "The ability to acquire enough food to satisfy minimal nutritional requirements at both national and household levels" (Tuinenburg, 1987, cited by Pottier, 1999). In 1996 the World Food Summit in Rome defined food security as follows: "Food security, at the individual, household, national, regional and global levels... exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 1996, cited by Pottier, 1999).

Looking closely at the World Bank's (1986) and the World Food Summit's (1996) definitions, one finds that they contain the same key words which are access to food, sufficient food, and active healthy life. The main difference between the two definitions

is that the 1996 definition is an expansion of the 1986 definition. Since the 1986 World Bank's definition has the same key words as those of the definition given by the 1996 World Food Summit, most researches on food security, even this one, adopt the 1986 World Bank's definition, which is shorter but also comprehensive.

The 1996 World Food Summit was followed by another World Food Summit in 2002, which was called World Food Summit Five Years Later. Internationally, there has been a shift in focus from food security to the right to food, adopted from the wording in the final documents from the 1996 and 2002 World Food Summits. The Plan of Action from the 1996 World Food Summit talks about the need to propose ways to implement and realize the rights related to food..."taking into account the possibility of formulating voluntary guidelines for food security for all." The 2002 World Food Summit Five Years Later calls for a "set of voluntary guidelines to support member nations to achieve the progressive realisation of the right to adequate food in the context of national food security," which is the declaration of the World Food Summit Five Years Later (Eide, 2005). This was adopted with reference to the Universal Declaration on Human Rights (1948), which states: "Everyone has the right to a standard of living adequate for the health and well-being of himself and his family, including food" (FAO, 2007a).

The above declarations have been arrived at based on cognizance of the importance of food security for development hoping, presumably, that every one at his/her level of responsibility will fulfil his/her role to see to it that food security is realised at the individual, household, national, regional, and global levels. However, it is probable that, based on the declaration of the right to adequate food, some irresponsible subsistence smallholder farmers may develop a dependency syndrome, give inadequate efforts to

food production and claim for food from the government when they have food scarcity. Thanks to Haen (2005), cited by Eide and Kracht (2005), who cautions that "the right to food is not a right to be fed; it is a right of people to be given a fair opportunity to feed themselves." FAO (2007b) emphasises: "it is the right to feed oneself in dignity, rather than the right to be fed." Food security is not only a right but also a development issue, as seen in the following sub-section.

2.3.2 Food security as a development issue

Food security is a development issue in the sense that when food insecurity prevails, according to Kracht (2005), it retards development as follows: (a) it reduces the capacity of physical activity and the productive potential of the labour while labour is the most important asset the food insecure people have; (b) it impairs people's ability to develop physically and mentally; hence it retards child growth, reduces cognitive ability and seriously inhibits school attendance and performance thus compromising the effectiveness of investment in education; (c) it passes from generation to generation through hungry mothers giving birth to underweight children who start life with a handicap; (d) it contributes to social and political instability that further undermines the ability of governments to reduce poverty and (e) it causes serious long-term damage to health, linked to higher rates of disease and premature death. Other adverse effects of food insecurity are that it impinges negatively on education and health as explained in the following paragraph.

A study which was carried out in Nepal revealed that the probability of attending school was only 5% among nutritionally stunted children, compared to 27% among children with normal nutrition (World Bank, 1993). The development of human resources through education helps alleviate food insecurity by people with more education

producing more rationally, such as through proper use of fertilizers, improved seeds, pesticides and herbicides. World Bank (1993) also reports that four years of primary education boost farmers' annual productivity by 9%. With regard to health, without sufficient calories and nutrients, the body slows down, making it difficult to undertake the work needed to produce food. Without good health, the body is also less able to make use of the food that is available. A hungry mother will give birth to an underweight baby, who then faces a future of stunted growth, frequent illness, learning disabilities, and reduced resistance to diseases (World Bank, 1993). Due to the importance of food as seen above, research on it is very important.

While governments and citizens have their roles to play in order to achieve food security, it is good for both to have common objectively measurable indicators of the concept so that when planning to improve it they can determine the baseline level and the ultimate level of food security in the same ways without under- or over-estimation of the levels. The measurements should also be standard so that the results can easily be compared with other results of food security measurement elsewhere in the world. The merits and demerits of various methods used should also be clear to those using them so that specific methods befitting certain situations are used. Owing to the objective measurement of food security and insecurity being crucial, it is reviewed in the following sub-section.

2.3.3 Determination of food security

The definition of food security by World Bank (1986, cited by Pottier, 1999) is the basis for most methods of determining food security. Sijm (1997) commends it for being comprehensive as follows. Firstly, it entails two essential determinants of food security that are: (a) the availability of food (through domestic production, storage and/or

imports) and (b) the ability to acquire food (through subsistence production, market activities, food and/or income transfers). Secondly, the phrase "by all people" emphasises the importance of assessing food security at a disaggregated level of individuals, households or vulnerable groups. Thirdly, the phrase "at all times" refers to the need to assess food security in both the short and long terms. Hence, the definition encompasses emergency situations and seasonal fluctuations in access to food as well as the sustainability of access to food in the long run. Finally, although the phrase "enough food for an active, healthy life" emphasises the quantitative aspect of food security (i.e. the amount of calories consumed), it does not exclude the quality aspect (i.e. the composition of required micronutrients in the diet).

Heeding the comprehensiveness of the above definition, food security determination methods can be grouped into the following five main categories: (a) Determination of food sufficiency based on actual food intake; (b) Assessment of food availability in terms of grains obtained; (c) Food security determination using the entitlement to food approach; (d) Food security determination based on access to enough food at all times and (e) Food security determination based on process and outcome indicators. These methods are described in the following sub-sections.

2.3.3.1 Determination of food sufficiency based on actual food intake

By this method of food security determination, kilocalories contained in grains eaten are calculated, inflated for energy from other sources, and compared with the minimum recommended dietary energy intake, to judge whether an individual or household is food secure. The focus on the energy aspect is justified by the fact that under nutrition, rather than malnutrition, is nowadays widely regarded as the principal nutritional problem in most developing countries. According to Payne (1990), cited by Sijm

(1997), under nutrition refers to effects of low intakes of dietary energy while malnutrition refers to effects of deficiencies of any or all nutrients, including micronutrients such as Vitamin A, iron or iodine. Another point for justification of using the energy method is that in developing countries grains supply more than 50% of human food energy intake, and they contain some other nutrients (Brown and Kane, 1994; Kim *et al.*, 1998).

Based on dietary energy intake, a household is food insecure if it consumes fewer than 2280 kcal per adult equivalent per day. This amount is the one that is recommended by the World Health Organisation that the minimum dietary energy intake per day per adult should not be less than 80% of the adequate daily caloric intake of 2850 kcal (Reardon and Matlon, 1989, cited by Wanmali and Islam, 2002). The above amount (2280) is 80% of 2850. However, in Tanzania the minimum recommended dietary energy intake is 2200 kcal per adult equivalent per day (NBS, 2002).

However, Maxwell and Frankenberger (1992) contend that by using energy contained in grains consumed there is too much focus on calories, and too little focus on protein and micronutrients consumption in defining food security. Therefore, they propose a methodology considering all nutrients (including micro nutrients like iron, iodine and vitamin A) and the quality of food consumed by individuals and different nutritional needs of men, women and children according to their physiological status and levels of activity. Nevertheless, in spite of the contention, and because there can not be nutrition security without basic food security, the Food and Agriculture Organisation (FAO) of the United Nations stipulates that dietary energy intake goes on being the indicator of choice in assessing food security and when comparing national data (FAO, 1996, cited by Wanmali and Islam, 2002). Nutrition security is defined as "access to nutritionally

adequate diet and biological utilization of food consumed such that adequate performance is maintained in growth, resisting or recovering from disease, pregnancy, lactation, and physical work" (Frankenberger *et al.*, 1997, cited by Smith *et al.*, 2000).

Dietary energy consumed in terms of kilocalories is normally expressed per adult equivalent or per capita, both per day. When dietary energy consumed is expressed per capita per day, a household is said to be food insecure if it consumes less than 2100 kcal per capita per day unlike the 2200 kCal per adult equivalent per day seen above. The global average dietary energy consumption per capita per day is 2100 kCal (Silke and Hand-Peter, 2005). In both cases of dietary energy consumed per adult equivalent and per capita per day the cut-off point formula, which was introduced in 1961 by Sukhatme (Naiken, 2002), is used to separate food secure households from food insecure ones. The general form of the cut-off formula is expressed as:

$$P(U) = P(x < r_L) = \int_{x < r_L} f(x)dx = Fx(r_L)$$

Where: $P(U)$ = Proportion of the food insecure households;

x = Dietary energy intake;

r_L = Minimum recommended dietary energy intake; and

$f(x)$ = Marginal frequency distribution of dietary energy intake.

2.3.3.2 Assessment of food availability in terms of grains obtained

Using this method of food security determination, grains obtained through production, purchase and receipt in kind are recorded and compared with the average amount of grains recommended per capita. The amounts of such grains vary in different regions of the world. For example, the amounts for USA, Italy, and India are 800 kg, 400 kg, and

200 kg respectively per capita per year (Brown and Kane, 1994). Unlike the above average amounts of grains consumed in other countries, the minimum recommended amount of grains for one to be considered food secure in Tanzania is 270 kg per adult equivalent per year (URT, 1999), but available information does not give the amount of grains needed per capita per year for one to be considered food secure in Tanzania. This is partly attributed to the reality that national household surveys of calorie consumption are extremely scarce in African countries (Sijm, 1997).

2.3.3.3 Food security determination using the entitlement to food approach

The access and entitlement to food approach resulted from the pioneering work of food entitlements by Amartya Sen (1981). While the above approaches to food security deal with the supply (availability) of food through production and sufficiency of food that is indicated by consumption of enough kilocalories, the entitlement approach contends that shortage of food supply is usually not the ultimate cause of famine and endemic hunger. The approach was formulated by Amartya Kumar Sen in 1981 contending that food insecurity is not an issue of low food supply but it is an issue of lack of entitlements to get access to food. The entitlements include having money to buy food.

Based on this approach, food insecurity is normally determined by calculating the amount of money that is needed to obtain food that contains the minimum amount of dietary energy, and people (number and proportion) unable to get such amount of money are said to be food insecure. Using this approach, it is argued that the most food secure households are those which achieve adequate access to food while using only a small proportion of available resources; the most food insecure households are those which fail to achieve access to adequate food even by devoting a large proportion of available resources to food (Maxwell and Frankenberger, 1992).

Using this approach, Bne- Saad (2000) conceptualizes that households with access to resources including enough rainfall, good soil quality, water availability, forest resources, fish and seafood, livestock, infrastructure, farm implements, land, and other physical assets are more likely to be food secure than their counterparts who either do not have such access or have poorer access to the resources. The same author (Bne-Saad, 2000) also conceptualizes that households that have larger land area cultivated, irrigated area, good supply and use of inputs, number of cropping seasons, crop diversity, crop yield, food production, cash crop production, number of sources of non-farm income, and equitable gender division of labour are likely to be more food secure than their counterparts who either do not have the factors or have poor amounts and qualities of them. He also conceptualizes that households with good income in terms of total income, crop income, livestock income, wage income, self employment, migrant income, producer prices, good markets of their products, and road access are likely to be more food secure than their counterparts who do not have such income. Although the entitlement to food approach explains food insecurity to a large extent, it has widely been criticized. Since entitlement to food is more of a theory than a mere contention, it is dealt with in more detail in Sub-section 2.3.5.2.

2.3.3.4 Food security determination based on access to enough food at all times

With regard to secure access to enough food at all times, attention is paid to chronic and transitory food insecurity. Chronic food insecurity means that a household runs a continually high risk of inability to meet the food needs of its household members, unlike transitory food insecurity which occurs when a household faces a temporary decline in the security of its entitlement and the risk of failure to meet food needs is of short duration. Transitory food insecurity is divided into cyclical and temporary food insecurity (CIDA, 1989, cited by Maxwell and Frankenberger, 1992; Jaeger, 1992).

Temporary food insecurity occurs for a limited time because of unforeseen and unpredictable circumstances; cyclical or seasonal food insecurity occurs when there is a regular pattern in the periodicity of inadequate access to food. It may be due to logistical difficulties or prohibitive costs in storing or transporting food.

2.3.3.5 Food security determination based on process and outcome indicators

Process indicators of food security include variables that reflect food supply by providing information on the likelihood of a shock or disaster that will adversely affect household food security (Maxwell and Frankenberger, 1992). They include such things as inputs and measures of agricultural production (agro-meteorological data), access to natural resources, institutional development, and market infrastructure, and exposure to regional conflicts or their consequences (e.g. influx of refugees). Maxwell and Frankenberger (1992) group outcome indicators of food security at the household level into direct and indirect indicators, which are described in the following paragraphs.

Direct indicators of food security include those which are close to food consumption rather than to marketing channel information or medical status. Indirect indicators are generally used when direct ones are either unavailable or too costly in terms of time and money to collect. The main direct indicators of food security are: (a) money spent on food and kilocalories contained in the foods eaten (either only grains or all foods) are recorded through Household Income and Expenditure Surveys (HIES); (b) household perception of food security and extent of self-provisioning whereby people are asked whether they have access to their culturally accepted food and the number of months their food produce and receipts in kind lasted and (c) food frequency whereby people are asked about the number of meals per day and about the frequency of consuming specific food items deemed inferior or superior.

The main indirect indicators of food security, according to Maxwell and Frankenberger (1992), are: (a) food storage estimates and comparing the amounts stored with the amounts specified to be sufficient per household per year; (b) subsistence potential ratio in households which produce most of their food, which is the ratio of the amount of food produced at the household level in terms of energy to the amount of energy requirements of the household per year (Frankenberger, 1985, cited by Maxwell and Frankenberger, 1992) and (c) nutritional assessments, whereby anthropometric measures are used to determine food consumption.

However, anthropometric measures do not always correlate directly with food availability and access. This is because nutritional status is a result of many factors besides food consumption. For example Staaz *et al.* (1990), cited by Maxwell and Frankenberger (1992) carried a nutritional survey in Mali using anthropometric measures but found no correlation between them and household food security. Nevertheless, Cogill (2003) argues that weight-for-length (in children up to two years of age) which is called weight-for-height (in children over two years of age) is appropriate for examining short-term food insecurity effects such as seasonal changes in food supply or short-term nutritional stress brought about by illness.

Brigham (2004) contends that underweight, which is a composite measure of stunting and wasting, is a good indicator to assess changes in the magnitude of malnutrition over time. She supports her argument with Nubé's findings. Nubé (2001), cited by Brigham (2004), used weight-for-height to study the relationship between the prevalence of underweight in children under five years and the prevalence of low Body Mass Index (BMI) among adult women in 23 developing countries and found that these measures were highly and significantly correlated (with a correlation coefficient, r, of + 0.88 and

a p-value of 0.000), indicating that the nutritional status of children under five is a useful indicator of under nutrition in the population at large.

However, food security measurements based on weight-for-height approach are very unlikely to reflect nutritional status among men and older children because they are not closely associated with the nutrition of mothers like in the above case of Nubé (2001). While the above methods of food security determination presuppose that once adequate food is produced and supplied in market places people will automatically get sufficient food, the entitlement to food approach, which is described in Sub-sections 2.3.3.3 and 2.2.5.2, contends otherwise.

2.3.4 Coping strategies against food insecurity

Coping with food insecurity is defined as a short-term response to an immediate and inhabitual decline in access to food. It is different from adapting to food insecurity which is a permanent change in the mix of ways in which food is acquired, irrespective of the year in question (Davies, cited by Maxwell and Frankenberger, 1992). Common responses to household food shortage, according to Watts (1983, cited by Maxwell and Frankenberger, 1992), are better described with a graph depicting the likelihood of reversibility of the coping mechanism and the extent of committing domestic resources. Such a graph is given in Fig. 2 and shows that out-migration, farmland sale, farmland pledging, and selling productive assets are the worst ways of coping with food insecurity since their reversibility is very low.

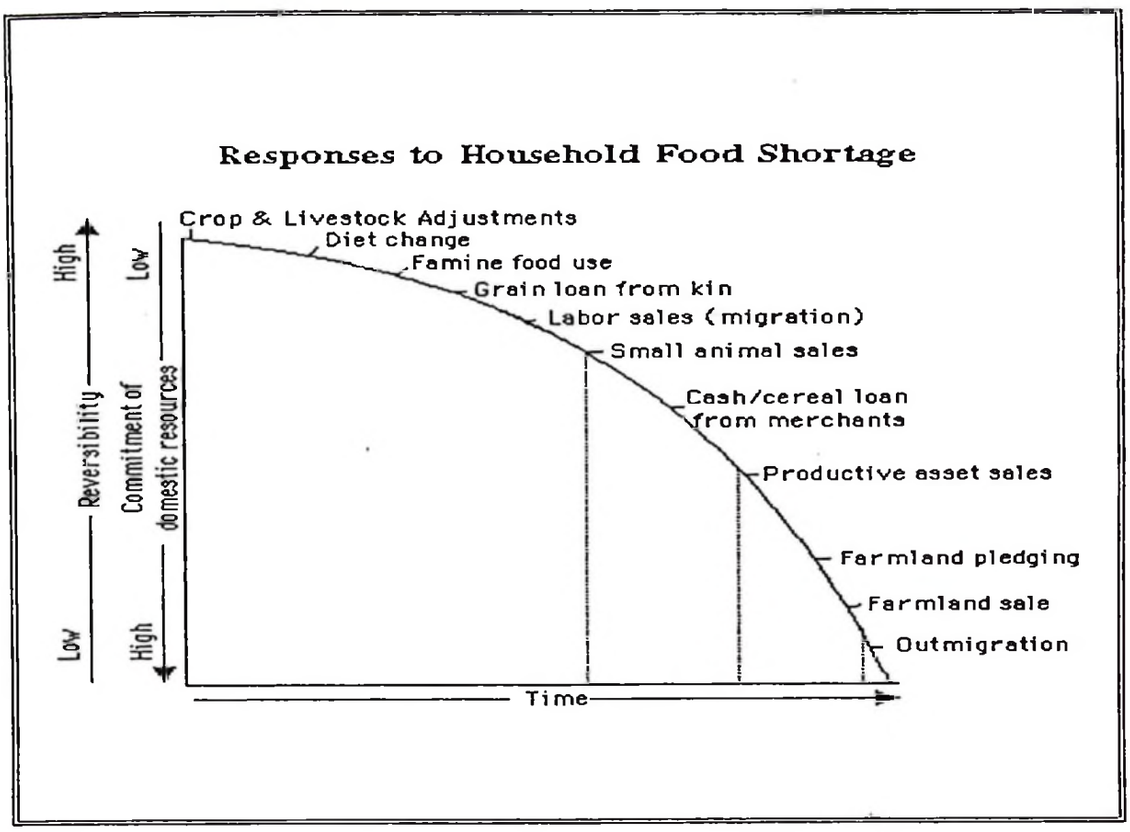

Figure 2: A graph depicting mechanisms for coping with food shortage*

* Adapted from Watts (1983, cited by Maxwell and Frankenberger, 1992)

2.3.5 Determinants of food insecurity

Factors that lead to food insecurity can be thought of and observed, and one can come up with general ones. Determinants of food insecurity obtained in that way are conceptual determinants. There are also determinants of food insecurity which have been articulated by prominent scholars in the form of theories. The conceptual and theoretical determinants of food insecurity are reviewed in the following sub-sections.

2.3.5.1 General determinants of food insecurity

In this sub-section, factors that enhance or constrain food security, if they are favourable or unfavourable, respectively, are given. The factors can apply to various countries whose people mainly depend on crop production for food security, and they

are outlined as follows, according to Tolossa (2002): (a) migration of male members of households for casual labour work; (b) poor allocation of resources for agricultural production; (c) growing cash crops at the expense of food crops; (d) laxity in mothers rationing and serving food;, (e) illness of adults at critical times in the food production process; (f) transition to commercial agriculture; (g) Insufficient farmland as well as low yields on farm; (h) high storage losses; (i) deterioration in ecological conditions of production; (j) inadequate storage facilities that cause grains to rot during rainy seasons and fall prey of rats, mice and insects during dry seasons; (k) excessive rainfall, which causes crop failure and (l) land use competitions between pastoralists and crop producers in which case the loser is more prone to food insecurity.

It is worth noting that the above list of general determinants of food insecurity is not exhaustive; one can come up with a longer list, especially if one considers various agro-ecological zones. Besides the above general determinants of food insecurity, there are also theories explaining food insecurity which are reviewed below.

2.3.5.2 Theoretical determinants of food insecurity

Theories explaining food insecurity can be classified into four classes, namely (a) pessimistic (Malthusian and Neo-Malthusian) theories, which argue that population increase causes food scarcity; (b) optimistic theories, which are quite the opposite of the pessimistic theories, hence argue that increase in population causes increase in food production; (c) entitlement to food theory, which contends that food insecurity occurs due to people lacking entitlements to access food and (d) composite theories, which combine the above classes of theories. The four classes of theories are reviewed below.

(a) Malthusian theories

Malthusians contend that food insecurity is due to the presence of too many people compared to the amount of food produced. This contention began during the time of a famous British Reverend called Thomas Robert Malthus who lived from 1766 to 1834 and wrote as follows in his first essay titled *An Essay on the Principle of Population* that was published in 1798: "Population, when unchecked, increases in a geometrical (i.e. compound) ratio. Subsistence (i.e. food production) increases only in an arithmetical ratio... By that law of our nature which makes food necessary to the life of man, the effects of these two unequal powers (of population and food) must be kept unequal. This implies a strong and constantly operating check on population from the difficulty of subsistence. This difficulty (of providing sufficient food) must fall somewhere and must necessarily be severely felt by a large portion of mankind" (Malthus, 1798, cited by Dyson, 1996, with interpretations in the brackets).

However, Malthus was not the first person to argue so; he was influenced by works of Giovanni Botero who lived from 1544 to 1617 to the extent that Schumpeter (Cited in *Population and Development Review*, 1985) criticises him as follows: "The Malthusian Principle of Population sprang full developed from the brain of Botero in 1588." To some extent the criticism is valid because Malthus's contentions are to a large extent similar to what Botero wrote in his 1588 "*Delle cause della grandezza delle città* (i.e. The Cause of the Greatness of Cities), which read as follows: "Populations tend to increase, beyond any assignable limit, to the full extent made possible by human fecundity: the means of subsistence, on the contrary, and the possibilities of increasing them are definitely limited and, therefore, impose a limit on that increase, the only there is; this limit asserts itself through want, which will induce people to refrain from marrying unless numbers are periodically reduced by wars, pestilence and so on"

(Schumpeter, 1994, cited by Brigham, 2004). But unlike Botero who was not sure of mentioning specifically food or any other means of subsistence, Malthus was specific on the negative impact of population growth on food production.

People who believed in the above contentions were Classic Malthusians; those who believe so until today are Neo-Malthusians; and those who have contrary beliefs are Anti-Malthusians. Classic Malthusianism was the dominant thinking about the relationship between population growth and food security until the early 1960s. In spite of the first agricultural revolution and the industrial revolution that occurred in Europe during the 18th century and the Green Revolution that occurred in India in the 1970s having made Malthusian thinking hardly applicable, the debate that Malthus initiated has been so persistent and recurrent since then that even today, especially after the 2nd World War, there are Malthus's adherents who are known as neo-Malthusians. Classic Malthusianism came under attack of anti-Malthusians in the late-1960s, as seen in (b) below. Therefore, strong believers in Classic Malthusianism had to formulate new arguments to counter the arguments of Anti-Malthusians. Due to the new arguments, Malthusianism got its new name of Neo-Malthusianism.

One of the today's best-known Neo-Malthusians is Lester R. Brown who, in collaboration with Hal Kane, has estimated that the earth's optimum carrying capacity is about 5.5 billion people and argues that large parts of today's developing world are caught in a demographic trap, which is described as follows: "Once populations expand to the point where demands begin to exceed the sustainable yields of local forests, grasslands, croplands, or aquifers, they begin directly or indirectly to consume the resources base itself. Forests and grasslands disappear, soils erode, land productivity declines, water tables fall, and wells go dry. This, in turn, reduces food production and

incomes, triggering a downward spiral in a process we describe as the demographic trap" (Brown and Kane, 1994).

Brown and Kane (1994) also argue that expansion of food production like during the green revolution of India in the 1970s is difficult today because the backlog of unused agricultural technology is shrinking, leaving farmers with fewer agronomic options to expand food output; demands for water are pressing against limits of the hydrological cycle to supply irrigation water; and in many countries the use of additional fertilizers on currently available crop varieties has little or no effect on yields. Neo-Malthusians are very pessimistic about food and population and predict that by 2020 there may be several hundred million excess deaths stemming from hunger and famine (Dyson, 1996).

(b) Anti-Malthusian contentions

In the late 1960s Classic Malthusianism became less popular after Ester Boserup, a Danish Economist who lived from 1910 to 1999, argued successfully that technological development could boost food production enough to keep up with population growth for many years. She was mainly reacting against Malthus's model of the relationships between population growth and food security. She argued that population growth is a major factor determining agricultural development (hence food security) and that "...in many cases the output from a given area of land responds far more generously to an additional input of labour than assumed by Malthusian authors" (Boserup, 1993). Boserup's contentions are shared by other Anti-Malthusians, for example, Simon (1981), cited by Dyson (1996) argues: "The ultimate resource is people; skilled, spirited, and hopeful people who will exert their will and imaginations for their own benefit, and so, inevitably, for the benefit of us all."

However, Boserup and other Anti-Malthusians were not the first ones to say the above words; Lütken (1756), cited by Dyson (1996) wrote as follows: "It is in my opinion...that there can never be too many people in a country...people and the multitude of people are the greatest and most splendid wealth by which...all other kinds of wealth can be achieved." Another Anti-Malthusian who held views similar to Lütken's a long time before Malthus wrote the pessimistic theory on food and population relationship was Marquis de Condorcet who lived from 1743 to 1794 and argued that with high population increase "a very small amount of ground will be able to produce a great quantity of supplies of greater utility or higher quality" (Dyson, 1996). In addition, Condorcet argued that education would bring lower birth rates, as rational human beings would see the value of limiting family size, giving their children the prospect for longer and happier lives. Reason, the anti-Malthusians argued, would secure a better balance between people and food (Sen, 1994, cited by Brigham, 2004). Moreover, anti- Malthusians, for example Dyson (1996) argue that it is not true that several hundred million excess deaths will occur by 2020 as Neo-Malthusians predict.

Unlike Malthusians who are pessimistic that the future will see too little food for the increasing population, Anti-Malthusians are optimistic that technology for food production, including biotechnology, will definitely make it possible to produce enough food no matter how much the population may grow. Malthusian and Anti-Malthusian contentions are two rivalry positions on the relationship between food availability and population growth.

(c) The entitlement approach to food security

The pessimistic and optimistic contentions about the relationships between population growth and food security reviewed above have been challenged by Sen (1981) by arguing

as follows: "People do not usually starve because of an insufficient supply of food at the local, national or international level, but because they have insufficient resources, including money ('entitlements') to acquire it" (Sen, 1981). Entitlements are defined as "the set of alternative commodity bundles that a person can command in a society using the totality of rights and opportunities that he or she faces" (Sen, 1984, cited by Leach *et al.*, 1999). Sen classified entitlements into three categories, namely (i) endowments, which are all legal resources that can be used to obtain food, including money, land, machinery and animals, but also more abstract resources such as labour power, "know how", kinship, and citizenship; (ii) entitlement mapping (or e-mapping), which includes terms of trade between endowments and food, goods, and the ratio between money wages and the price of food, or the input-output ratios in farm production; and (iii) entitlement-set, which represents the basket of food, goods, and services that a person can obtain using his/her endowments.

However, Sen is not the only person who has analysed entitlements; Leach *et al.* (1999) have also analysed them and introduced the concept of environmental entitlements which they define as "Alternative sets of utilities derived from environmental goods and services over which social actors have legitimate effective command and which are instrumental in achieving well-being." Such environmental entitlements, they add, include direct uses of resources in the form of commodities, such as food, water or fuel and the market value of such resources or of rights to them, and the utilities derived from environmental services such as pollution sinks or properties of the hydrological cycle.

Based on the examples of environmental entitlements given by Leach *et al.* (1999) above, it is easy to deduce from them that environmental entitlements can help to

improve food security, for example by people with free access to forests obtaining timber and non-timber forest products which they can sell to get cash for buying food. Such products may be poles as building materials, firewood, charcoal, and medicinal plants. Some wild foodstuffs and game to be consumed directly may be obtained from forests, but also some rocks for selling may be obtained freely from certain landscapes.

Sen's theory of the entitlement to food security was extensively criticised. For example, Patnaik (1991) argues as follows: "It would be a grave error to ignore or discount long-term decline in food availability for...these trends can set a stage for famine even though famine does not thereby become inevitable." This shortcoming is closely related to Woldemeskel's (1990) criticisms against Sen, as reviewed in (d) below. Patnaik's view is shared by Alexandratos (1997) who contends that the entitlement approach relegates the need to increase food production to a subsidiary role. Other criticisms against the entitlement approach are reviewed in the following paragraph.

Reutlinger (1984), cited by Sijm (1997) argues that the entitlement approach underestimates the importance of food supply while even minor real or expected shortfalls in food supply can have far-reaching consequences for food security of particular groups, e.g. through a steep rise of food prices which poor consumers have to pay for their food purchases. Mitra (1982) cited by Sijm (1997) argues: "Sen has not said anything beyond what our great grandmothers were already aware of." Srinivasan (1983), cited by Sijm (1997) asserts: "The entitlement to food approach is a fancy name for elementary ideas well understood by economists, though not necessarily by policy makers." Nolan (1993), cited by Sijm (1997) claims: "The entitlement approach does not constitute a methodological advance upon the best previous analyses of famine...the word has a scientific ring, but it is analytically useless." Sijm (1997) supports the above

criticisms by saying" "Most of Sen's ideas on the relationship between poverty and famines were already known; his exuberant use of new concepts complicates rather than facilitating understanding these ideas. It is preferable to use as much as possible the normal language of current disciplines on a comprehensive theme such as food security."

However, criticising others for their ideas is easier than suggesting better feasible ideas. Since some of the criticisms against the entitlement approach do not explain the how-sides of their suggested alternative analyses, and since some of the criticisms are rather ironic unnecessarily (for example Mitra's criticism above), the entitlement approach is strong. Not only that but also the strength can be explained by taking an example of a hypothetical society (e.g. pastoralists) which does not rely on crop production or whose circumstances do not favour crop production but the society has other activities of producing some lucrative goods and providing profitable services while the market forces are good for food. Such a society can be food secure by buying food from other societies, for which food production is one of the economic activities, using income obtained from selling the goods they produce and/or services they provide. Therefore, the entitlement approach greatly explains food security.

Although the entitlement approach has been criticised much, some writers support it. For example, Sijm (1997) commends Sen for bringing together and formalizing old ideas on hunger and poverty in a general framework, and for emphasizing the importance of factors other than aggregate food availability. Sijm adds that reading carefully Sen's writings can help understand why certain people suffer from hunger and under nutrition amid a world of plenty. Another writer supporting the entitlement approach is Osmani (1995, cited by Brigham, 2004) who asserts that Sen does not

dismiss food availability decline (FAD); he simply says that it is usually not the ultimate cause of famine and endemic hunger. Osmani further argues that Sen's main aim has been to prove that food availability decline should not be taken as a universal explanation for all famines. But the reason for de-emphasising food availability decline (as a cause of famine) was to challenge the hegemonic position of the food availability approach.

(d) Composite theories on determinants of food insecurity

Sen's analysis of food security in terms of food access through entitlements rather than food availability, unlike Malthusians and Anti-Malthusians, gave rise to hot debates, as seen above, most people opposing him. The debate culminated in the formulation of composite theories or rather general agreement that food security attainment is contingent upon four determinants, namely (i) availability; (ii) institutional elements; (iii) market forces and (iv) possession (Woldemeskel, 1990). Woldemeskel (1990) also contends that the entitlement approach recognises the contribution of food availability to food security but dismisses it and completely ignores institutional elements and market forces. In other words, Woldemeskel says that Sen considered food availability like the pessimistic and optimistic theories proponents besides entitlement, but neglected institutional elements and market forces.

However, unlike Woldemeskel (1990) who sees no institutional elements in Sen's analysis, reading closely Sen's book and having in mind the meaning of an institution as defined below, one finds that institutions are well covered in Sen's analysis of entitlement to food. Sen's classification of entitlements as seen in (c) above reflects institutions in terms of citizenship, kinship and culture, which influence the distribution of food in society. Unlike Woldemeskel (1990) and Patnaik (1991) who criticise Sen for

ignoring markets in his analysis, Brigham (2004) says that the entitlement approach considers markets by suggesting "concentration on such policy variables as social security, employment guarantees, and terms of trade between non-food and foodstuffs (especially between labour power and food)" (Sen, 1981, cited by Brigham, 2004). Sen (1981) also considers markets in entitlement mapping in terms of trade between endowments and food, goods and services (Sen, 1981).

Looking closely at the discussion in (d) above, one realises that the composite theories of food insecurity were at the heart of Sen's analysis, but he emphasised entitlements to challenge the common notion that food availability is the main determinant of food security. He also underscored the fact that some people can be food insecure at the same place where other people are food secure and food is plenty, depending on their entitlement to food.

The institutional and market factors emphasised in the composite theories of food insecurity cannot be left just hanging hence they are reviewed in this paragraph and in the following one. An institution is defined as a custom, practice, relationship, or behavioural pattern of importance in the life of a community or society (http://www.answers.com). Vatn (2005) defines institutions as follows: "Institutions are the conventions, norms and formally sanctioned rules of a society. They provide expectations, stability and meaning essential to human existence and coordination. Institutions regularize life, support values and produce and protect interests." Defined like that, institutions can help mitigate food insecurity at the household level, for example by households giving one another food where such a custom exists like in Rufiji District, Tanzania.

With regard to market forces as a factor influencing food security, market forces in terms of supply and demand for food affect food prices hence the extent to which various people have access to it through buying. The supply of food can be compounded by poor infrastructure, or poorly integrated food markets in famine-prone areas as well as high transport costs and risks (Devereux, 1988; de Waal, 1990; Nolan, 1998, cited by Sijm, 1997). Market forces are also analysed by Kalecki (1971, cited by Brigham, 2004) who explains that inelastic properties of food production greatly affect food markets. He clarifies that because it takes time after seeds are planted before they bear fruits, food production cannot be expanded rapidly, and the supply of food will be inelastic with regard to demand. Consequently, where the level of food supply is low relative to its demand, prices will tend to rise. On the other hand, where the supply is greater than demand, prices will tend to fall. This is unlike (the much more elastic) production of industrial goods, where supply varies according to demand and prices are relatively stable (Kalecki, 1971, cited by Brigham, 2004). On market forces, Osmani (1995, cited by Brigham, 2004) argues that the ratio between money wages and the price of food, and the input-output ratios in farm production influence food security. Having reviewed literature on HIV/AIDS and food security in Sections 2.2 and 2.3, respectively, now it is opportune to review literature on the linkages between the two aspects.

2.4 Linkages between HIV/AIDS and Food Security

Linkages between HIV/AIDS and food security are best analysed assuming that they have mutual (rather than unidirectional) relationships whereby they influence and exacerbate each other. Therefore, the linkages reviewed in this section are mainly based on Fig. 1, which depicts the variables hypothesised to be part of the mutuality. The relationships have been conceptualised regarding food insecurity as food poverty and

applying indicators of food poverty and those of HIV/AIDS at the household level to emulate the relationship between poverty and HIV/AIDS that has been used by UNAIDS and World Bank (2001) to analyse linkages between HIV/AIDS and poverty. The relationships are also analysed using the framework presented in Fig. 3.

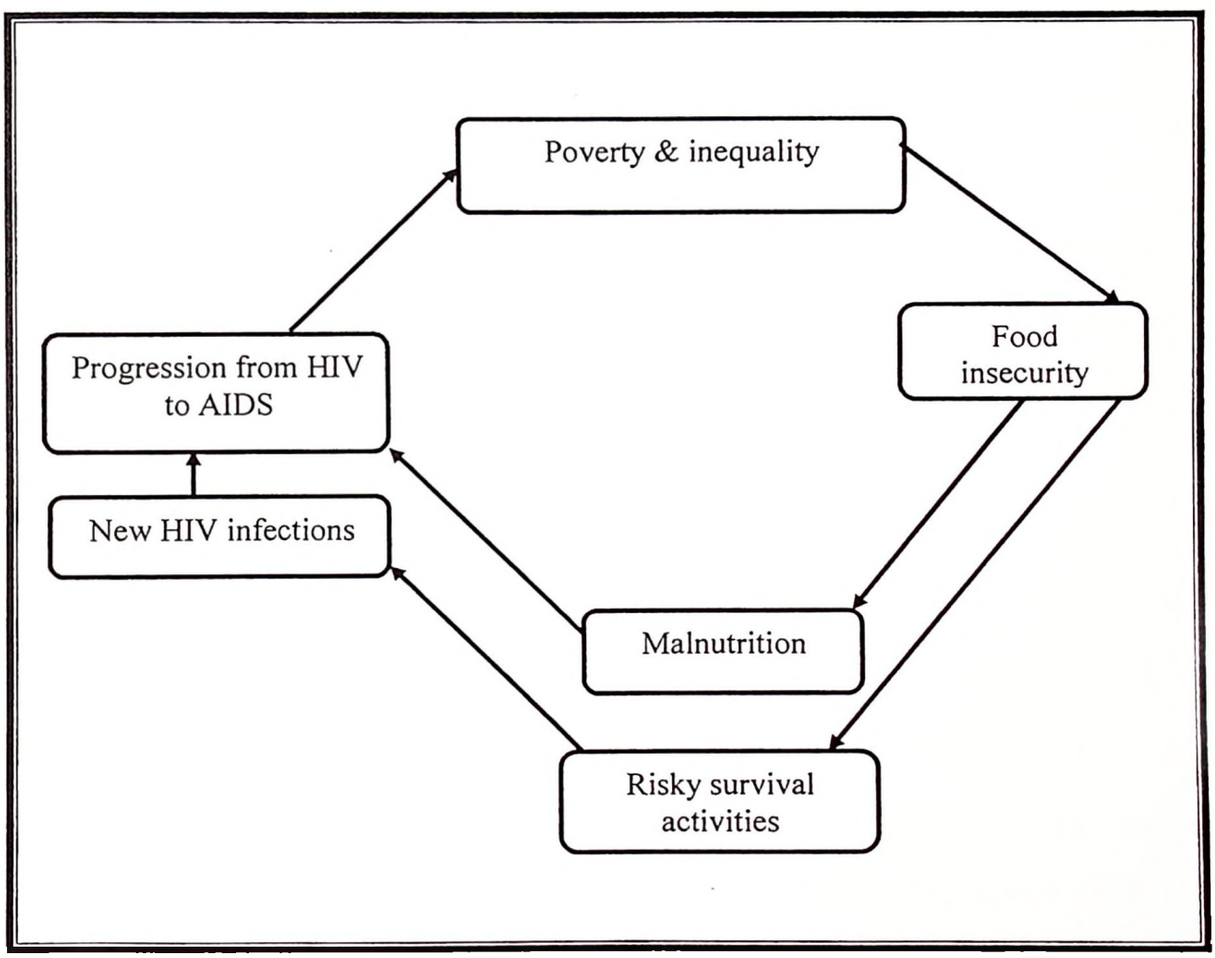

Figure 3: A framework for analysing links between HIV/AIDS and food insecurity

Source: Adapted from Save the Children (UK) and Oxfam International (2002)

Using the framework in Fig. 3, it is argued that there is a clear and critical two-way relationship between HIV/AIDS and food insecurity. The pandemic is driven by the very factors that cause malnutrition: poverty and inequality. Food insecurity increases the likelihood of HIV infection, as people are driven to adopt risky coping strategies in

order to survive. These include travelling to search for food and additional sources of income, migrating, engaging in hazardous work, and women exchanging sex for money or food. These actions facilitate the spread of HIV, putting individuals – especially women and children – at high risk of infection.

For those already infected with the virus, malnutrition exhausts the immune system and makes the victims more susceptible to malaria, tuberculosis, and other opportunistic diseases. This leads to faster progression from HIV to AIDS. People weakened by HIV/AIDS find it harder to access food because they are often not strong enough to work or walk long distances to market places. Fig. 3 is used alongside Fig. 1 to describe the relationships between HIV/AIDS and food security since both of them consider mutual relationships between the two aspects.

The linkage between HIV/AIDS and food security is also studied using the sustainable livelihoods frame. For example, O'Donnell (2004) has used it to analyse linkages between HIV/AIDS and food insecurity. While the sustainable livelihoods frame is good since it focuses on assets and vulnerability (issues that Fig. 3 also focuses on) it does not consider the reciprocal nature of HIV/AIDS and food security factors, which is why it was not used in this research. In order to add value to the relationships, some empirical data from past studies have been included.

2.4.1 Role of HIV infection in food insecurity

Unlike in Section 1.2 where some of the linkages between HIV/AIDS and food security are just outlined to introduce them, in this sub-section (2.4.1) they are elaborated to show the extent of the linkages. HIV/AIDS leads to decreased agricultural productivity through people suffering from AIDS-linked illnesses having reduced capacity to

participate in productive activities, including food production (Ngwira *et al.*, 2001). People suffering from AIDS also lose positive attitude towards agricultural production. Most of them develop a short-term outlook; in terms of economic activities they often prefer to invest in petty trading rather than agricultural enterprises whose returns take longer to accrue. They may be sceptical even to grow annual crops. Decrease in labour whereby members of the afflicted households spend time taking care of the sick and burying the dead hence less time for agricultural pursuits also contributes to decreased agricultural productivity. Other members of society are also affected; they have to spare time for visiting the sick and funerals. In a way, their participation in those ways is a subscription to society, and it enables them to claim benefits in time of hardship (Bota *et al.* 2001, cited by Ngwira *et al.*, 2001).

HIV/AIDS also causes shortage of labour, the labour that would be used to produce food among farming households. According to Topouzis (1999) and D'Onnell (2004), qualitative studies drawing on field work in Eastern and Western Africa suggest that labour shortage and/or labour loss on subsistence farms contributes to food insecurity as a result of one or more of the following factors: (a) reduction of land area under cultivation whereby fields may be under-utilised or left unattended because a young adult is physically unable to work on the farm or a grand parent is chronically ill or too frail to make up for the labour of his son/daughter; (b) reduction in the ability to control crop pests whereby weeding and other inter-cultivation measures may be neglected; (c) reduced investment in irrigation and soil maintenance including use of organic and inorganic fertilisers and mulching; (d) decline in the range of crops grown per household and the loss of agricultural knowledge which compels AIDS-afflicted families to reduce the number of crops under cultivation; (e) shifting from cash crop production to subsistence production that is less labour-intensive; (f) delay in carrying

out certain agricultural activities (tillage, planting and weeding) or neglect of fields, reduction of inputs and changes in cropping patterns that may result in decline in crop yields; (g) selling livestock to get income for AIDS treatment and related costs but also because livestock husbandry is a "male" activity which is often abandoned by female survivors and (h) loss of agricultural knowledge and farm management skills due to death of one or both parents to AIDS, meaning that younger members of the family may not have the necessary farming knowledge, experience and management skills.

Another adverse effect of HIV/AIDS on food security is catastrophic costs of healthcare, which are incurred during illness, at the time when income is also low due to less inability to work. Less of these resources can then be devoted to agriculture. Traditional beliefs in witchcraft compel people to seek health services from traditional healers, whose fees can be exorbitant (Ngwira *et al.*, 2001). UNAIDS (1996), cited by Tapouzis (1999) reports that in Rural Rakai District of Uganda, households can spend up to a third of their annual cash income on medical care.

Lack of cash capital for income generation activities also impinges negatively on food security in households affected by HIV/AIDS. Rugalema (1998), cited by Topouzis (1999) reports that for many widow-headed households in Tanzania the main constraint to food security following death of a husband is not labour shortage but cash income and that the most immediate need reported by widows is lack of credit to establish small projects that could be combined with farm and domestic work.

Increased dependency ratio that is caused by HIV/AIDS is another way by which HIV/AIDS contributes to food insecurity. When one or both parents pass away due to AIDS, the dependency ratio increases in the household due to the number of adults

decreasing. This reduces the ability of such a household to produce and or buy food. The problem of orphans with HIV/AIDS also exacerbates food insecurity. AIDS mortality leads to increased number of orphans thereby raising dependency ratio, i.e. fewer working-age adults. Therefore, it necessitates adjustment in roles, including the elderly women resuming roles of parenting their grand children, children becoming household heads, and young girls providing care for their younger siblings. Children left behind when their parents die are drawn increasingly into adult responsibilities by the remaining parent or guardians and may be taken out of school, with long-term negative impact on their ability to acquire literacy-based skills that would enhance their ability to produce and/or buy food (Ngwira *et al.*, 2001).

The illness and/or death of a woman is likely to threaten household food security more, especially in households which depend primarily on women's labour for food production, animal tending, crop planting and harvesting. About this, Forsythe and Rau cited by Topouzis (1999) argue that female morbidity or mortality has "a particularly dramatic impact on the family. If women fall ill while their husbands are working in urban areas, the overall socialisation and education of the children and the management of the household may be seriously affected. Moreover, studies have shown that children's nutritional status is more closely related to mothers' work and income than to the fathers' (Devereux and Eele, 1991, cited by Topouzis, 1999).

Food insecurity is more serious in households headed by orphans and the elderly. In some cases, young parents affected by AIDS take their children to the children's grand parents in rural areas. The grand parents may be too old to work efficiently while the grand children are too young to work, and some of the grand children who are very young take considerable time of their grand parents to care for, the time they would

spend on agriculture or other economic activities. Besides the
orphans to care for, they also lose valuable remittances from th
down by AIDS, while the remittances might have been import
of food production through purchased inputs (Barnett *et al.*,
miserable life for both the grand parents and the grand childre
conducted in Mutare, Zimbabwe, in the late 1990s it was found
were orphans. The number of children in need of care was r
increasing. Some 45% of those caring for orphans were grand
no income of their own (UNAIDS, 1998, cited by Ngwira *e*
households headed by children in Zimbabwe shows that wh
both parents, most of them had surviving relatives. But in
relatives reported that they did not want to care for the orphar
by Ngwira *et al.*, 2001). Where orphans are cared for, there
orphans receiving less food or food of poorer nutritional quality

HIV/AIDS also affects food security through reduced income
The sequence of responses to AIDS opportunistic infections
production, shift to less demanding enterprises, sale of assets a
deep impoverishment. Important assets like land, livestock a
further eroding the ability to produce and buy food. Reduced
and income as a result of prolonged illness put household
person living with HIV/AIDS at risk of malnourishment.
impact on on-farm and off-farm household income (such as
remittances) and particularly on the availability of disp
increases household expenditures (for medical treatment a
special foods for the sick, etc.), as seen above. One simula

spend on agriculture or other economic activities. Besides the grand parents receiving orphans to care for, they also lose valuable remittances from their urban children struck down by AIDS, while the remittances might have been important in maintaining levels of food production through purchased inputs (Barnett *et al.*, 1995). This results into miserable life for both the grand parents and the grand children. In a study which was conducted in Mutare, Zimbabwe, in the late 1990s it was found that 15% of the children were orphans. The number of children in need of care was rising as HIV/AIDS was increasing. Some 45% of those caring for orphans were grand parents who might have no income of their own (UNAIDS, 1998, cited by Ngwira *et al.*, 2001). A study of households headed by children in Zimbabwe shows that while the majority had lost both parents, most of them had surviving relatives. But in 88% of those cases, the relatives reported that they did not want to care for the orphans (UNAIDS, 1998, cited by Ngwira *et al.*, 2001). Where orphans are cared for, there have been reports of the orphans receiving less food or food of poorer nutritional quality than non-orphans.

HIV/AIDS also affects food security through reduced income to buy and produce food. The sequence of responses to AIDS opportunistic infections and lastly death, reduced production, shift to less demanding enterprises, sale of assets and indebtedness results in deep impoverishment. Important assets like land, livestock and bicycles may be sold, further eroding the ability to produce and buy food. Reduced production, consumption and income as a result of prolonged illness put household members other than the person living with HIV/AIDS at risk of malnourishment. HIV/AIDS has a marked impact on on-farm and off-farm household income (such as loss of assets, savings and remittances) and particularly on the availability of disposable cash, while it also increases household expenditures (for medical treatment and transport, funeral costs, special foods for the sick, etc.), as seen above. One simulation study in Kenya, which

compared the impact of AIDS on urban and rural household income, showed that rural households were the most severely affected, with AIDS costs representing 78% of household income the first year and 167% the second year (Forsythe and Rau, cited by Topouzis, 1999).

Moreover, HIV/AIDS affects food security through costs incurred on funerals and mourning of deceased HIV/AIDS victims. Various customs surrounding funerals create further demands on households' savings and assets. Traditionally, funeral ceremonies last for four to seven days, and there is normally a mourning end ceremony after one month, 40 days, or a year. During the funerals and mourning end ceremonies cash and food are consumed, impinging negatively on cash savings and food reserves (Mwinga, 1995, cited by Bolton, 2003).

HIV/AIDS also affects food security through depletion of human resources. AIDS affects the ability of agricultural and allied institutions to provide services by depleting their human resources. First, the quality of human resources declines due to morbidity of staff afflicted by AIDS. Second, there is attrition of staff in agricultural administration, extension and research, due to AIDS death. In Malawi, in 1998, nearly 66% of staff that died in the Ministry of Agriculture died from AIDS related illness (based on UNAIDS estimates of AIDS-related mortality in urban areas) (Bota *et al.*, 19990, cited by Ngwira *et al.*, 2001). Death of some staff members results into overload on the remaining staff who compensate for work that would be done by their former colleagues who have passed away. In Zimbabwe, extension staff members were losing 10% of their monthly working time attending funerals (Topouzis, 1999).

HIV/AIDS also leads to nutrition insecurity. The pandemic causes malnutrition in terms of weight loss and muscle wasting, altered metabolism and increased use and excretion of nutrients. Deficiencies of vitamins and minerals such as Vitamins A, E and B, and minerals selenium and zinc needed by the immune system to fight infections are commonly observed (Chopra, 2003). For example, a study by Semba *et al.* (1995, cited by Chopra, 2003) found that HIV-positive intravenous drug users with more than 10% loss of weight from baseline to the last visit before death had an approximately eightfold higher risk of mortality compared with controls, after adjusting for CD4 cell counts.

HIV/AIDS also threatens food security by eroding social security networks, an important social capital. The burdens of caring for the sick and for orphans are customarily spread within communities, benefiting households that are both better and less well off (Shah *et al.*, 2001, cited by Ngwira *et al.*, 2001), but as HIV/AIDS prevalence rises, these burdens may overwhelm the ability or willingness of other households to further divide their economic entitlements (Mtika, 2001, cited by Ngwira). This results into an increase in the incidence of child-led households. Girls become increasingly vulnerable to abuse since some caretakers see them as a source of labour and others abuse them sexually (Ngwira, 2000, cited by Ngwira *et al.* 2001).

HIV/AIDS also causes drop in food consumed. For example, FAO has found that food consumption dropped by 40% in households affected by HIV/AIDS. However, this was confirmed anecdotally, not empirically, by relief and health workers observing HIV/AIDS patients bedridden, weakened and struggling to find food and the HIV/AIDS patients they were visiting ranking lack of food as a high priority problem (*Médecins*

sans Frontières Holland Nchelenge District Office (MSF-H) Staff, 2003, cited by Bolton, 2003).

Something that is a fact but which people do not normally say openly is that when relatives pass away due to AIDS after long-time illness, the well being of some households improves compared to the illness phase because healthcare costs are no longer incurred, and caring requirements like time spent on the care are no longer there (O'Donnell, 2004). While the points given in Sub-section 2.4.1 are about how HIV/AIDS impacts on food security, the ones given in Sub-section 2.4.2 are on how food security in turn influences HIV infection and aggravates AIDS.

2.4.2 Role of food insecurity in HIV infection and deepening of AIDS

In some cases food insecurity increases chances of food insecure people to be infected by HIV, and it hastens progression of HIV positive people to full-blown AIDS, as explained in the following paragraphs. Due to poverty, especially low income for general expenditure, including buying food, young adults both men and women often find few opportunities to make a living where they live; hence they are forced to move to other places in search of work. Work from Uganda indicates that such movement, in the sense of relocation, is a risky factor for HIV infection (Decosas *et al.*, 1995, cited by Topouzis, 1999). Much of the literature in this area places emphasis on movement by single adults. However, married men are also known to migrate temporarily for labour work and trade. While they are away from their homes they may engage in unsafe sex and get infected by HIV; their wives back at home may be forced into transactional sex due to life hardship and get infected by HIV. When the men go back home or when their wives join them in the places of work they infect each other further. Poverty also

makes people less able to act on their knowledge of risk to minimize HIV exposure (Gillespie and Kadiyala, 2005).

Restricted choices of safe economic activities also contribute to HIV infection. Lack of livelihood prospects where young adults live contributes to attitudes in which the threat of death after 5 to 10 years due to AIDS has little weight. In such situations, people are much less likely to act on what they know about HIV/AIDS. Poor women with few other subsistence options may resort to selling sex for gifts or money on an occasional or more continuous basis (Malawi Government, 2001, cited by Ngwira *et al.*, 2001).

Low agricultural production that does not provide surplus products for sale to get income for education pursuits, among other needs, among farmers contributes to HIV infection risk. The linkage is in terms of people with low education failing to follow up properly messages for avoiding HIV infection. Although the Tanzania HIV/AIDS Indicator Survey of 2003-04 shows that HIV prevalence among respondents with no formal education and those with incomplete primary education was less (5.3%) while that among respondents with complete primary education was higher (7.9%), it is still incontrovertible that people with more formal education are more likely to avoid HIV infection than those with less formal education since they are literate enough to interpret and practise messages about how to avoid HIV/AIDS. Elsewhere, for example in Lesotho, formal education has been found to be negatively associated with HIV infection (Corno and de Walque, 2007).

Another way by which food insecurity influences HIV/AIDS is by food insecure people spending almost every cent they get on buying food while other needs, including sex,

are there. As a result, they may fail even to buy condoms for safe sex; hence succumb to HIV infection due to having unprotected sex.

Another food-related factor that increases chances of HIV infection is reduced farmers' access to information on HIV/AIDS. Such access is sometimes higher among food insecure people who tend to spend more time on activities meant for looking for food, including temporary migration hence missing access to information about how to avoid HIV/AIDS, even messages that are disseminated in village meetings. People who have no or low access to information about HIV/AIDS are likely to be easily infected than those who have access to such information.

Nutrition insecurity also exacerbates HIV/AIDS. It does so through poor nutrition whereby People Living with HIV/AIDS (PLWHA) have increased nutritional requirements: up to 50% greater for protein and 15% for energy (Piwoz and Preble, 2000, cited by Ngwira *et al.,* 2001). Therefore, failure to maintain nutritional status when people are food insecure weakens immunity and increases susceptibility to opportunistic infections. This linkage is depicted in Fig. 3.

Besides the linkages between HIV/AIDS and food security reviewed in Sub-sections 2.4.1 and 2.4.2 in the context of the conceptual framework of this thesis and Fig. 1 and 3, there are a lot of contentious assertions in literature that there is no linkage between HIV/AIDS and food security. Therefore, in Section 2.4.3 such contentions are reviewed, with much reference to some countries in the Southern African Region where most empirical studies about the linkages between HIV/AIDS and food security have been done, since the countries are the ones that have hardest been hit by the HIV/AIDS pandemic.

2.4.3 Contentious assertions on linkages between HIV/AIDS and food security

In South Africa, the country that has hardest been hit by HIV/AIDS in the Southern Africa sub-region and in the world, an HIV/AIDS epidemic, severe poverty in the agrarian sector and external shocks such as drought threaten to create a famine with a distinct vulnerability profile and a new course of impoverishment and coping. Such a famine is called 'New Variant Famine' (NVF) (De Waal, 2003, cited by Bolton, 2003). However, although some people recognise such famine, other people do not believe in it. For example, Guy Scott (2003, cited by Bolton, 2003) asserts as follows: "The New Variant Famine nonsense is just a way for the HIV/AIDS people at the UN to get food security money and for the food security people to get HIV money." Musing over the above quotation profoundly, one finds that it represents an extremely negative view that there is no linkage between HIV/AIDS and food security. This extremely negative view of the linkage between HIV/AIDS and food security is quite against the belief of some international organisations, especially UNAIDS, which believes that the food crisis in the Southern Africa sub-region and the HIV/AIDS pandemic are deeply intertwined" (UNAIDS, 2003, cited by Bolton, 2003).

One notable critique against the NVF view is given by Scott and Harland (2003, cited by Bolton, 2003) who, after conducting a study in Zambia to establish the linkage between HIV/AIDS and the new variant famine, came up with the following conclusion: "Although there are stories told of 'famine,' the examination of hospital records and nutrition surveys as well as the testimony of reliable informants indicates that there is no such a thing at the present time in Zambia." While acknowledging the "long-term situation of rural Zambians was serious," Scott and Harland (cited by Bolton, 2003) contend that the NVF scenario "does not reflect the real situation" in Zambia and express concern that "the trend has been to make more and more

dramatised statements about HIV and its effects in countries like Zambia." Finally they argue that "the impact of AIDS on smallholder agriculture is still relatively mild and the NVF scenario may be unhelpful in distracting attention from the real situation, which is serious enough without such distortion."

Scott and Harland are not the only ones who do not believe in the lack of linkage between food insecurity and HIV/AIDS; the Forum for Food Security in Southern Africa (FFSA), funded by the British Government's Department for International Development (DfID), cited by Bolton (2003) contends: "There is uncertainty over the relationship between HIV/AIDS and food." Not only that but also Barnett (1994), cited by Bolton (2003), argues that the farming systems which are most vulnerable to labour loss are not those which are most vulnerable to the epidemic.

Debating on the linkage between food security and HIV/AIDS, Broemmelsiek (2003, cited by Bolton, 2003) argues as follows: "The debate over the link between HIV/AIDS and food security is largely an academic one, which distracts attention from the very real victims of both these problems. Broemmelsiek (2003, cited by Bolton, 2003) adds: "We have to look at HIV/AIDS and food insecurity, even separately if there is no link – those are the two biggest problems here, but food insecurity must be placed in the context of other factors..."

On the same issue of linkage between HIV/AIDS and food security, a research done in Southern Africa by the Overseas Development Institute (ODI) Forum for Food Security in Southern Africa noted that widespread chronic poverty was the main determinant of food insecurity that led 7.5 million out of a population of 11.6 million to be in need of emergence food in Zimbabwe. The ODI report concluded that there was still not enough

evidence to quantify how HIV/AIDS had impacted on farming communities (Wiggins, 2005, cited by GRA, 2005). To illustrate the extent to which the pandemic had impacted on food production, the ODI research looked at the 25% HIV prevalence rate in Zimbabwe in 2003, and estimated that if the disease on average took eight years to progress from initial infection to death, with the final two years as sick and invalidated, and adding another year to reflect periodic sickness in the initial six years, then about 9% of the labour force would be out of action at any one time. "Assuming that this translates into the same loss of agricultural production, the epidemic causes losses of less than 10%. At this rate, the epidemic cannot account for more than a minor proportion of the harvest losses seen," said the report.

According to Wiggins, labour was only one factor of production contributing at most to 50% of output. In a field of maize, for example, there were other factors of production to consider, such as land, seeds, animal traction and fertiliser. Labour being so important in maize production is further corroborated by research findings of a study with the Zimbabwe Farmers Union which showed that the death of a breadwinner due to AIDS cuts the production of maize in small scale farming and communal areas by 61% (The Policy Project, 1999, cited by World Bank, 2000).

Looking objectively into the discussion above, it is evident that results of previous studies on the linkage between HIV/AIDS and food security are mixed. The best position to take on the mixed results is probably the one put forward by O'Donnell (2004) who contends as follows: "there are typically high numbers of AIDS-affected households which are not food insecure, and there are often higher absolute numbers of unaffected households which are unable to meet their minimum food needs for unrelated reasons." This position has been derived from careful analysis of empirical

information from Southern Africa countries where many studies have been conducted on the linkage between HIV/AIDS and food security. The above empirical information has potential use for comparison with results of similar studies which may be done in a country like Tanzania where few of such studies have been conducted. Findings of some similar studies (on linkage between HIV/AIDS and food security) that have been conducted in Tanzania are reviewed in Section 2.5.

2.5 Status of Research on HIV/AIDS and Food Security in Tanzania

One of the earliest empirical studies on the linkage between HIV/AIDS and food security in Tanzania was done by Barnett *et al.* (1995) and was titled "The Social and Economic Impact of HIV/AIDS on Farming Systems and Livelihoods in Rural Africa: Some Experience and Lessons from Uganda, Tanzania and Zambia". The study described the impact of HIV/AIDS on food security and one of its conclusions was "...it is difficult to disentangle AIDS impact on food security from impacts of other factors." Another empirical study that has been done in Tanzania on the linkage between HIV/AIDS and food security is the one by Rugalema (1998, cited by Topouzis, 1999), which was titled "Consequences of Loss of Labour due to HIV/AIDS in Smallholder Households in a Buhaya Village, Bukoba District, Tanzania." One of the findings of the study was that HIV/AIDS had contributed to livestock destocking due to disposal of cattle in order to generate income for AIDS treatment and related costs, but also because livestock husbandry is a "male" activity which was often abandoned by female survivors.

The above studies have been instrumental in Tanzania in the quest for the nature of the linkage between HIV/AIDS and food security so that it can be controlled to foster food security while mitigating the effects of HIV/AIDS, and halting and reversing its spread

as the sixth millennium development goal stipulates. However, the studies were essentially descriptive; for example, the study by Barnett *et al.* (1995) did not attempt to determine quantitatively the proportion of food decline explained by HIV/AIDS factors and the one explained by non-HIV/AIDS factors. The study by Rugalema quantified neither the proportion of livestock destocked nor the proportion of income spent on AIDS treatment and related costs. Nor did it determine the proportion of households in which female survivors had abandoned livestock husbandry due to the demise of their husbands. These are just a few instances of low, if not lack of, quantification of the linkages between HIV/AIDS and food security. Since results of such qualitative studies are less informative for appropriate policy measures to be undertaken, Scicchitano and Whitlock (2002) urge researchers to "shift from merely describing the effects of HIV/AIDS on agricultural production to actually measuring them, " as seen in Sub-section 1.3.2.

With regard to the above advice by Scicchitano and Whitlock (2002), for this thesis effort was made to determine the extent to which HIV/AIDS factors had caused food decline in comparison with the extent to which non-HIV/AIDS factors had. Moreover, differences in acreage, agricultural capital, hours spent on agricultural activities, farm labourers, and harvests before and after households were affected by HIV/AIDS were quantified, and they are reported in Chapter 4. By doing so, this thesis has contributed to quantitative measurement of food security using various methods, quantitative measurement of the impact of HIV/AIDS on food security, and disentanglement of the impact of HIV/AIDS on food security in comparison with the impact of other factors. This quantification helps to fill in gaps in literature about the linkage between HIV/AIDS and food security in Tanzania using Rufiji District as a case study.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Overview

In this chapter, the geographical location of the research area is described, and so are the research design, sampling, data collection and data management procedures. The chapter ends with description of how the three null hypotheses of the research were tested, including the binary logistic regression model that was used to test the third hypothesis.

3.2 Geographical Location of the Research Area

The research was conducted in the Rufiji Health and Demographic Surveillance System (HDSS) Area (Fig. 4) in Rufiji District in order to contribute to the objectives of the SUA-Rufiji HDSS Food Security and Nutrition Monitoring (FSNM) Project that funded the PhD work. The area is located about 160 km South of Dar es Salaam, and it represents Rufiji District by having about 46% of the district's population albeit it has 2 divisions, 6 wards and 33 villages out of 6 divisions, 19 wards and 98 registered villages of the district. The population of the Rufiji HDSS Area is 92 278 out of 202 001 people of Rufiji District, according to Village and Street Statistics (URT, 2005 (a)) extracted from the 2002 Population and Housing Census (URT, 2003). The above 46% is obtained as follows: (92 278 ÷ 202 001) x 100 = 45.7, which is about 46%. The location of the research area is shown in Fig. 4 and 5.

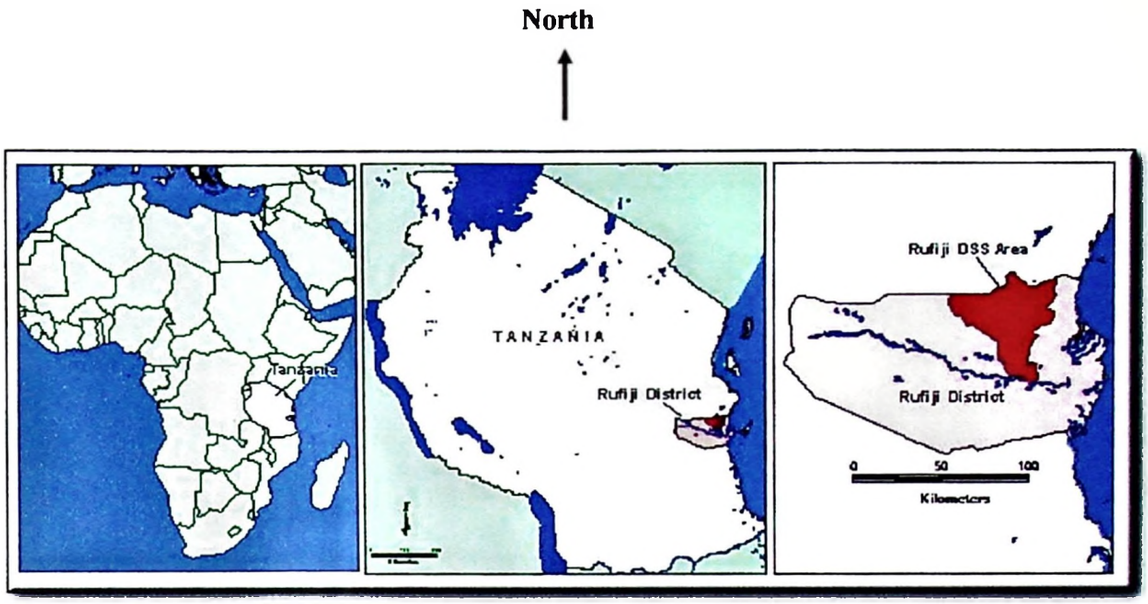

Figure 4: Africa, Tanzania, and Rufiji District showing Rufiji HDSS Area

The research area that is labelled Rufiji DSS Area in Fig. 4 is shown separately in an enlarged form in Fig. 5 with details of the wards and villages where data for this study were collected. DSS, i.e. Demographic Surveillance System, is an old name. In 2007, a new name (HDSS, i.e. Health and Demographic Surveillance System) was adopted because all such DSS Areas all over the world now integrate health variables with demographic variables, unlike previously when some of them were not doing so.

The names written in upper case letters in the shaded area in Fig. 5 are the names of the 6 wards of the Rufiji HDSS Area where data were collected. Specifically the research was done in 12 villages which are Ikwiriri South in Ikwiriri Ward; Umwe Central in Umwe Ward; Mgomba South in Mgomba Ward; Kibiti A, Kibiti B, and Kimbuga in Kibiti Ward; Mchukwi B and Mlanzi in Mchukwi Ward; and Bungu A, Jaribu Mpakani, Uponda and Pagae in Bungu Ward.

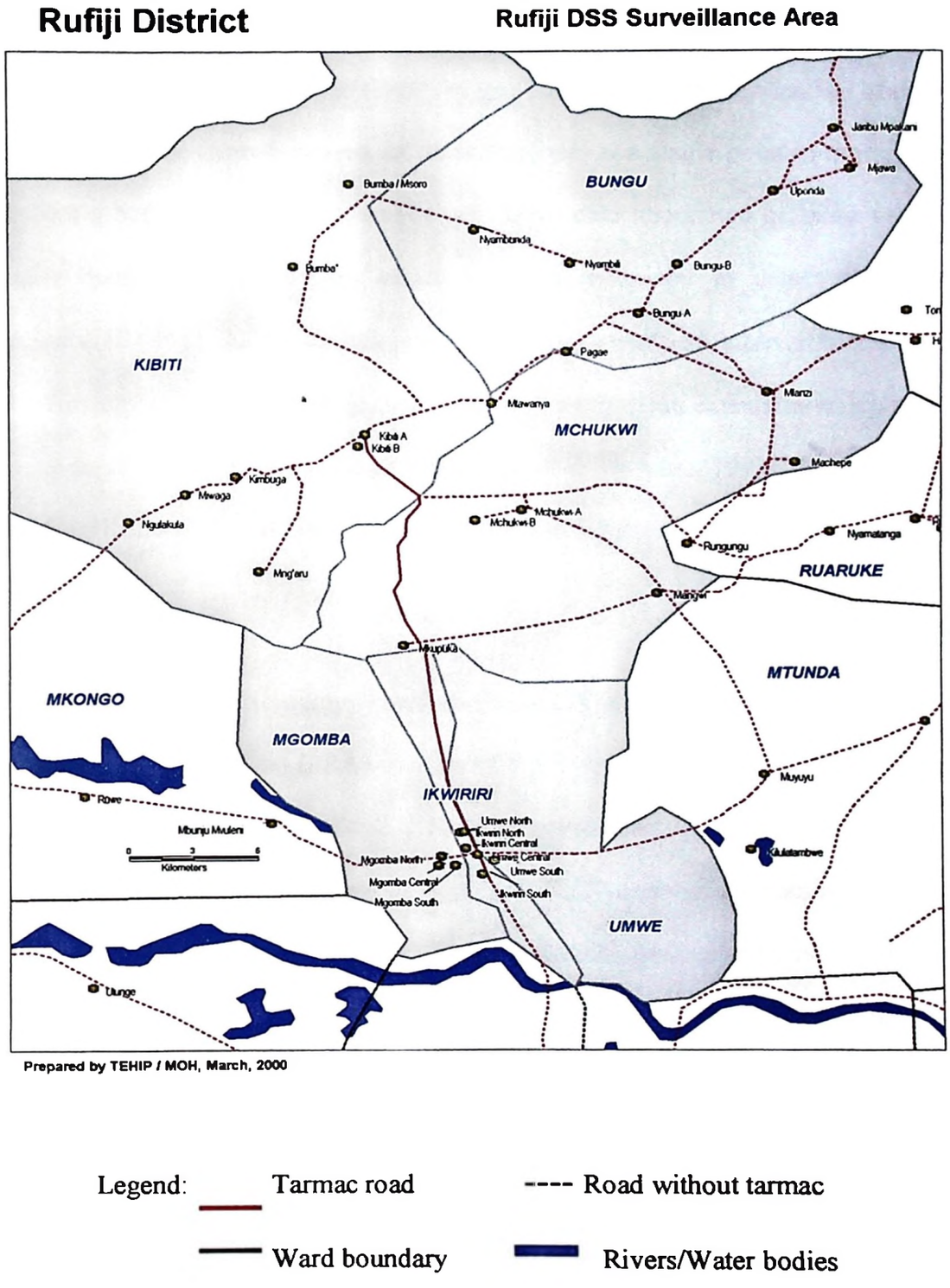

Figure 5: A detailed map of Rufiji HDSS Area showing the villages for this study

3.3 Research Design

The research employed a cross-sectional design. The design entails collection of data on more than one case (usually quite a lot more than one) at a single point in time in order to collect a body of quantitative and/or qualitative data about two or more variables (usually many more than two), which are then examined to detect patterns of association (Bryman, 2004). The adoption of the design was justifiable on the basis that it is the commonest design used in survey research to compare extents to which at least two groups of people differ on the dependent variable (de Vaus, 1993). The time frame was the agricultural season 2005/06, which was from 1 July 2005 to 30 June 2006.

3.4 Sampling Procedures

3.4.1 Sampling for participatory rural appraisal (PRA)

Participatory rural appraisal (PRA) was one of the methods for data collection in the 12 villages where data were collected. Sixteen participants for PRA were selected purposively from each of the villages to represent the diversity of the community views, women, men, the youth, various groupings as locals and non-local settlers, major ethnic groups, and occupation. Every Village Executive Officer (VEO) was given in writing attributes of 16 participants to sample for PRA. The attributes were as specified in Table 3.

Table 3: Attributes of participants in PRA

SN	Attributes		
	Sex	Age	Occupation
1	M	Younger	Farmer
2	M	Younger	Farmer
3	F	Younger	Farmer
4	F	Younger	Farmer
5	M	Older	Farmer
6	M	Older	Farmer
7	F	Older	Farmer
8	F	Older	Farmer
9	M	Younger	Non-farmer
10	M	Older	Non-farmer
11	F	Younger	Non-farmer
12	F	Older	Non-farmer
13	M	Any age	Local Government Leader
14	F	Any age	Religious Leader
15	M	Any age	Salaried employee
16	F	Any age	Local Government Leader

3.4.2 Sampling for HIES and for questionnaire-based survey

The sampling frame was all active households in the Rufiji HDSS Area, which were 16 567 in January 2005, as seen in Table 4. Active households were those whose respondents were within the Rufiji HDSS Area. Based on literature which says that regardless of the population size a sample or sub-sample of 30 cases is the bare minimum for studies in which statistical data analysis is to be done (Bailey, 1994), it was first decided with the discretion of the author that a sub-sample of 50 households affected by HIV/AIDS was reasonably high in comparison with the above minimum recommended number of cases. Since HIV/AIDS prevalence in the district was 8%, if purely proportional stratified sampling had been used, the number of households not affected by HIV/AIDS should have been (50 x 92)/8 which is 575 in order to get 92% of households sampled from the sub-population of households not affected by HIV/AIDS. This means that the sample should have been 625 (i.e. 50 + 575), but time, financial and manpower resources could not allow for this.

Therefore, modified proportional stratified sampling was conceived of whereby a sampling fraction (0.0126) that was used to sample from the sub-population of the households not affected by HIV/AIDS was one-third of the sampling fraction (0.0378) that was used to sample from the sub-population of the households affected by HIV/AIDS. Since HIV/AIDS prevalence was 8%, the number of households affected by HIV/AIDS was estimated to be the number of Rufiji HDSS active households times the HIV/AIDS prevalence, i.e. 16 567 x 0.08, which was 1325. Therefore, the number of households not affected by HIV/AIDS was estimated to be 16 567 – 1325, which was 15 242. Using a sampling fraction of 0.0126, a sub-sample of 192 households not affected by HIV/AIDS was arrived at (i.e. 0.0126 x 15 242). Using a sampling fraction of 0.0378, a sub-sample of 50 households affected by HIV/AIDS was arrived at (i.e. 1325 x 0.0378). Among the 1325 households that were estimated to have been affected by HIV/AIDS, 353 households were in the Rufiji HDSS database which showed that the 12 villages selected had bigger proportions of the households affected by HIV/AIDS. In proportional stratified sampling, sub-samples that are proportional to the sizes of the sub-populations are selected, but in simple stratified sampling sub-samples which are equal are selected regardless of the sizes of the sub-populations (William, 2006). Simple stratified sampling was not used to avoid overrepresentation of the households affected by HIV/AIDS which might have resulted into exaggeration of HIV/AIDS impact.

The use of modified proportional stratified sampling which involved increasing the sampling fraction among households affected by HIV/AIDS was guided by literature which says that when dealing with small samples and sub-samples (for example the households affected by HIV/AIDS in this case) even a slight increase in the sampling fraction can substantially reduce the sampling error, but that with large samples and

sub-samples (for example the households not affected by HIV/AIDS in this case) increasing the sampling fraction does not have the same payoff (de Vaus, 1993).

Table 4: Sample selection

Division	Rufiji HDSS Wards	Active households in each ward (N)	Households selected (n)	Households available* (n)		
				Affected	Not affected	All
Ikwiriri	Ikwiriri	1 450	21	6	13	19
	Umwe	1 350	20	3	8	11
	Mgomba	1 108	16	1	8	9
Kibiti	Kibiti	4 472	65	17	54	71
	Mchukwi	2 771	41	5	28	33
	Bungu	5 416	79	18	64	82
Total	-	**16 567**	**242**	**50**	**175**	**225**

Source: Rufiji HDSS, January 2005

* Some of the sampled households were not available due to migration, travelling, or declining to answer some or all questions.

After getting the sub-sample sizes (50 households affected by HIV/AIDS and 192 households not affected by HIV/AIDS) their selection was done systematically by first computing relevant sampling intervals in each of the 12 villages. Abiding by the rigours of systematic sampling, the first household in every case was chosen randomly by punching a random number on a hand calculator and then choosing each of the subsequent households by adding the respective sampling interval to the number chosen first in each of the villages. The process ended with selection of 242 households. However, since respondents had the freedom to respond or not respond to the questions and since some of the selected households migrated when data collection was going on; data were obtained from 225 households. Any household affected by HIV/AIDS that was not available was replaced with another household affected by HIV/AIDS which was in a reserve list. The aim of the replacement was to maintain the number of 50 among households affected by HIV/AIDS. Any household not affected by HIV/AIDS

which was not available was not replaced since the sub-sample of households not affected by HIV/AIDS was already large.

Households affected by HIV/AIDS were identified confidentially by selecting them from the list of households which had lost at least one member due to AIDS from 1 January 2003 to 31 December 2005, according to the database of the Rufiji HDSS, after getting consent of Rufiji HDSS Management to have access to the database. Rufiji HDSS collects such data, among others, in the area since 1998. Deaths due to AIDS are confirmed rigorously by verbal autopsy (VA), which is done as explained below, according to Mwageni *et al.* (2002).

VA interviews on all HDSS-registered deaths are conducted by VA supervisors, using specific standard questionnaires for deaths of infants less than 31 days old; children aged 31 days to just less than 5 years; and all persons aged 5 years and above. The interviews are held with one of the adult relatives of the deceased (preferably a caretaker) who is well informed of the sequence of events that led to the death. VA supervisors conduct interviews within 2 months of the report of death and use any available documents, such as death certificate or medical prescriptions to obtain confirmatory evidence about the cause of death from the last health facility which the deceased visited before passing away. Such evidence, however, is often unavailable. The completed questionnaire copies are then coded independently by two physicians, according to a list of causes of death, based on WHO International Classification of Diseases. A third physician is asked to independently code the cause of death in the case of discordant results. Where there are three discordant codes, the cause of death is registered "unknown".

The data of deaths due to AIDS are confidential even among the households where such deaths occurred. Due to the confidentiality, and also due to the advice by Mashalla *et al.* (2001) that in order to safeguard confidentiality in medical research identity of research subjects should be confidential, the households where at least one member had passed away due to AIDS were studied alongside other households without telling anybody, apart from the Rufiji HDSS Management, that certain households had been included in the study due to having lost a member due to AIDS.

The 225 households for the research were located in 12 villages listed in Table 5. The villages were chosen purposively based on having larger proportions of households affected by HIV/AIDS in comparison with other villages in the Rufiji HDSS Area.

3.5 Data Collection Procedures

Three methods were used to collect data, namely (a) Participatory Rural Appraisal (PRA); (b) Household Income and Expenditure Survey (HIES) and (c) Structured interviews. PRA was conducted in the 12 villages in November 2005 based on a matrix of issues for PRA and a checklist of items for discussion with 16 villagers representing the rest of the villagers. The matrix and the checklist are given in Appendix 1. The 12 PRA exercises were conducted by three researchers one being the moderator (the author of this thesis) and the other two being a recorder and a co-recorder. The standard procedure of conducting PRA outlined by Rietbergen-McCracken and Narayan (1998) was abode by.

Two Household Income and Expenditure Surveys (HIES) were conducted each for 30 consecutive days during a period of food shortage from 21 November 2005 to 20 December 2005 and during a period of food abundance from 21 June 2006 to 20 July

2006. Collecting HIES data twice during those months was aimed at taking into account seasonality that is behind high fluctuation in food security in the research area. Then the average of the 60 days' data was taken and expressed per month and per day. Otherwise, HIES data would have been collected for only 30 days, which is the conventional approach that is used even by the Tanzanian National Bureau of Statistics. It was done by Rufiji HDSS enumerators residing in the villages visiting sampled households after every three days and requesting the household heads or other members authorised by the household heads to tell them the actual amounts of foodstuffs consumed during the previous three days and prices of the foodstuffs at the price of a nearby market place. Moreover, they asked them about non-food items they had consumed on the previous three days and about durable assets they had bought from 1 July 2005 to 30 June 2006. For every household, the data were recorded in a spiral-bound booklet that contained 30 pages that were exactly similar for entering the data for 30 consecutive days.

Table 5: Villages and numbers of households sampled in the villages

Ward	Village	Households affected by HIV/AIDS sampled	Households not affected by HIV/AIDS sampled	All households sampled
Ikwiriri	1. Ikwiriri South	6	13	19
Umwe	2. Umwe Central	3	8	11
Mgomba	3. Mgomba South	1	8	9
Kibiti	4. Kibiti A	5	16	21
	5. Kibiti B	10	29	39
	6. Kimbuga	2	9	11
Mchukwi	7. Mchukwi B	3	13	16
	8. Mlanzi	2	15	17
Bungu	9. Bungu A	6	18	24
	10. Jaribu Mpakani	5	28	33
	11. Uponda	3	11	14
	12. Pagae	4	7	11
Total	-	**50**	**175**	**225**

The structured interview was conducted in September 2006 referring to the 2005/06 agricultural season that extended from 1 July 2005 to 30 June 2006. The 12 months' period was divided into three seasons: (a) dry season (From 1 July 2005 to 30 September 2005); (b) short rains season (From 1 October 2005 to 31 December 2005) and (c) long rains season (From 1 January 2006 to 30 June 2006). Based on the questionnaire, food amounts harvested, bought and obtained through other means during the three seasons were summed up to get values per year. Data collection through household income and expenditure survey and through the questionnaire was done by the enumerators of Rufiji HDSS and the supervisors of the enumerators respectively while the author of this thesis was in the research area monitoring the data collection exercise and clarifying any ambiguities to the enumerators. Before participating in the data collection process the enumerators were trained on the subject matter of the research and how to collect the data for the research.

3.6 Data Management Procedures

3.6.1 Determination of dietary energy consumed

Dietary energy consumed (DEC) was calculated based on only grains consumed because grains are the main staple foodstuffs in the research area, and their importance as a basis for DEC determination is justified by literature (Sub-section 2.3.3). In Tanzania, cereals supply 80% while other foods supply 20% of dietary energy (Seshamani, 1981, cited by Ashimogo, 1994). Therefore, using only grains, DEC obtained has to be inflated by multiplying it by 100/80 to cater for energy from other foods. Tables for Proximate Composition of Foods Commonly Eaten in East Africa (West *et al.*, 1988) were used for the calculation. The tables show that 1 kg of white maize flour as well as 1 kg of rice contains 3350 kcal. Therefore, the amounts of rice and maize eaten in kg were multiplied by 3350 to get the amounts of kcal consumed in

maize and rice. DEC obtained using the above procedure was multiplied by100/80 to take into account energy from other sources. DEC amounts obtained in that way were divided by household sizes and by adult equivalent units to get DEC per capita and DEC per adult equivalent, respectively.

3.6.2 Determination of the proportion of food insecure households

Food secure and food insecure households were obtained by segregating the households based on the Sukhatme' (1961) formula given below.

$$P(U) = P(x < r_L) = \int_{x<r_L} f(x)dx = F_x(r_L)$$

(Sukhatme, 1961, cited by Naiken, 2000), where:

P(U) = The number of food insecure households;

x = Caloric food intake per adult equivalent per day;

r_L = The minimum recommended DEC (2,200 kCal) per adult equivalent per day; and

f(x) = The marginal frequency distribution of dietary energy intake.

3.6.3 Determination of adult equivalent units

Cognisant of the fact that if variables like income and dietary energy consumed are expressed per capita they do not reflect good comparative figures in households with different sizes and composition by age and sex, dietary energy consumed was expressed per adult equivalent following Collier *et al*'s (1990) procedure in their study in Tanzania, which is exemplified below. In order to calculate adult equivalent units, the sex and age of every household member must be known first. Then a two-step procedure is followed. In the first step adult equivalent scales for East Africa by age and

sex are added up for all household members to get all the household members in terms of adult equivalents. The equivalent scales are presented in Table 6.

For example; if a household has six members who are: (a) Male aged 61 years; (b) Female aged 59 years; (c) Male aged 30 years; (d) Male aged 17 years; (e) Female aged 13 and (f) Female aged six years; they are equivalent to $0.88_{(\text{First Person})} + 0.88_{(\text{Second Person})} + 1.00_{(\text{Third Person})} + 1.20_{(\text{Fourth Person})} + 1.00_{(\text{Fifth Person})} + 0.56_{(\text{Sixth Person})} = 5.52$ adults. However, the 5.52 adults are not used directly as a denominator for computing values per adult because of economies of scale. Therefore, the second step involves adjusting the above adult equivalents for economies of scale due to the fact that larger households need fewer amounts of resources per person due to sharing some facilities. In the example, economies of scale are taken into account by multiplying the adult equivalent units obtained above (5.52) by the average cost corresponding to six people (i.e. 0.778) since 5.52 is approximately six, correct to no decimal point, as seen in Table 7.

Therefore, since 5.52 is approximately six, correct to no decimal point, 5.52 is multiplied by 0.778, which is the average cost (Table 7) corresponding to 6 adults living together, in order to adjust 5.52 for economies of scale. Therefore, the adjusted adult equivalent units are 4.29456, i.e. 5.52 x 0.778. This (4.29456) would be the denominator for calculating values per adult equivalent in that household. Such a procedure is followed for every household in a sample. If the six-people household consumed 14 000 kCal per day, their DEC per adult equivalent per day would be 14 000/4.29456 = 3259.9 kCal, unlike DEC per capita, which would be 14 000/6, which is 2333.3 kCal.

Table 6: Adult equivalent scales for East Africa

Age group	Sex	
	Male	Female
0 – 2	0.40	0.40
3 – 4	0.48	0.48
5 – 6	0.56	**0.56***
7 – 8	0.64	0.64
9 – 10	0.76	0.76
11 – 12	0.80	0.88
13 – 14	1.00	**1.00**
15 – 18	**1.20**	1.00
19 – 59	**1.00**	**0.88**
Above 60+	**0.88**	0.72

Source: Latham (1965), cited by Collier *et al.* (1990)

*The Figures in bold are the values corresponding to six hypothetical household members' caloric requirements.

Table 7: Household economies of scale constants

Household size (Number of adults)	Marginal cost	Average cost
1	1.000	1.000
2	0.892	0.946
3	0.798	0.897
4	0.713	0.851
5	0.632	0.807
6	0.632	0.778
7	0.632	0.757
8	0.632	0.741
9	0.632	0.729
Above 10+	0.632	0.719

Source: Deaton (1980), cited by Collier *et al.* (1990)

3.6.4 Methods of food security determination used in this study

Based on the methods of food security determination reviewed in Section 2.3.3, the following methods and indicators were used in this research to determine food security:

(a) Self qualitative appraisal of households themselves on having had food shortage or not. Households which said they had had food shortage any time within 12 months during the agricultural season 2005/06 were considered to be food insecure.

(b) The number of meals eaten by adults per day. Households whose adult members had eaten an average of less than three meals per day during seven days prior to the survey were considered to be food insecure.

(c) Amounts of grains harvested, bought and received freely per capita per year and per adult equivalent per year. Households with less than 200 kg per capita per year and those with less than 270 kg per adult equivalent per year were considered to be food insecure. The 200 kg is the amount of grains consumed in India per capita per year, but it is considered to be low in comparison with the amounts consumed in USA and Europe (Brown and Kane, 1994). The 270 kg is the amount recommended by Tanzania Food and Nutrition Centre (TFNC) per adult equivalent per year in Tanzania.

(d) Dietary energy consumed per capita per day and per adult equivalent per day based on annual data collected using a household questionnaire. In this case households were said to be food insecure if they had consumed less than 2100 kcal per capita per day and less than 2200 kcal per adult equivalent per day.

(e) Dietary energy consumed per capita and per adult equivalent per day based on seven days' data collected using a household questionnaire. In this case, like in the previous one, households were said to be food insecure if they had eaten less than 2100 kcal per capita per day and less than 2200 kcal per adult equivalent per day.

(f) Household Income and Expenditure Survey (HIES) whereby food consumption data were collected for 30 consecutive days and expressed for 28 days. In this case, like in the previous one, households were said to be food insecure if they had eaten less than 2100 kcal per capita per day and less than 2200 kcal per adult equivalent per day. In order to take into account seasonality, the average of data collected for 30 days during a period of food shortage and those collected for another 30 days' period of food abundance was taken.

3.6.5 Measurement of the relevance of theories on food insecurity

Indicators of the theoretical determinants of food insecurity analysed in the research are given in Table 8. The indicators were coined to facilitate the task of determining quantitatively the extent to which the theories explained food insecurity. Coining of the indicators involved scaling technologies used to produce food, food supply in market places and prices of foodstuffs in market places in order to measure them at the ratio level. Having got all the variables at the ratio level, Pearson's moment correlation was used to determine the correlation between each of the indicators of theories and food security in terms of dietary energy consumed.

Table 8: Indicators of theoretical determinants of food insecurity

Theoretical determinant	Indicator at the household level
Population	Household size
Technology	Scores on irrigation and use of tractors, improved seeds, fertilisers, and pesticides
Food supply	Number of times poor food supply in nearby market places was mentioned as a bigger cause of food shortage vis-à-vis other factors
Entitlement	• Acreage in hectares per capita for grain production • Cash spent on buying grains (maize and rice) per capita per day • Number of chickens owned per capita
Institutions	Grains (maize and rice) received freely and eaten per capita per day
Markets	Number of times high prices of food in nearby market places were mentioned as a bigger cause of food shortage vis-à-vis other factors

The use of the indicators defined in Table 8 was justifiable on the following grounds:

(a) Determining population in terms of household size was based on the level of analysis that was a household and the study being a cross-sectional one. At the community level population pressure is used in lieu of household size.

(b) Using technology in terms of a scale comprising irrigation and use of tractors, improved seeds, fertilisers, and pesticides was based on very few households having used at least one of the technologies. Therefore, using all the technologies as a

composite measure of technology made it possible for more households to be included in the analysis.

(c) The number of times poor food supply in nearby market places was mentioned as a bigger cause of food shortage in comparison with other factors was used as a measure of food supply because the places are common centres from where various foodstuffs are bought, rather than supermarkets (which are not in villages but are in towns) or in homesteads where farm gate prices tend to exploit either sellers or buyers. The more the foodstuffs in nearby market places, the higher the chances people have access to them and vice versa.

(d) Acreage, rather than land owned, was used as an indicator of entitlement because the more the acreage the more the food produced, especially among smallholder farmers of developing countries. Moreover, it was used rather than land owned because the district is one of the areas with little population per unit area of land in Tanzania, hence some land that is suitable for crop production remains fallow in many cases.

(e) Cash spent on buying grains was also used as an indicator of entitlement because, though the villagers in the research area are predominantly crop producers, their production levels are so low that almost every one buys grains. Moreover, literature has it that a significant proportion of smallholder farmers are net buyers of food (Tschirley and Webber, 1994).

(f) Grains (maize and rice) received freely were used as a proxy indicator for institutions because giving foodstuffs to neighbours and relatives, especially from one's harvests, is a custom in the area. The definition of institutions includes norms, customs and practices.

(g) The number of times high prices of food in nearby market places was mentioned as a bigger cause of food shortage in comparison with other factors was taken as an

appropriate indicator of food markets because the lower the prices the more the chances for more people to afford buying the food, and vice versa.

(h) Dietary energy consumed per capita per day was used as a measure of food security because it is the actual indicator of food security and a universal measure of food security, which is used and recommended by FAO.

3.6.6 Indicators used to determine the relevance of some contentions about HIV/AIDS effects

Besides analysing how the above theoretical determinants of food security explained food security using the indicators presented in Table 8, some of the contentious factors regarding how HIV/AIDS is linked to food security were analysed as explained below. The measurement was a step beyond merely describing the relationships, taking into account Scicchitano and Whitlock's (2002) advice that researchers should shift from merely describing the effects of HIV/AIDS on agricultural production and food security to actually measuring it. The linkages between HIV/AIDS and food security analysed were the following ones:

(a) The impact of labour on food security was analysed by comparing food security in households with different changes in labour before and after households lost a member due to AIDS and between households where members were ill for fewer days and those where members were ill for more days.

(b) Catastrophic expenditure on health care was analysed by comparing the costs of expenditure on health between households affected and those not affected by HIV/AIDS.

(c) Dependency ratio was analysed by comparing dependency ratios between households affected and those not affected by HIV/AIDS.

(d) Reduced income to buy food was assessed by comparing income spent on buying food between households affected and those not affected by HIV/AIDS.

(e) Costs incurred on funeral were analysed by comparing them with overall expenditure.

(f) The food insecurity factors that are likely to deepen HIV/AIDS or predispose HIV negative people to HIV infection were analysed as strategies for coping with food insecurity.

3.6.7 Hypothesis testing

The first hypothesis, which was about determining whether the amounts of food produced were significantly different between households affected and those not affected by HIV/AIDS and between households with different non-HIV/AIDS factors was tested using t-test because it is ideal for comparing two groups. The second hypothesis, which was about determining whether dietary energy consumed per adult equivalent per day was significantly different between households affected and those not affected by HIV/AIDS, and in households with different non-HIV/AIDS factors, was tested using one-way ANOVA since it is ideal for determining differences among more than two groups.

The third hypothesis which was determining the likelihood of households affected by HIV/AIDS to be food secure vis-à-vis the likelihood of households not affected by HIV/AIDS to be food secure was tested using a binary logistic regression model since such a model is ideal for variables in which the dependent one is dichotomous, like food insecure (0) and food secure (1) in this research. The model was specified as follows:

Logit $(p_i) = \log (p_i/1-p_i) = b_0 + b_1x_1 + b_2x_2 + \ldots + b_kx_k$ (Agresti, 2002; Xie, 2000),

where:

Logit (pi) = ln (odds(event), that is the natural log of the odds of an event occurring

p_i = prob (event), that is the probability that the event will occur

$1-p_i$ = prob (nonevent), that is the probability that the event will not occur

b_0 = constant of the equation

b_1 to b_k = coefficients of the independent (predictor, response) variables

k = number of independent variables

x_1 to x_i = independent variables entered in the model, which were:

x_1 = dependency ratio

x_2 = maize and rice acreage

x_3 = maize and rice eaten from own harvests

x_4 = maize and rice bought

x_5 = maize and rice received freely

x_6 = health expenditure

x_7 = death due to AIDS

x_8 = death due to non-AIDS causes

The dependent variable was a dummy of food security, whereby food insecure was 0 if a household had consumed less than 2 200 kCal per adult equivalent per day and food secure was 1 if a household had consumed at least 2 200 kCal per adult equivalent per day. This dependent variable was regressed on the above 8 independent variables to find the impact of each of them on the dependent variable. Testing of the third hypothesis was concerned only with the impact of x_7 on the dependent variable.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Overview

This chapter gives the findings of the research and discussions. Prior to collecting quantitative information, qualitative assessment of the prevalence of HIV/AIDS and food insecurity was done in order to get some insights about the two issues and their relationship from local people's point of view so that the insights could inform subsequent quantitative data collection. The qualitative information is presented in Section 4.2 while Section 4.3 gives the socio-demographics of the households surveyed and quantitative examination of the status of food security. Section 4.4 is about food security levels among households affected and those not affected by HIV/AIDS while Section 4.5 is about strategies used to cope with food insecurity. In Section 4.6 results of food status in relation to non-HIV/AIDS factors and theoretical determinants of food security are given. In Section 4.7 the odds ratios of being food secure given various variables are given, while Section 4.8 is about poverty. The chapter ends with Section 4.9 which gives a critical view of the results.

4.2 Qualitative Appraisal of the Status of HIV/AIDS and Food Security

The first objective of the research was to appraise qualitatively the status of HIV/AIDS and food security. In order to meet this objective, participatory rural appraisal (PRA) was conducted in all the 12 villages selected for the research. The PRA exercises concentrated on the indicators of food supply, entitlement to food, food sufficiency, strategies for coping with food shortage, prevalence of HIV/AIDS and other diseases, linkage between HIV/AIDS and food security, linkage between HIV/AIDS and some

cultural elements, and linkage between food security and some cultural elements. The results of the PRA exercises are presented below.

4.2.1 Appraisal of indicators of food supply

Food supply indicators are facts whose existence at favourable levels enhances food availability through production or other means. For example, the bigger the size of land cultivated for food production, the more the chances of harvesting more food. According to Maxwell and Frankenberger (1992), food supply indicators include amount of rainfall, agricultural land fertility, availability of water for irrigation, acreage, amounts of food produced and stored, amounts of food bought and received freely, amount of food consumed, amount of food given away and amount of food lost. All the above indicators of food supply were discussed in the 12 villages where data were collected.

About rainfall, it was found that rainfall was erratic in some years, and this was one of the factors constraining production of adequate food. The district normally receives bimodal rainfall whereby there is a short rains period from October to December and a long rains period from February to May. However, during this research in the agricultural season 2005/06, short period rains, which were supposed to rain from October to December 2005, did not rain. Such shortage of rainfall also occurred during the 2004/05 and 1996/97 agricultural seasons. One of the participants lamented: "Nowadays, rainfall is inadequate. This has led to decline in food production. For example, most of those who used to harvest 500 kg of maize are harvesting only 100 kg."

About land fertility, the PRA participants in almost all the villages said that their land was infertile. It was only in Kimbuga Village where they said that the land was moderately fertile. About irrigation, it was found that only few households were producing some crops by irrigation near water sources during the dry seasons. The horticultural crops grown during the dry season included tomatoes, spinach and okra. Few of the villagers were also producing maize by irrigation during the dry season. The maize was being sold to maize roasters; it was not being dried for making flour for stiff porridge.

About land pieces owned, acreages and amounts of food harvested per unit area and in total, the PRA participants said that the sizes of the plots owned for agricultural production ranged from one to five acres per household and that most of the villagers were cultivating only about 50% of the land they owned. The amounts of grains harvested were normally 300 to 400 kg of rice per acre and 400 to 500 kg per acre for maize. However, in some years some households were not producing either of the crops. Moreover, the people of Kibiti Division, who depend more on cassava and maize, unlike those of Ikwiriri Division who mainly depend on rice, were producing more maize than the people of Ikwiriri. The amounts of harvests were not satisfactory for their households' consumption. However, one said: "In a good year when rainfall is enough and rodents have not devoured one's crops in field, one can harvest even 1000 kg of maize per acre." Another one added: "But these days, due to rainfall unreliability, harvests have decreased by about 50% for many villagers."

They said that the main factors that were behind low production were crop pests especially weeds, insects, rats, birds, wild pigs and monkeys; inadequate rainfall that had led to many households being food insecure between 2004 and 2006; farm lands

being infertile; people cultivating small plots of one to two acres per household per season; and failure to practise irrigation due to great scarcity of water in most of the villages. Other factors that were causing low production were said to be use of poor agricultural tools, including the hand hoe by means of which a large area cannot be cultivated; failure to use fertilizers due to belief that their land did not need fertilisation; gender imbalance whereby women were the ones participating more in agricultural production with little or no support from their husbands, sons and daughters; and inadequate cash capital, agricultural inputs and agricultural implements. The PRA participants corroborated the negligence of young people of agriculture by saying: "*Vijana hawashiriki kilimo; wanasema kilimo ni adhabu,*" which means the youth do not participate in agriculture; they say agriculture is punishment."

Other factors that were said to be behind low agricultural production were inadequate agricultural extension services; poor agronomic practices; theft of crop products in field; human illnesses; use of unimproved seed varieties; unreliable markets for their food and cash crop products; having big families containing many members in the age dependency group; and practice of patriarchy whereby women's suggestions on how to improve agricultural production were always not considered. The presence of patriarchy was revealed by one female participant who unhappily said: *"Mwanamke atazungumza kitu wakiwepo wanaume?"* This literally means "Can a woman say anything in front of men?" Women nodded heads in agreement with her but men just kept silent. It implies that once men are there women's views are neglected. Therefore, sometimes even if women have good suggestions they just shelve them. Other factors behind low agricultural production were said to be most farmlands being far away from home thereby substantial time being lost on the way to and from the farms, and draughty weather with excessive sunny conditions that is locally called *langalanga*, and which

occurred prominently in the agricultural season 1996/1997 but a little in the agricultural season 2005/2006.

From the participants' point of view, a food secure household, if it was an average one comprising five members, was one harvesting 500 kg of maize per acre; 800 kg of rice per acre; 2000 kg of cassava per acre; 400 kg of sorghum per acre; 2000 kg of cashew nuts per 70 cashew nut trees; and 10 000 coconuts. However, since not all villages had such crops, and due to low production because of the factors outlined above, most households were buying most of the foodstuffs they needed for their own consumption. The participants in PRA estimated that only about five percent of the households were harvesting the amounts of crop products listed above, which means that about 95% of the villagers were food insecure.

The participants also said that food shortage was critical in certain months while there was food abundance in some months. The months of food abundance were said to be January, March, April, June, July, and August; those of food shortage were said to be September, October, November, December, February and May. This information was helpful to know the appropriate months in which to conduct Household Income and Expenditure Survey (HIES). During the months of food abundance, 80% of the households were estimated to eat three meals a day while during the months of food shortage about 30% of the population was estimated to eat three meals a day.

About the proportions of people whose previous season's food harvests were reaching the next season, the participants estimated that they were only about two to 25% of all the people in all the villages. While in Mgomba South Village the estimate of households whose previous season's harvests were reaching the next season was as high

as 25%, in Ikwiriri South participants said that no villager in their village had harvests of one agricultural season reaching the next agricultural year's harvests.

About the proportions of households buying staple foodstuffs, it was estimated that up to 90% of households in Ikwiriri Division were purchasing staple foodstuffs, particularly maize and rice, at a certain period of the year. But in Kibiti Division, relatively smaller proportions of villagers were purchasing maize and rice because they produce much cassava, unlike the people of Ikwiriri Division who hardly produce cassava, hence rely almost entirely on maize and rice as their carbohydrate foodstuffs. In Kibiti Division villages it was estimated that about 20% of households were purchasing cassava; about 80% were purchasing maize, and about 80% of households were purchasing rice.

About storage of foodstuffs, it was estimated that only about three to 10% of households were storing maize and up to 30% of households were storing rice. In some of the villages, for example, Ikwiriri South, it was initially said that no household was storing foodstuffs harvested. Musing over this critically, it is very unlikely since it is hardly true that every household was consuming all its harvests at once. Therefore, probing on the answer was done, and the participants revealed that, in some households, maize and rice harvested were being stored for a short period of a few weeks to about two months. Storage of foodstuffs for a short duration of about two months in Rufiji District is contrary to the duration of food storage in other places, for example in the Southern Highlands of Tanzania where maize is normally stored even for more than 12 months. The longer duration of maize storage in the Southern Highlands is due to the fact that much maize is harvested, unlike in Rufiji District where the harvests are relatively very little.

4.2.2 Appraisal of indicators of entitlement to food

Entitlements to food are wealth items including productive assets, cash, and liquid assets, which can easily be sold to get cash to buy food or can be exchanged for food. Maxwell and Frankenberger (1992) contend that such items include land, livestock, house, and farm implements. Therefore, the participants in PRA were asked about villagers' ownership of various assets including the ones listed above. It was found that all households owned land. But the sizes of the land pieces owned were small: 1 to 5 acres per household. Since, as seen in Section 4.2.1, little proportions (5–30%) of land owned were being cultivated, the portions of land that were not being cultivated would have been hired out, if the market for land hire had been good. The money obtained by hiring out land might have contributed to buying some food. But the market for hiring land was not good. With respect to livestock keeping, the major species of livestock kept was chicken. PRA participants estimated that chickens were being kept in about 95% of the households and that only about 1% of the households were keeping goats.

Environmental entitlements can help improve food security by people collecting materials including poles as building materials, firewood, charcoal, some rocks, and medicinal plants for selling to obtain cash for buying food. Some wild foodstuffs and game can also be obtained for direct consumption. Cognisant of these facts, during PRA, participants were asked whether some villagers were collecting wild foods. It was found that the collection was very little, and it was mainly of wild fruits locally known as *mabungo* (*Dictyophleba lucida*), *fulu* (*Vitex doniana* and *V. keniensis*), *and zambarau* (*Syzygium guineense* and *S. cuminii*), which were being collected during rainy seasons, especially between December and March. Another wild food was locally known as *mibao*, which is a carbohydrate tuber that was being collected during the late dry seasons, especially from September to November when food was scarce. The fruits

were normally being eaten as snacks; the *mibao* were normally being eaten as lunch. However, very few villagers (at most about 15% of the food insecure households) were estimated to collect such foods. This shows that wild food collection was not a reliable source of food.

About assets ownership, participants estimated that up to 75% of households owned iron sheets roofed houses, and a good number of them owned bicycles while all of them owned farm tools including hand hoes and machetes. A considerable amount of some of the assets owned, including livestock, were being sold during food shortage to buy food.

4.2.3 Appraisal of indicators of food sufficiency

Participants were asked to discuss the amounts of grains they considered to be sufficient. Their views were that 20 to 30 bags of maize were sufficient per year for a household containing an average of six members. The amount of 20 bags for six people per year is about three bags per adult per year, which is recommended by Tanzania Food and Nutrition Centre (TFNC) (URT, 1999). This means that although the figures obtained from PRA were rough estimates, in some cases they were close to the real situation. Food sufficiency was also assessed in terms of amounts of grains consumed per day. About this proxy measure of food sufficiency, the participants said that for a household having five members 1 kg of maize flour was sufficient per meal while for rice such a household needed 1.5 kg per meal. They said that consumption during the months of food shortage was normally less than that during the months of food abundance.

It was noted that food shortages in the research area were so common that the residents of the place had coined catchphrases to signify the shortages. One of the catchphrases

was "*Mwenda haendi na mrudi harudi*" period. The slogan literally means "the one who would like to travel away from home doesn't do so and the one who would like to go back home doesn't go". They clarified the slogan that during that period of critical shortage of food a household head who would like to travel from home does not travel because he has nothing to leave his family with, and the one who would like to go back home does not do so because he has nothing to bring home. They added that in some worst instances of such critical shortage of food a household head could abandon his household and go away. Another slogan for a period of critical shortage of food was "*mwache mwache*," which literally means "leave him or her". The term is applied to the habit of people sneaking away from their friends and going to eat, if food is ready at their home or anywhere else, where they can have access to it. Moreover, unlike the African traditions, which allow visitors to eat with their hosts once they find them eating or when food is ready for being eaten while visitors are present, during the period of *mwache mwache* people do not give food to visitors; if a visitor comes, they hide the food they were about to eat or they were eating and postpone eating until the visitor leaves. One participant underlined this point by saying "*Chakula kinafichwa hata ndani ya kofia ikiwa imevaliwa,"* which means "Food is hidden even in a hat when it is worn." This is normally done lest visitors see the food, let alone eating it.

The participants also said that a household is food secure if it has an average of three acres of a cassava farm, two acres of a rice farm and 100 cashew nut trees, if it is an average one comprising five members. They estimated that approximately 80% of the villagers owned cashew nut trees. They also said that if a household head had "large-scale business" or he/she was a government employee the household could have enough food without producing it. During the PRA exercises, participants were also asked to estimate the proportion of income spent on food. They estimated that 70% to 90% of

household income was being spent on food items. From this finding, it is obvious that the proportion of income spent on food was high vis-à-vis the proportions of consumption expenditures on food in Tanzania that is 65% (NBS, 2002).

Food preference being one of the proxy indicators of food security, the participants were asked to state the foodstuffs that people in the villages considered inferior and the ones that they considered superior. Their discussion outcomes are recorded in Table 9.

Table 9: Foodstuffs preferred in Rufiji District

Carbohydrate foodstuffs		Protein foodstuffs	
Most preferred	Rice	Most preferred	Chicken
↑	Maize	↑	Beef
	Cassava		Fish
	Yams		Vegetables
	Sweet potatoes		Beans
	Banana		Cow peas
	Pumpkins		Pigeon peas
↓	Sorghum	↓	Green gram
Least preferred	Cooked jack fruits	Least preferred	Sardines
	Cooked mangoes		Shrimps

The inferiority of foods was judged on the basis of their being consumed in the absence of superior ones and by low income earners. It was said that about 60% of meals in a month were of inferior foods while about 40% of the meals in a month were of superior foods. About the number of meals eaten, it was said that about 50% of adults were getting at least two meals per day and about 50% of households which had children aged six to 59 months were getting at least three meals per day for their under-five years old children. It was also said that about 80% of the households were taking three meals a day: tea and boiled cassava as breakfast in the morning, stiff porridge and cassava leaves vegetable as lunch, and stiff porridge and sardines as dinner. The participants said that during food shortage months only about 10% of households were getting three

meals a day and during food abundance about 95% of households were getting three meals a day. About 50% of the households were taking three meals a day when food was abundant, and only about 20% of households were taking three meals a day when food was scarce.

With regard to meals of inferior and superior foods, the participants said that about 60% of adults in the villages were eating such meals at least twice a day. They also said that more people were eating superior foods in January, March, April, June, July and August when food was abundant relatively. They added that taking fewer meals was common in February, May, September, October, November and December which were the months of food shortage relatively. The above percentages are rough estimates given by participants in the PRA exercises for the research; they may be quite different from questionnaire-based data.

The majority of villagers were eating three meals a day during the seasons with bumper harvests. Since such seasons were also common, like seasons with critical shortage of food, there were slogans to signify the seasons. One of the most famous slogans was "*ukipata tumia ukikosa jutia*", which literally means "when you have something use it; when you don't have it lament for not having it." The lamentations were happening during seasons with low harvests in which case they were eating only one to two meals per day. About proportions of households whose children aged six to 59 months were getting more than three meals per day, they said that it was only in about 25% of the households.

The participants in PRA were asked to rank the availability of food in the calendar year and give reasons for variation in the availability. Asterisks were used with the highest

number of them representing the month of the highest food availability and vice versa. The results are given in Table 10.

Table 10: Seasonal levels of food availability and reasons for variation

Month	Food availability*	Count	Reason for the level of food security
Jan	**	2	Not yet harvested; casual labour work
Feb	*	1	Dry spell
Mar	*********	9	Harvesting maize, pumpkins
Apr	********	8	Maize harvested in March still there
May	**********	11	Start of rice harvesting
Jun	**********	12	Rice and maize harvesting
Jul	**********	10	Rice and maize harvested still there
Aug	*******	7	Rice and maize harvested decreasing
Sep	******	6	Previous food harvests heading to exhaustion
Oct	******	5	Previous grains harvests exhausted
Nov	****	4	Previous grains harvests exhausted
Dec	***	3	Farm preparation; paying to farm labourers

Source: Consensus among PRA participants, November 2005

* Fewer asterisks mean less food availability and vice versa

Using the data in Table 10, Fig. 6 was drawn to illustrate the variations in food availability, with a view that various interventions might be timed during certain months according to the variations.

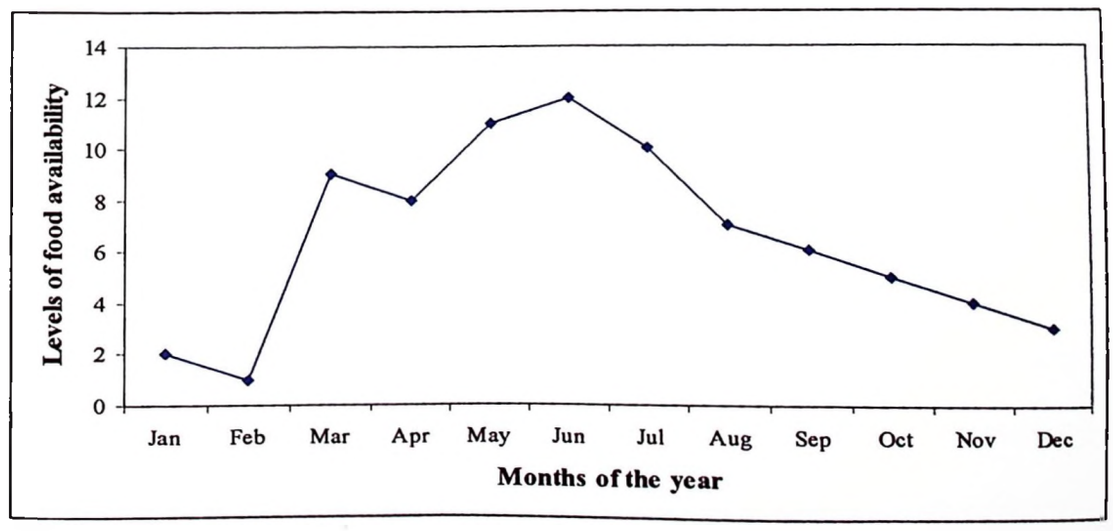

Figure 6: A seasonal calendar for food availability in Rufiji District

4.2.4 Appraisal of indicators of strategies for coping with food shortage

During periods of food shortage, the villagers had various ways of coping with the situation. One of the commonest ways that was mentioned was "*kula mtu na dada yake*", which literally means "eating a person and her sister." They clarified that the "person" was cassava in its various forms and that the sister was cassava leaves. A cassava farm was considered to be a bank from which food could be obtained during critical shortage of food. Therefore, eating cassava (boiled or cassava stiff porridge) in combination with cooked cassava leaves, which is known as *kisamvu* in Kiswahili, was common during periods of food shortage. Not only '*kula mtu na dada yake*', but they also said that eating other foodstuffs they considered to be inferior was another strategy of coping with food insecurity. Another way of coping with food insecurity was eating one meal per day, instead of two or three meals. Also, doing casual labour work was another way of coping with food insecurity. Those with food insecurity were mostly doing causal labour work in October, November, December, January, February and April when food scarcity was higher than in other months. Casual labour work was associated with temporary migration for some villagers for the work.

Another way of coping with food insecurity was seeking loans for consumption. Most people were doing so in the same months when food security was more severe. Lenders were informal ones, and they were mainly shop/kiosk owners and traders who were lending either cash or food items to their neighbours and relatives. Other villagers were coping with food insecurity by selling some of their assets. This was usually being done from November to April. The assets included chickens, bicycles, and radio receivers. Charcoal making was also said to be another common strategy for coping with food insecurity. This was normally being done any time of the year, but more so during late dry seasons from August to October. Some of the villagers were also engaging

themselves in lumbering and others were consuming some wild food varieties, as explained in Section 4.2.2. During extreme shortage of food, some villagers had received food relief from the government in some years including 1999, 2004 and 2006. For example, in Kimbuga Village in 2004 all the 523 households received food relief from the Government due to famine that was looming.

4.2.5 Appraisal of prevalence of HIV/AIDS

In order to assess whether HIV/AIDS was a problem in the research area, participants were asked to rank the most important diseases in their villages. The results are as seen in Table 11, and they show that HIV/AIDS was a substantial problem, which is indicated by the fact that it was mentioned among the first two most serious health problems.

Elephantiasis of the scrotum, which is called "*busha*" in Kiswahili, was found to be one among the major health problems in Rufiji District as indicated by its having been mentioned in eight villages out of 12 villages. Other major health problems in the research area, as seen in Table 11, were eyes, scrotal hernia, numbness and joint pains, polio, tuberculosis (TB), pneumonia, sexually transmitted infections (STIs), and skin fungal diseases, which were said to be major health problems in at least half of the villages.

4.2.6 Appraisal of linkages between HIV/AIDS and food security

In the light of the conceptualisation that HIV/AIDS and food security have mutual effects, as illustrated in Fig. 1 and 3; the reciprocal relationships were looked into during PRA by discussing with participants to find whether they thought such reciprocal

relationships existed in their villages. Their discussions revealed that reciprocal relationships between HIV/AIDS and food security existed, as elaborated below.

4.2.6.1 Food abundance exacerbating HIV/AIDS

Two main ways by which food abundance was influencing HIV/AIDS were discussed. One of them was that during years of food abundance the majority of villagers were engaging themselves more in traditional dances. Due to the dances taking a couple of days, day and night, some of the people who were taking part in the dances were practising sexual promiscuity, which is risky for HIV transmission, especially if unprotected sexual intercourse is done. In association with traditional dances, sometimes raping was happening. The youths were not afraid of being jailed for raping, and they were saying: "*Hatuogopi jela; kuna sembe la bure*" meaning "We are not afraid of being jailed; in jail there is free food." This means that there is free food in jail.

Another way through which abundant food was exacerbating HIV infection was through using income from agricultural products sales to engage in sexual promiscuity or marrying additional wives who might be HIV positive. Participants said that abundant food in years when it was abundant or in households where it was always abundant was tempting some men to commit adultery, which might lead to HIV infection. Moreover, if a man had increased income from agricultural production, he might decide to marry another wife. The new wife might be HIV positive or so sexually promiscuous that she might bring HIV to her husband. Moreover, a man with much income from agricultural products sales might abandon his family and spend the money in extra marital love affairs with another woman or other women. The latter might be HIV positive and cause the man to be infected by HIV. Alternatively, the man might be HIV positive and spread the virus to a number of women.

Table 11: The frequencies at which HIV/AIDS and other diseases were mentioned

Disease (n = 12)	Number of villages where it was mentioned as a major health problem
Malaria	12
HIV/AIDS	12
Stomach-ache/diarrhoea	11
Elephantiasis of the scrotum	8
Eyes	8
Scrotal hernia	8
Numbness and joint pains	8
Polio	8
Tuberculosis (TB)	8
Pneumonia	6
Sexually transmitted infections (STIs)	6
Skin fungal diseases	6
Chest related diseases	5
Asthma	3
Chickenpox	3
Diabetes	3
Headaches	3
Measles	3
Typhoid fever	3
Cholera	2
Convulsions	2
Ear infection	2
Epilepsy	2
Leprosy	2
Teeth	2
Bilharziasis	1
Cancer	1
Elephantiasis	1
Flue	1
Hypertension	1
Injuries	1
Kwashiorkor	1
Mumps	1
Peptic ulcers	1
Rabies	1
Trachoma	1
Worms	1

4.2.6.2 HIV/AIDS exacerbating food shortage

The participants in PRA were also asked to discuss whether HIV/AIDS was aggravating food shortage in their villages in any way. They discussed affirmatively including the following arguments. HIV/AIDS aggravates food insecurity by causing loss of labour

for agricultural production; a lot of expenses being incurred to visit traditional healers for AIDS treatment; and additional expenses being incurred for treatment of opportunistic infections in hospital. Moreover, they said that People Living with HIV/AIDS (PLWHA) have to have other people caring for them in lieu of the other people working for themselves. They added that a lot of income, some of which would be used to buy food or agricultural inputs, is used for treatment. The issue of consulting traditional healers for HIV/AIDS treatment observed in Rufiji is consistent with literature that has it that traditional beliefs in witchcraft compel people to seek health services from traditional healers, whose fees can be exorbitant (Ngwira *et al.*, 2001), as seen in Sub-section 2.4.1.

The participants also said that HIV/AIDS affects food security by affected households incurring additional costs to take care of HIV/AIDS victims. They said that the victims may stay in bed for up to three years while they are unable to work. In such cases their relatives have to take care of them in terms of labour, food, and cash. They insisted that a lot of time is required to care for HIV/AIDS victims and that the victims cannot participate in food production. They also said that HIV/AIDS deaths cause increase of orphans in the villages, leading to increased burden for households to care for the orphans. They also said that victims of HIV/AIDS who have investments far from their villages may lose those investments due to the inability to follow up activities of the investments. They also said that members taking care of PLWHA cannot engage in food production since their substantial time is spent on the care.

One rather amazing point on how HIV/AIDS affects food security was given by PRA participants in Mlanzi Village: *"Hatimaye mgonjwa akifa ndugu zake wanasherehekea kifo chake"*; which means "Eventually when a PLWHA passes away his/her relatives

celebrate his/her death." This statement was given by one participant, and his fellow supported him. They elaborated that if one dies then his/her days to live have been calculated off by the Almighty God. One of them added: "Expenses that were being incurred in terms of time, labour and financial resources to take care of him or her are saved; hence, some improvement in household well being may be realised, including getting more time to work on farm to produce food and/or using cash that would be used to take care of the HIV/AIDS victims to buy food." Although these words look amazing, especially because they are not normally said openly, they contain some truth, and some scholars have documented similar views, for example O'Donnell (2004), as seen in Section 2.4.1. However, one of the participants reminded the rest: "Although some people celebrate such for death, functions associated with burial and mourning a deceased relative are costly, especially the end of mourning function that is normally done 40 days after death." Another one added that AIDS claiming lives of energetic people who would be working to produce food impinges negatively on food security.

4.2.7 Appraisal of linkages between food security and some cultural elements

The participants were also involved in discussing whether some cultural practices in Rufiji District had any effect on food security. They discussed the practices discussed hereunder. One of the traditional practices affecting food security is ceremonies to finalise mourning of a deceased relative. The participants in PRA said that over 90% of the households were organising such ceremonies 40 days after their relative had passed away. They added that sizeable proportions of food harvested and relatively substantial amounts of cash were being used on such ceremonies. By so doing, it is obvious that the ceremonies contributed to food shortage. The participants estimated that about 100 kg of grains might be consumed during such a ceremony.

Another cultural practice that was said to have negative effect on food security was devilish dances ("*Ngoma za kupunga Mashetani*" in Kiswahili). This is facilitated by witchdoctors helping some households, whose members believe in their ancestors who passed away many years ago helping them in their economic and social endeavours, seek favour from the ancestors or thank them for good harvests. It was estimated that about 10% of the households were practising this, which is normally done for one or two weeks. Sizeable proportions of food harvested are spent on this type of ritual.

Using some foodstuffs for brewing, especially cassava, banana, and sorghum thereby reducing food that would be consumed in terms of meals was another practice leading to fast exhaustion of food harvested. Participants in PRA estimated that about 25% of the households were using some of their food reserves to prepare local brew.

Celebrating girls' attainment of sexual maturity was another cause of fast exhaustion of food harvested. More than 80% of the households were engaging themselves in such traditional celebrations. It was said that a household not having such celebration might be segregated by the rest of the households since not having such celebration means being unsociable. Invited and uninvited people participate in such celebrations. Their number can be as high as 1000. If a household fails to organise for such a dancing ceremony while their daughter has attained sexual maturity, it is considered to be very shameful, and members of those households blame their household head for the failure to organise such a ceremony. Common months for traditional dances were said to be July, August, September, and April when food is relatively abundant. Substantial amounts of food are consumed during such traditional dances. For example, a household which has harvested five bags of maize may use three bags during the

traditional dances. The household is required to feed all the invited and uninvited guests for one to five days, depending on their food ability.

The Government is concerned that the celebrations are too many and have negative impact on food security. Therefore, it has imposed conditions for the celebrations to take place. The conditions include the households paying a fee to a local government authority (LGA) before having the ceremony, but this has not been effective to discourage the celebrations. One old female PRA participant said emphatically: "We have to abide by our traditions of celebrating girls' attainment of sexual maturity because that is what our ancestors insist on; if we do not do it, they may be angry with us and punish us." Participants estimated that more than 95% of all girls have such dances played to celebrate their attainment of sexual maturity. This shows that the tradition of celebrating girls' attainment of sexual maturity and that of celebrating boys' circumcision discussed in Sub-section 4.2.8 are so deep rooted that they are likely to linger for many years to come.

Another traditional practice that contributes to food shortage is celebrating boys' circumcision. As seen in Sub-section 4.2.8, about 80% of boys are circumcised by traditional circumcisers known as *ngariba*. The circumcisions are accompanied by ceremonies in which substantial amounts of food harvested may be consumed thereby contributing to fast exhaustion of food stocks.

4.2.8 Appraisal of linkages between HIV/AIDS and some cultural elements

Besides the above linkages between HIV/AIDS and food security, there are some cultural elements in Rufiji District which contribute to fuelling the HIV/AIDS epidemic. Some of cultural elements are the beliefs that traditional circumcisers circumcise better

than medical personnel do, and that traditionally circumcised penises perform better sexually than the ones circumcised in hospital. Accordingly, about 80% of boys are circumcised by traditional circumcisers known as *ngariba*. This may contribute to HIV transmission among the boys being circumcised if any of them is HIV positive and the circumcisers do not take appropriate sanitary measures. One knife can be used by *ngariba* to circumcise up to 10 boys during one circumcision session.

In spite of traditional circumcision being risky for HIV transmission, the people of Rufiji embrace it. This was authenticated by the following words: "We cannot abandon traditional circumcision because our elders keep insisting on it and of course on the associated traditional dances for social recognition of the households where the events take place," said one of the participants. The majority of the boys are circumcised when they are seven to 11 years old. "At this age they are about to reach sexual maturity hence the circumcision is done to inform the society that the boys are in the streets ready to work; any boy who is uncircumcised gets nothing." said one participant while others were nodding and laughing in support of the words. The above words are obvious that one of the aims of the circumcision is to prepare the boys for sexual intercourse at a young age.

A number of cultural elements in terms of slogans, practices, and habits that contribute to fuelling HIV infection were also found. They included youths' engagement in occasional dances organised by the youth themselves. The dances take place day and night for about three days, say from Friday to Sunday. Many young men and women take part in the dances, and the possibility of engaging in unsafe sex is very high. In Rufiji District there are also some slogans with negative connotations about HIV/AIDS. One of the famous slogans in the area is *"Kufa ni kufa tu; ajali kazini"*; which literally

means "Dieing is dieing; accident at work." People say so implying and/or believing that death occurs any time; even if AIDS does not kill them any other cause like an accident can kill them any time. This statement persuades others, especially the naïve ones, to be active in sex devoid of being afraid of HIV infection.

Another slogan is "*Ponda mali kufa kwaja"*; which literally means "Squander wealth; death is coming." This slogan is used to imply that people should not be afraid of HIV; instead they should enjoy their life to the maximum, including human sexuality, since they may die any time before they have enjoyed much. Another common slogan in the research area is "*Hakuna kinachodumu hata miti hufa."* This literally means "Nothing lives forever; even trees die". This slogan, like the first one above, implies that even if they do not die from AIDS they will definitely die from any other cause. Therefore, the slogan persuades people to enjoy sex without being afraid of HIV infection.

There are also some habits, which fuel HIV infection in Rufiji District. One of them is the concept of *"Vunja jungu*", "which literally means "Break up the pot". By this habit, just before the month of Ramadan, people do deliberately deeds prohibited by the Islamic Religion, especially adultery, to "compensate" for the days when they will not be doing so during the Holy Month of Ramadan when Muslims are supposed to fast by not eating food during day time and refraining from committing any sin, including adultery, since it is their month for confessing their sins. Participants in PRA estimated that over 30% of youths and over 10% of adults were engaged in "v*unja jungu*".

Another habit fuelling HIV transmission in the area is "*mafiga matatu"* (that is three fire-stones) practice whereby young ladies who have just attained sexual maturity are advised by elder women, especially their sisters, grandmothers and aunts that a woman

should not depend on only one man. They take the analogy of traditional cooking whereby a pot has to balance on three firestones (*mafiga*) for efficient cooking. Therefore, this makes some women to be sexually promiscuous because they apply the advice to having as many men as possible even if they are in marriage. This, also, is dangerous for HIV infection, as MoH and NACP (2002) caution in Sub-Section 2.2.4.3. Learning of the above practices that are risky for HIV transmission prompted the author to assess the participants' awareness of HIV/AIDS. This is reported in Sub-section 4.2.9.

4.2.9 Awareness of HIV/AIDS

Having learnt of the practices that are risky for HIV infection reported in Sub-section 4.2.8, one would think that the people of the area do not know anything about HIV/AIDS. However, discussions with them to find out about their knowledge of HIV/AIDS revealed that they had good knowledge about HIV/AIDS. About how to control HIV/AIDS, they mentioned the following: "Avoiding unsafe sex; avoiding using contaminated medical instruments like syringes and knives used for circumcision; testing for HIV before marriage; avoiding bad customs and practices like night traditional dances since they entice people to commit adultery; avoiding drunken behaviour since it may tempt one to practise unsafe sex; avoiding sharing pointed tools and instruments like ear tattooing ones; abstaining from sexual intercourse; avoiding unsafe sex by using condoms during sexual intercourse; and avoiding transfusion of blood contaminated with HIV."

The above knowledge about how to prevent HIV/AIDS transmission was substantial. Therefore, the participants were asked about where they had obtained it. They said that there was an NGO called CARE–International, which was working in various villages

of the district including theirs. They also said that the NGO was providing education to fight the spread of HIV/AIDS. Not only that, but also they were following campaigns against HIV/AIDS over the radio, and they were reading various messages on leaflets, posters and signboards about HIV/AIDS.

The above findings on the first objective to appraise the status of HIV/AIDS and food insecurity show that the two problems were prevalent in the research area, food insecurity at a high proportion, and HIV/AIDS at levels noticeable by almost every one. Having appraised the prevalence of HIV/AIDS and food insecurity in Section 4.2, the following section, Section 4.3, gives socio-demographic characteristics of the households surveyed, and it addresses the second objective of the research, which is about finding patterns of food acquisition and utilisation in terms of quantities and qualities of food produced, bought, obtained freely, and consumed.

4.3 Socio-Demographic Characteristics of Households Surveyed and Food Status

The socio-demographic characteristics of focus were households having been affected by HIV/AIDS, sex categories of household heads, ages of household heads, marital status of households head, years of schooling of household heads, main occupations of household heads, household sizes, adjusted adult equivalent units, and age dependency ratio. The food patterns analysed were proportions of food consumed from household production, purchasing and food receipts in kind. Moreover, as part of food patterns analysis, various food types and combinations were found. The socio-demographic characteristics are presented in Sub-section 4.3.1 while the food status is presented in Sub-section 4.3.2.

4.3.1 Socio-demographic characteristics of households surveyed

4.3.1.1 Being affected by HIV/AIDS and particulars of household heads

Being affected by HIV/AIDS was the main criterion for choosing households for the research. Selecting the households was a sensitive and ethical issue. Thanks to Rufiji Health Demographic Surveillance System (HDSS) that keeps database containing information on all causes of death in the Rufiji HDSS from 1998. The database was relied on to select households affected by HIV/AIDS, and individuals who had passed away due to HIV/AIDS in the households were identified in terms of date of death, sex, and age at death. As seen in Table 5, the number of households affected by HIV/AIDS was 50 in the sample for this research; that of households not affected by HIV/AIDS was 175. The whole sample comprised 225 households, which contained a total of 1193 people. The 225-household sample included 156 (69.3%) male-headed households and 69 (30.7%) female-headed households.

4.3.1.2 Ages and marital status of household heads

In terms of age, the minimum and maximum ages of household heads were 21 and 92, respectively, while the average age was 51.1 years. The minimum and maximum ages of household heads show that the household heads were adults; no household was headed by a child, who is someone with an age less than 18 years in Tanzania. On average male household heads were 50.1 years old while female household heads were 53.3 years old. This finding is consistent with the reality that women's life expectancy is higher than that on men. About one-fifth (20.9%) of the household heads were at most 35 years old while 21.8% of them were over 65 years old. Among male household heads 23.1% were at most 35 years old while 22.4% were over 65 years old. Among female household heads 15.9% were at most 35 years old while 17.4% were over 65 years old. Among the households affected by HIV/AIDS the average age of household

heads was 52.7 years while the minimum and maximum numbers of years were 21 and 92, respectively. Among the households not affected by HIV/AIDS the average age was 50.6 while the minimum and maximum numbers of years were 21 and 91, respectively.

With regard to marital status, 70.7% of the household heads were married; the rest had various marital statuses as seen in Table 12, by sex and by being affected by HIV/AIDS. The data in Table 12 show that the percentage of married household heads in households affected by HIV/AIDS was smaller (66.0%) than that in households not affected by HIV/AIDS (72.0%). This is because, among other reasons, some of the spouses had passed away due to AIDS.

Table 12: Marital statuses of household heads

Marital status	FHH* (n = 69)	MHH** (n = 156)	Affected by HIV/AIDS (n = 50)	Not affected by HIV/AIDS (n = 175)	All (n = 225)
	%	%	%	%	%
Married	24.6	91.0	66.0	72.0	70.7
Divorced	34.8	5.1	14.0	14.3	14.2
Widow	24.6	0.0	12.0	6.3	7.5
Not yet married	5.8	3.2	4.0	4.0	4.0
Widower	5.8	0.0	2.0	1.7	1.8
Separated	4.4	0.7	2.0	1.7	1.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

*FHH means female headed household(s)
**MHH means male headed household(s)

Married people are more likely to be food secure than unmarried ones like widows and widowers. Partly this is because married people in most cases help one another in producing and buying food. With regard to HIV/AIDS, married people who are loyal to their marriages are less likely to contract HIV because of not having sexual intercourse with other people, unlike unmarried people who are more likely to have multiple sexual

partners. Even if married people are not loyal to their marriages they are very likely to have fewer sexual partners than unmarried ones since they have to go to bed with them secretly lest they are caught by their spouses. By maintaining the secrecy, sometimes they fail to meet with their extra-marital sexual partners even if they desire so. Eventually, sexual encounters outside the wedlock are limited.

4.3.1.3 Years of schooling

The average number of years household heads had gone to school was 4.8. The minimum and maximum years of schooling were zero and 19, respectively. About two-fifths (38.2%) of the household heads had not gone to school while 21.4% had partially pursued primary education, and 26.7% had completed primary education. Those who had gone to school beyond primary education were only 13.6%. These findings imply that formal education was low among the respondents. For example, while the proportions of adults who had not gone to school on Mainland Tanzania were 24.9% in 1991/92 and 25.2% in 2000/01, according to the 2000/01 Household Budget Survey (NBS, 2002), the proportion was 38.2% in Rufiji District in 2005/06. The situation was worse among FHH where the proportion of those who had not gone to school was 62.3% while it was 27.6% among MHH. Among households not affected by HIV/AIDS the proportion of household heads who had not gone to school was 36.0% while it was 46.0% among household heads whose households had been affected by HIV/AIDS.

Almost two-fifths (38.2%) of the household heads had not pursued formal schooling; they had "zero years of formal education". However, some people in the district pursue Koran education which enables them to read and write at least Koran. This means that some of those who were recorded as having zero years of formal education knew how to read and write. More than one-fifth of the household heads (21.3%) had partial

primary education which means that their years of schooling were one to six. Only 26.7% of the household heads had completed primary education (Standard Grade 7) and 13.8% of them had gone to school beyond primary education. This implies that generally the household heads had insufficiently gone to school. This might be negatively associated with food security, for example by the household heads not following properly advice on improved agricultural practices, which would enable them to produce more food. Low formal education also might make the households not take appropriate measures to prevent HIV/AIDS and deal with it appropriately, if it affects any of their household members.

4.3.1.4 Household size, adult equivalents, and age dependency ratio

In the whole sample, the average household size was 5.3. But in terms of adult equivalent units which represent the composition of households adjusted for age and sex so that all household members are equivalent to adults in terms of requirements, the average was 3.5 adult equivalent units while the minimum and maximum adult equivalent units were 0.7 and 6.7, respectively.

Table 13: Household sizes, adult equivalent units, and age dependency ratio

Variable	FHH (n=65)	MHH (n=150)	Affected by HIV/AIDS (n=46)	Not affected by HIV/AIDS (n=169)	All (n=215)
Household size	4.5	5.7	5.4	5.3	5.3
Adult equivalent units	3.0	3.7	3.5	3.5	3.5
Age dependency ratio	121.8	123.8	120.0	124.1	123.2

The household sizes and adult equivalent units are summarised in Table 13 by sex of household head and according to households having been affected by HIV/AIDS or not. The average household size of 5.3 per household was higher than the national average household size in Tanzania that is 4.9, according to the 2002 Population and Housing

Census (NBS, 2003). The minimum and maximum household sizes were one and 11, respectively.

In order to compute age dependency ratio, which is defined by Haupt and Kane (2000) as the number of persons in the age groups defined as dependent (under 15 years and over 64 years) to persons in the age group defined as economically productive (15 to 64 years) in a population and expressed as a percentage, household members were grouped into the above three age groups. Household members in the dependent age groups of 0 to 14 years and over 64 were 540 and 84, respectively, while those in the economically productive age group of 15 to 64 years were 569. Therefore, the overall age dependency ratio computed manually was [(540 + 84)/569] x 100, which is 109.7. However, computing the age dependency ratio automatically whereby the computer neglected 10 households (out of 225) whose members aged 15 to 64 were zero, the overall age dependency ratio was 123.2, as seen in Table 13. Since the age dependency ratio computed manually cannot be used for inferential analysis in relation to other variables entered in an analytical software like SPSS that was used; the age dependency ratio obtained using the computer was adopted for inferential analysis, for example to compare food security in households with different age dependency ratios. Comparing age dependency ratios between households affected and those not affected by HIV/AIDS revealed that they were not significantly different ($p = 0.815$).

More than a half of the households (54.7%) had at most five household members. This shows that the average household size in the study area was higher than that of Rufiji District that is 4.6 (NBS, 2003). However, unlike some other districts which have much larger households, for example 6.5 in Bukombe and Sengerema Districts, and 7.1 in Meatu District (NBS, 2003), the household size of Rufiji District is relatively small. The

average number of adult equivalent units was 3.5 while the average household size was 5.3. Adult equivalent units are normally fewer than household sizes because household sizes include children, women and old people who are less than an average adult in terms of essential needs, especially dietary energy, while adult equivalents deflate children to be equivalent to fractions of adults. This results in fewer adults than individuals.

The number of adult equivalent units was about two-thirds that of household size. Therefore, values per capita such as dietary energy consumed are likely to be about two-thirds of values per adult equivalent in this research because of the difference in the size of denominators (household size which is bigger and adult equivalent units, which is smaller). Since the economically dependent people were more numerous than the economically independent ones, this situation might influence negatively food security. The 123.2 age dependency ratio found in the research area is higher than the national age dependency ratio in Tanzania, which is 104, according to the 2004-05 Tanzania Demographic and Health Survey (NBS and ORC Macro, 2005).

The results in Table 13, which show that the average household size and the average adult equivalent units in households affected by HIV/AIDS were higher than those in households not affected by HIV/AIDS while the age dependency ratio was lower in households affected by HIV/AIDS, are contrary to conventional thinking that in households affected by HIV/AIDS household size is smaller and age dependency ratio is higher vis-à-vis households not affected by HIV/AIDS. The explanation for the finding is that in the research area the practice of living with extended family members is high; it contributed to the situation. In 16.0% of all the households there were members of extended families. Having such members was more in households affected

by HIV/AIDS where 18.0% had such members, unlike in households not affected by HIV/AIDS where 15.4% had such members.

4.3.1.5 Occupations of household heads

The occupations of household heads have an important role to play in food security. For example, a household with a head having a salaried employment or a well paying non-farm business is very likely to have much income to buy food and agricultural inputs to produce more food than subsistence farmers, relying solely on food production. Therefore, the occupations of household heads are summarised in Table 14.

Table 14: Occupations of household heads

Occupation (n = 225)	Proportions of household heads with the occupations (%)
Crop production	74.8
Petty (unlicensed) trade	5.9
Big (Licensed) trade	3.1
Non-governmental salaried employment	3.1
Government employment	2.2
Livestock production	1.8
Fishing	1.3
Lumbering	1.3
Transportation	1.3
Carpentry	0.9
Technical job	0.9
Masonry	0.4
Service provision	0.4
Traditional healing	0.4
Too old to work	2.2
Total	**100.0**

The findings in Table 14 show that the main occupation for the majority of household heads (74.7%) was crop production. The findings also reveal that only 1.8% of the households had livestock keeping as their main economic activity implying that entitlement to food in terms of livestock ownership is poor in the district. Livestock are

an important asset that increases access to food by selling the livestock or their products and by-products to get cash to buy various foodstuffs.

Since non-farm income generating activities can help people obtain income to increase food security, the respondents were asked about various non-farm activities which they and their household members were doing. The results are presented in Table 15 and show that the main non-farm income-generating activities were selling food and cash crop products, selling charcoal and firewood, doing casual labour work, trading, and water selling. The results also show that households affected by HIV/AIDS were selling water and charcoal/firewood more than other households.

Table 15: Non-farm income generating activities done in the households surveyed

Main non-farm income generating activity	Affected (n=50)	Not affected (n=175)	All (n=225)
	%	%	%
Selling food crop products	28.0	34.9	33.3
Fire wood/charcoal selling	36.0	30.3	31.6
Receiving cash from relatives	26.0	28.0	27.6
Selling cash crop products	20.0	26.3	24.9
Casual labour work	20.0	26.3	24.9
Trading	18.0	25.1	23.6
Vending cooked food	20.0	10.3	12.4
Craftsmanship	8.0	13.1	12.0
Log/timber selling	6.0	9.7	8.9
Water selling	12.0	7.4	8.4
Salaried employment	8.0	5.7	6.2
Fishing	4.0	6.3	5.8
Selling local brew	0.0	3.4	2.7
Mats making	2.0	0.6	0.9
Beekeeping	0.0	0.6	0.4
Traditional circumcision	0.0	0.6	0.4

Receiving remittances in terms of cash, albeit it is not an income-generating activity *per se*, was another source of income.

4.3.2 Status of food acquisition and consumption

Since the main source of food in Rufiji District, like in other rural areas of Tanzania, is food production, this sub-section starts by analysing land ownership and amounts of land cultivated.

4.3.2.1 Land owned and cultivated

Land is a very important resource for agricultural production and other economic activities. In areas like Rufiji District where the main economic activity is agricultural production, one owning more land is likely to be more food secure by producing more food on the land or leasing the land and get cash to buy food. Therefore, land owned, cultivated and means by which it had been obtained were asked for. It was found that 91.6% of the households owned land while 8.4% didn't. The average size of land owned was 1.5 ha per household. The amounts of land owned in various areas are summarised in Table 16.

Table 16: Amounts of land plots owned per household in various areas

Land owned in various areas (ha) (n = 206)	Mean		Min.	Max.	Std Dev.
	Land area	%			
Land owned in flooding areas	0.16	10.4	0.00	4.05	0.42
Land owned in non-flooding areas	1.04	69.7	0.00	8.10	1.05
Land owned in bush	0.30	19.9	0.00	8.10	0.80
All	**1.50**	**100.0**	**0.00**	**13.77**	**1.43**

Most of those who owned land 47.1% had obtained it through opening virgin land. This means that there was sizeable land lying idle somewhere. However, it implies also that some people were encroaching natural forests for shifting cultivation. Such encroachment has adverse implications on the environment. Land inheritance and land buying were other important ways whereby land had been acquired, with 26.7% and

18.4% of land owners having acquired it in those ways, respectively. The rest of land owners had got it through other means (6.3%) and through village allocation (1.5%).

The amounts of land owned were much for the respondent households, given that their means of cultivation was the hand hoe. Land being enough was partly indicated by some of those owning it leaving some of it without cultivation (fallowing) during some years. For example, during the agricultural season 2005/06 more than a quarter (28.6%) of the households that owned land left some of it fallow. The proportion of land left fallow among the 59 households was 42.9% of the land areas they owned. The amounts of land cultivated were smaller than the amounts of land owned per household, as seen in Table 17.

Table 17: Amounts of land cultivated and grain yields

Acreage for various crops	Mean acreage		
	Affected by HIV/AIDS	Not affected by HIV/AIDS	All
Total acreage in acres per household	3.190	2.979	3.026
Total acreage in ha per household	1.292	1.206	1.225
Only maize acreage in ha per household	0.340	0.302	0.310
Only rice acreage in ha per household	0.271	0.234	0.243
Only maize acreage in ha per capita	0.058	0.065	0.063
Only maize acreage in ha per adult	0.088	0.090	0.090
Only rice acreage in ha per capita	0.047	0.049	0.048
Only rice acreage in ha per adult equivalent	0.0726	0.070	0.070
Maize and rice acreage in ha per household	0.611	0.536	0.553
Maize and rice acreage in ha as a % of all land owned per household	37.280	49.028	46.461
Maize and rice in ha as a % of all land cultivated per household	45.191	48.730	47.962
Maize yield in kg/ha	483.329	474.433	476.227
Rice yield (kg/ha)	522.225	657.140	631.744

The data in Table 17 show that households affected by HIV/AIDS had smaller acreages for maize (0.0876 ha per adult equivalent) than households not affected by HIV/AIDS

(0.0901 ha per adult equivalent). However, comparing the acreages using a t-test showed no significant difference ($p = 0.901$) between the acreages. Maize and rice acreage in ha as a percentage of all land cultivated per household was less (45.2%) in households affected by HIV/AIDS than in households not affected by HIV/AIDS (48.7%). Moreover, rice yield was smaller (522.2 kg/ha) in households affected than in households not affected (657.1 kg/ha) by HIV/AIDS. However, comparing the acreages and yields between households affected and those not affected by HIV/AIDS using a t-test revealed that they were not significantly different. The lack of significant difference between the two might be due to the plots being small, which means that in spite of constraints like illness they still managed to till almost the same areas.

About half of the households (48.4%) cultivated less than 1 ha while four-fifths (80.0%) of them cultivated at most 1.92 ha. This finding is comparable with that reported by Isinika *et al.* (2005) that acreage in Tanzania is in small plots of less than 2 ha for the majority of households. The combined acreage for maize and rice, which was nearly 50% of all acreage, further attests to the fact that they are the most important crops in the area. However, in spite of the importance, it is sad to note that the acreages were small. The average yields for maize and rice were 476.2 kg and 631.7 kg per ha, respectively, as seen in Table 17.

4.3.2.2 Grains produced, bought and received freely

Various ways by which the respondent households had acquired food and the types of food they had eaten during mornings, afternoons and evenings were assessed by asking them various questions. The sources of food and the types of food they had eaten during different times of the day could indicate food security or food insecurity. For example, where under-five years old children were always eating with adults and having no other

meal between meals this might indicate food insecurity among the under-five-year old children. Also, where people were mostly eating foodstuffs ranked as less preferable this might imply low food security in the households.

The sources of grains eaten are given in Table 18, which shows that more than a quarter of the grains eaten were bought, notwithstanding the fact that the main occupation of 74.8% of the households was agriculture, particularly crop production.

Table 18: Sources of grains eaten for 60 days per adult equivalent

Sources of grains eaten (n=144)	Amounts of grains eaten (kg)		
	Affected by HIV/AIDS	Not Affected by HIV/AIDS	All
Maize and rice harvested and eaten for 60 days per adult equivalent	7.4	6.9	7.0
Maize and rice bought and eaten per adult equivalent for 60 days	22.8	17.6	18.8
Maize and rice received feely and eaten per adult equivalent for 60 days	1.0	1.5	1.4
Overall maize and rice eaten per adult equivalent for 60 days	31.2	26.0	27.2

The data in Table 18 and Fig. 7 show that the amounts of grains harvested and eaten were much lower than the amounts bought. The data also show that the amounts of grains harvested were almost the same in households affected and those not affected by HIV/AIDS while the amounts bought were higher in households affected by HIV/AIDS.

The proportion of grains bought that is almost three-quarters of all grains eaten in households affected by HIV/AIDS implies that they were relying more on food buying than food production in comparison with other households. This might be due to shortage of resources for food production because of using the resources on meeting needs brought about by their being affected by HIV/AIDS.

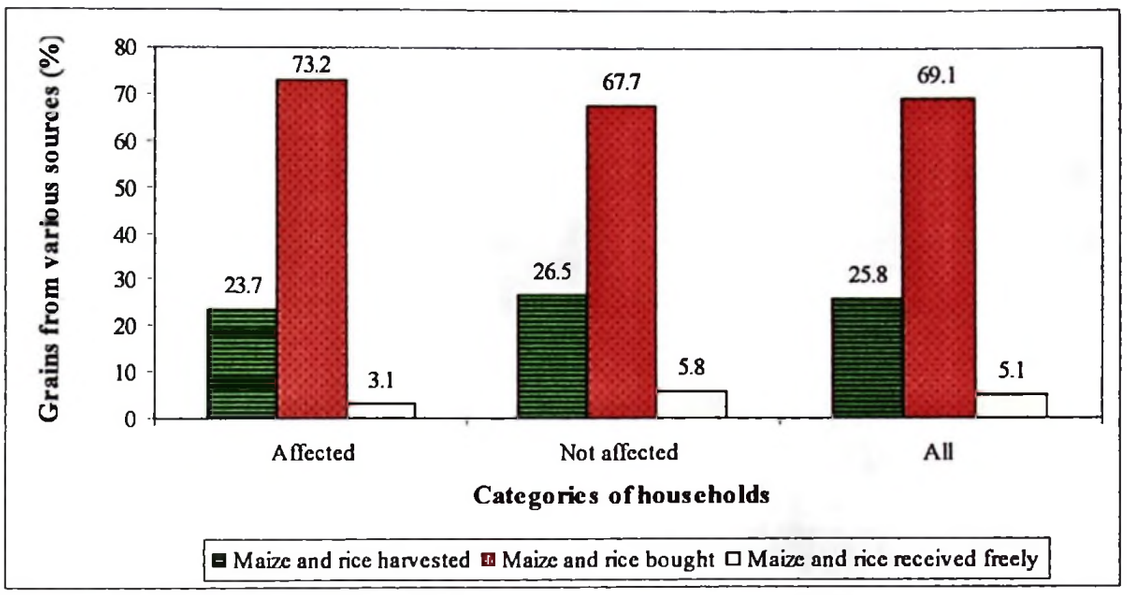

Figure 7: Sources of grains eaten in households affected and those not affected by HIV/AIDS

Regarding the time of eating, it was found that among 90.9% of the households under-five years old children were eating at the same time with adults, which means the children were eating two to three times a day while they are supposed to eat five times per day (URT, 1999). About food habits, which was assessed in terms of food taboos by asking the respondents if there were any foodstuffs prohibited for certain members of their households, the respondents, in most cases, said that there were no such foodstuffs. Only 6.2% of all the respondents replied positively that men were prohibited to eat some foodstuffs, while 6.7% replied so for women and only 4.0% replied so for children. Since the vast majority replied that there were no foods prohibited for men, women and children, it means that food taboos hardly exist in the area.

4.3.2.3 Frequencies of eating certain foodstuffs

The number of meals eaten per day and the frequencies of eating certain foodstuffs are some of the proxy indicators of food security. Cognisant of this, the respondents were asked to state the number of meals and the types of food they and their household

members were eating and how many times they were eating them per week. Informed by PRA findings, it was already known that chicken meat, goat meat, beef meat, fish, beans, vegetables, rice, and maize stiff porridge were preferred foods while pigeon peas, cassava leaves, sardines, cassava and cassava stiff porridge, banana, and potatoes were not preferred foods. This means that in the households where preferred foods were being eaten more frequently the households were more food secure while the ones who were eating foods not preferred were less food secure. The results in Table 19 show that the average number of meals eaten per week was 20.0 and that consumption of meat of any type was low while the consumption of fish was high.

Table 19: Frequency of eating certain foodstuffs

Types of foodstuffs eaten for 7 days	Number of times the foodstuffs were eaten during the previous 7 days					Those who ate the food at least once per week	
	n	Min.	Max.	Mean	Std. Dev.	Number	%
Number of meals	225	11	21	20.04	2.303	-	-
Chicken meat	216	0	6	0.23	0.802	26	12.0
Goat meat	216	0	1	0.00	0.068	1	0.5
Beef meat	216	0	7	0.49	1.305	38	17.6
Fish	216	0	21	5.08	4.321	180	83.3
Beans	216	0	8	1.54	1.709	124	57.4
Vegetables	216	0	14	0.91	1.922	66	30.6
Rice	216	0	16	3.81	3.427	174	80.6
Maize stiff porridge	216	0	19	5.01	3.627	183	84.7
Buns	216	0	8	1.46	2.169	88	40.7
Rice buns	216	0	7	0.62	1.393	52	24.1
Bread/pastry	216	0	7	0.25	0.887	26	12.0
Pigeon peas	216	0	12	2.13	2.803	107	49.5
Cassava leaves	216	0	14	2.36	2.991	119	55.1
Sardines	216	0	14	1.65	2.132	117	54.2
Green gram	216	0	2	0.02	0.166	3	1.4
Shrimps	216	0	8	0.35	1.098	28	13.0
Cassava stiff porridge	216	0	18	5.08	4.578	151	69.9
Boiled cassava	216	0	21	4.45	2.857	193	89.4
Banana/Potatoes	216	0	7	0.61	1.282	56	25.9

The data in Table 19 show that cassava, although it is said to be one of the less preferable foodstuffs, was eaten by many people and that meat which is the most preferable protein foodstuff was eaten very rarely while sardines that are said to be an inferior type of food were eaten by more than a half of the households. The main reason for not eating more preferable foodstuffs like meat and rice was lack of income to buy them. Those with low income were compelled to eat more frequently less preferable foodstuffs like cassava, cassava leaves and sardines. Since in more households less preferred foodstuffs were eaten, food insecurity prevailed.

4.3.2.4 Selling various agricultural products

The number of households which had sold various crop products and the amounts they had sold are summarised in Table 20. Cashew nut was the leading crop that had been sold, followed by cassava. It is unfortunate that very few people had sold maize and rice while the two crops were the most important food crops grown in the area. This implies that so little amounts of the two crops had been harvested that there was no surplus to sell in most of the households. Selling cashew nut which is a cash crop can help the people to get income to buy food and other necessities. Likewise, selling cassava that is less preferable in the research area can enable them to get income to buy more preferable foodstuffs and some other necessities.

Table 20: Crop products sold per household

Crop product (kg)	n	Min.	Max.	Sum	Mean	Std. Dev.
Maize	16	3.0	810.0	2 954.0	184.63	139.58
Rice	25	10.0	700.0	5 324.0	212.96	150.54
Cassava	62	20. 0	25 000.0	66 236.0	106.82	2 517.09
Sorghum	4	20.0	500.0	970.0	242.50	116.42
Sesame	3	3.0	70.0	93.00	31.00	14.97
Cashew nuts	73	10.0	4 680.0	35 055.5	480.21	724.85
Cowpeas	4	3.0	60.0	103.0	25.75	10.627
Pigeon peas	3	40.0	65.00	145.00	48.33	14.360
Other crops	1	204.0	204.00	204.00	204.00	-

4.3.2.5 Prices of crop products sold

The prices of various crop products sold are summarised in Table 21 and show that the average price of maize harvested during the short rains period (October to December) and sold was TSh 240.80 per kg while the minimum and maximum prices were TSh 100.00 and 380.00, respectively. The data in Table 21 further show that the price of rice was just slightly higher than that of maize.

Table 21: Prices for which crop products were sold

Crop product sold (TSh per kg)	n	Min.	Max.	Mean	Std. Dev.
Short rains maize	13	100.00	380.00	240.80	66.64
Long rains maize	5	200.00	380.00	276.00	68.04
Short rains rice	7	250.00	400.0	276.14	34.41
Long rains rice	16	100.00	350.0	256.38	57.25
Short rains cassava	44	100.00	200.00	104.55	19.22
Long rains cassava	33	100.00	250.00	108.48	28.30
Short rains sorghum	2	70.00	200.00	135.00	91.92
Long rains sorghum	5	250.00	500.00	330.00	103.68
Short rains sesame	1	400.00	400.00	400.00	-
Long rains sesame	2	600.00	700.00	650.00	70.71
Short rains cashew nuts	66	200.00	500.00	321.52	71.82
Long rains cashew nuts	3	250.00	300.00	276.67	25.17
Short rains cow peas	3	150.00	400.00	283.33	125.83
Long rains cow peas	1	180.00	180.00	180.00	-
Short rains pigeon peas	1	300.00	300.00	300.00	-
Long rains pigeon peas	2	180.00	200.00	190.00	14.14
Long rains vegetables	2	175.00	250.00	212.50	53.03

4.3.2.6 Costs for which various foodstuffs were bought

The costs of buying foodstuffs similar to what the respondent households had produced were assessed by asking the respondents the costs they had incurred on buying the foodstuffs. The aim was to compare the costs of buying foodstuffs and the prices of selling their agricultural products. It was found that the costs of buying foodstuffs were higher than the prices at which they had sold similar crop products. For example, maize harvested was sold at an average price of TSh 250.6, but the average cost at which they had bought maize was TSh 432.3, which was 172.5% of the price they had sold maize.

This is because they sold immediately after harvesting when the price was low due to high supply, and they bought maize later in the agricultural season when supply was low and the price was high. The costs per kilo of various foodstuffs bought are summarised in Table 22.

Table 22: Costs of foodstuffs bought

Crop products bought (TSh per kg)	n	Min.	Max.	Mean	Std. Dev.
Short rains maize	83	73	941	429.45	133.93
Long rains maize	112	50	800	434.33	107.60
Short rains rice	88	280	1000	683.51	155.73
Long rains rice	106	243	5000	663.63	451.17
Short rains cassava	27	100	1200	155.68	210.81
Long rains cassava	33	100	1257	192.71	212.80
Short rains sorghum	4	150	400	250.00	108.01
Long rains sorghum	1	160	160	160.00	-
Short rains sesame	1	600	600	600.00	-
Short rains beans	61	400	850	588.48	120.67
Long rains beans	96	300	1000	630.41	124.43
Long rains cashew nuts	1	400	400	400.00	-
Short rains cow peas	15	100	800	455.33	170.08
Long rains cow peas	31	40	1500	431.94	256.94
Short rains pigeon peas	7	125	500	270.26	122.41
Long rains pigeon peas	22	145	600	276.75	121.40
Short rains vegetables	5	100	150	130.00	27.39
Long rains vegetables	15	20	450	190.20	122.24

4.3.2.7 Foodstuffs given to relatives free of charge

The custom of giving foodstuffs to relatives, friends and neighbours was so common in the area that about one-fifth of the sampled households had done it. For example, as seen in Table 23, 21.3% of the households reported having given an average of 28.8 kg of maize to some of their relatives, and 19.6% of the households reported having given an average of 46.0 kg of rice to relatives.

Table 23: Crop products given to relatives free of charge

Crop products given (kg)	n	Min.	Max.	Mean	Std. Dev.
Maize	48	1.0	100.00	28.8	16.65
Rice	37	3.0	375.0	46.0	33.01
Cassava	44	2.0	320.0	52.1	33.25
Sorghum	11	5.0	38.0	17.5	4.75
Beans	1	18.0	18.0	18.0	1.27
Cashew nuts	3	4.0	18.0	7.3	1.37
Cowpeas	19	1.0	61.0	9.3	5.00
Pigeon peas	18	0.8	19.0	5.3	1.95
Green gram	3	2.0	9.0	5.7	0.78
Other crops	6	6.0	14.0	3.3	1.09
Vegetables	1	3.5	3.5	3.5	0.25

4.3.2.8 Foodstuffs received freely from relatives

The amounts of foodstuffs received freely from relatives are given in Table 24. The numbers of households where some foodstuffs had been given to their relatives, friends and neighbours and those of households which had received some foodstuffs from their relatives, friends and neighbours are not the same since some of those who received and some of those who gave away foodstuffs were not in the sample, and they could be in different geographical localities. However, the numbers are almost the same: about 20%. For example, while 21.3% of the households reported having given an average of 28.8 kg of maize to relatives (as seen above); 20.0% of the households reported having received an average of 39.8 kg of maize freely from relatives.

4.3.2.9 Foodstuffs bought

Although the main economic activity in the households involved in the research was crop production, most of them were buying various crop products like the ones they were producing because the amounts they were producing were much less than their needs per year. The amounts of various foodstuffs they bought are summarised in Table 25. The data show that about two-thirds of the households (67.1%) were buying maize while about the same proportion of the households (66.2%) was buying rice. A few

households had bought cassava because it is considered to be an inferior foodstuff and most of them, especially in Kibiti Division where they grow it.

Table 24: Crop products received free of charge from relatives

Products received (kg)	n	Min.	Max.	Sum	Mean	Std. Dev.
Maize	45	1.0	360.0	1 792.2	39.83	31.83
Rice	51	1.5	335.0	1 885.5	36.97	29.95
Cassava	25	4.0	1 206.0	2 603.0	104.12	87.13
Sorghum	8	2.5	45.0	154.5	19.31	4.56
Sesame	1	2.0	2.0	2.0	2.00	0.13
Beans	6	3.0	26.0	88.0	14.67	2.75
Cashew nuts	0	0.0	0.0	0.0	-	0.00
Cowpeas	20	2.0	13.0	128.0	2.40	2.06
Pigeon peas	35	1.0	22.0	315.5	9.01	4.04
Green gram	1	8.0	8.0	8.0	8.00	0.53
Other crops	1	5.0	5.0	5.0	5.00	0.33
Vegetables	8	3.0	50.0	99.0	12.38	3.69

Table 25: Amounts of foodstuffs bought per household

Foodstuff bought (kg)	Those who bought (n = 225)	Mean amounts of foodstuffs bought (kg) per	
		Among all	Among those who bought
Maize	151	97.02	144.57
Rice	149	73.99	111.72
Cassava	49	32.04	147.10
Sorghum	2	0.37	42.00
Sesame	2	0.04	4.75
Beans	110	11.21	22.93
Cashew nuts	5	0.48	21.60
Cow peas	41	2.12	11.63
Pigeon peas	25	0.98	8.84
Green gram	1	0.02	5.00
Other foodstuffs	0	0.00	-
Vegetables	19	1.56	18.42

4.3.2.10 Various food crop products in store during the survey

One of the proxy indicators of food security among subsistence farmers is the amount of food, especially grains stored. Therefore, the representatives of the respondent households were asked to give estimates of various foodstuffs they had in store. The

results are presented in Table 26. Those who stored cassava were very few because the commonest way to store cassava that is used in Rufiji District is leaving it in the field without harvesting it. Although in other places of Tanzania like Mara, Kigoma and Ruvuma Regions cassava is normally dried and stored for some months, this way of cassava storage is not common in Rufiji District.

Only 3.1% of the households had grown any crop during the dry season. This proportion of households that had produced crops during the dry season is very little, unlike in some other regions of Tanzania where farmers produce some food crops near water bodies including river streams. Such production contributes appreciably to food security. For example, Isinika and Mdoe (2001) estimate that in Njombe District about 20% of food produced is due to dry season production of this kind which is popularly known as *vinyungu* in Iringa Region. The data in Table 26 show that only few households stored crop products.

Table 26: Amounts of various foodstuffs in store during the survey

Kg of crop product	Those who stored	Min.	Max.	Mean amounts of foodstuffs stored (kg)		Std. Dev.
				The whole sample (n = 225)	Those who stored	
Maize	45	0	1 800	26.40	132.02	148.57
Rice	70	0	1 250	51.84	166.61	158.06
Cassava	7	0	700	4.18	134.43	47.33
Sorghum	16	0	202	2.13	29.94	14.90
Sesame	3	0	12	.08	6.33	0.90
Cashew nuts	1	0	6	0.03	6.00	0.40
Cow peas	19	0	20	0.47	5.58	2.30
Pigeon peas	16	0	25	0.58	8.13	2.64
Green gram	1	0	6	0.03	6.00	0.40

4.4 Explaining Food Security Status and its Linkage with HIV/AIDS

Based on the methods of food security determination reviewed in Chapter Five Two, the following methods and indicators of food security were used to determine food security:

(a) Self qualitative appraisal of households themselves on having had food shortage or not. Households which said they had had food shortage any time within 12 months during the agricultural season 2005/06 were considered to be food insecure.

(b) The number of meals eaten per day. Households whose adult members had eaten an average of less than three meals per day and whose children (aged six to 59 months) had consumed less than five meals per day during seven days prior to the survey were considered to be food insecure.

(c) Amounts of grains harvested, bought and received freely per capita per year and per adult equivalent per year. Households with less than 200 kg of grains per capita per year and those with less than 270 kg of grains per adult equivalent per year were considered to be food insecure.

(d) Dietary Energy Consumed (DEC) per capita per day and per adult equivalent per day based on annual data collected using a household questionnaire. In this case households were said to be food insecure if they had consumed less than 2100 kcal per capita per day and less than 2200 kcal per adult equivalent per day.

(e) Dietary Energy Consumed (DEC) per capita per day and per adult equivalent per day based on seven days' data collected using a household questionnaire. In this case, like in the previous one, households were said to be food insecure if they had consumed less than 2100 kcal per capita per day and less than 2200 kcal per adult equivalent per day.

(f) Household Income and Expenditure Survey (HIES) whereby food consumption data were collected for 60 days. In this case, like in the previous one, households were

said to be food insecure if they had consumed less than 2100 kcal per capita per day and less than 2200 kcal per adult equivalent per day.

4.4.1 Food security based on qualitative assessment

Self-assessment of being food secure or insecure was based on a household questionnaire. One of the questions in the questionnaire asked respondents to reply 'Yes' or 'No' to a question about their households having had food shortage or not during the period of 12 months from 1 July 2005 to 30 June 2006. The self-assessment was informed by the local indicators for a household to be considered food secure as discussed during PRA. The PRA-based estimates were rough but gave important insights that were useful for choosing methods to determine food security. Therefore, the PRA findings were supplemented with more qualitative information based on the questionnaire for the research whereby household representatives were asked whether food was sufficient for every crop they had grown and whether food was sufficient overall in their households during the period from 1 July 2005 to 30 June 2006.

Of all the 225 household representatives, 76.4% said that their households had had food insufficiency. Therefore, based on households' self-appraisal, it was taken that food insecurity was 76.4%). Although so many households had food insufficiency overall, not so many households had food insufficiency based on some crops. For example, 66.5% of the households had had insufficient maize while 62.3% and 29.4% had had insufficient rice and cassava, respectively. Based on this proxy indicator of self-appraisal for food security, among households affected by HIV/AIDS the proportion of food insecure households was higher (84.0%) than that in households not affected by HIV/AIDS (74.3%). The proportion of food insecure households was much higher than the average food insecurity for Tanzania, which was 19% in 2001 (NBS, 2002). Some

statements given by participants in PRA exercises that were part of this research support the high level of food insecurity found. They said that in a few years just before 2005/06 and including 2005/06 harvests had decreased by about 50% mainly due to the decrease in rainfall. They also estimated that about 90% of the households were buying maize and rice and that 70% to 90% of their incomes were being spent on buying food.

4.4.2 Food security based on numbers of meals eaten per day

Based on numbers of meals eaten per day as a proxy indicator of food security, households are said to be food secure if adults consume at least three meals per day and children aged six to 59 months consume at least five meals per day (URT, 1999). Therefore, during household questionnaire administration, respondents were asked to say the numbers of meals that had been consumed by adults and by less than five years old children in their households during the previous seven days. This means that in food secure households adults were supposed to have eaten 21 meals and under-five years old children 35 meals, but among 88.9% of the 225 households adults and under-five years old children had been eating at the same time, meaning the same number of meals. Therefore, the numbers of meals are reported only for adults and subsume the number of meals that under-five years old children ate.

The average number of meals was 20.0 per week; the minimum was 11 and the maximum was 21. The modal number of meals was 14. Only 170 households' representatives responded to the question; 17.1% of them reported having taken less than three meals while 82.9% of them reported having taken three meals a day. Therefore, based on the number of meals, 82.9% of the households were food secure in the whole sample. Food security was lower in households affected by HIV/AIDS (79.5%) than in households not affected by HIV/AIDS (84.0%). The food security results based on meals eaten per day are

in stark contrast with the level of food security based on self-assessment of households themselves reported above. It also differs much from food security based on the amounts of grains and of dietary energy consumed reported below. The main reason for the big difference is that the number of meals does not consider the quantity of food consumed in each meal. The average number of meals eaten in households affected by HIV/AIDS was smaller (19.8) than that for households not affected by HIV/AIDS (20.1). This implies that, based on meals eaten per day, households affected by HIV/AIDS were less food secure in comparison with those not affected by HIV/AIDS.

4.4.3 Food security based on amounts of grains available

Determination of food security based on grains available was done by adding up grains harvested, grains bought, and grains received freely from relatives and neighbours per capita per year and per adult equivalent per year. This was done in two ways: (a) based on grains per capita per year and (b) based on grains per adult equivalent per year.

4.4.3.1 Food security based on grains obtained per capita per year

Based on the amounts of grains obtained per capita per year, the cut-off point for Tanzania was not available. However, based on the cut-off point of grains consumed in India which is 200 kg per capita per year (Brown and Kane, 1994), as seen in Sub-Section 2.3.3, it was found that 85.4% of the households were food insecure since they had obtained and consumed less than 200 kg of grains per capita per year. Among the households affected by HIV/AIDS those which had obtained less than 200 kg per capita were 83.3% while among those not affected by HIV/AIDS those with less than 200 grains per capita were 86.0%. The average amount of grains available per capita was 116.04 kg; the minimum was 0.67 kg, and the maximum was 963.3 kg per capita per year among the 144 households. In the sample, based on the household questionnaire

that was administered to 225 households, 144 households reported the amounts of maize and rice they had harvested, bought, and received freely during the agricultural season 2005/06 while 81 didn't. Of the 144 households, 81 had produced both maize and rice; 49 had produced only maize; and 14 had produced only rice. The amounts of grains harvested, bought, and received freely are given in Table 27 in groups of households affected and those not affected by HIV/AIDS. The two types of grains (maize and rice) were added up because both contain the same amount of kilocalories (3350) per kg of edible portion, according to West *et al.* (1988).

Table 27: Amounts of grains obtained from various sources

Category of grains source	Amounts of grains obtained per year			
	Per capita		Per adult equivalent	
	Amount (kg)	% of the total	Amount (kg)	% of the total
Among all (n=144)				
Maize and rice harvested	81.35	70.10	117.44	69.94
Maize and rice bought	30.91	26.64	45.59	27.15
Maize and rice received freely	3.78	3.26	4.88	2.91
Overall grains (maize and rice)	116.04	100.00	167.91	100.00
Among those affected by HIV/AIDS (n=30)				
Maize and rice harvested	80.63	67.59	124.64	68.95
Maize and rice bought	34.50	28.92	51.23	28.34
Maize and rice received freely	4.16	3.49	4.89	2.71
Overall grains (maize and rice)	119.29	100.00	180.76	100.00
Among those not affected by HIV/AIDS (n=114)				
Maize and rice harvested	81.54	70.79	115.54	70.23
Maize and rice bought	29.97	26.02	44.11	26.81
Maize and rice received freely	3.68	3.19	4.87	2.96
Overall grains (maize and rice)	115.19	100.00	164.52	100.00

4.4.3.2 Food security based on grains per adult equivalent per year

Based on the amounts of grains obtained per adult equivalent per year whereby the cut-off point is 270 kg per adult equivalent per year in Tanzania (URT, 1999), it was found that 81.9% of the households were food insecure since the grains available for them were less than 270 kg per adult equivalent per year. Among the households affected by HIV/AIDS 80.0% were food insecure while among the households not affected by HIV/AIDS 82.5% were food insecure. Adult equivalent units were determined as exemplified in Section 3.6.3. The average amounts of kilos of grains obtained in all the households and among those affected and those not affected by HIV/AIDS are as seen Table 27.

4.4.4 Food security based on dietary energy consumed

Determination of dietary energy consumed was done by using the procedure described in Sub-sections 3.6.1 and 3.6.2. The dietary energy consumed was determined per capita and per adult equivalent based on seven days' data, 60 days' data, and one year's data. The results are presented below.

4.4.4.1 Dietary energy consumed per capita per day based on one week's data

The amounts of grains (maize and rice) consumed on seven consecutive days preceding the day of interview were obtained from 131 households. They were used to compute dietary energy consumed per capita and per adult equivalent. The average amount of DEC consumed per capita from maize and rice was 1351.5 kcal per capita per day. The minimum and maximum amounts were 119.6 and 5832.6 kcal per capita per day, respectively, in the whole sample. DEC per capita per day was higher in households not affected by HIV/AIDS where it was 1390.1 while among households affected by HIV/AIDS it was 1221.4 kCal per capita per day. Of the 131 households from which

the amounts of both maize and rice consumed were available, 87.0% were food insecure in the sense that they had consumed less than 2100 kCal per capita per day; the rest (13%) were food secure. A greater proportion of households affected by HIV/AIDS were more food insecure; the proportion of food insecure households affected by HIV/AIDS was 90.0 while among the households not affected by HIV/AIDS the food insecure households were 86.1%.

4.4.4.2 Dietary energy consumed per adult equivalent per day from 7 days' data

The average amount of DEC from maize and rice consumed was 1918.7 kcal per adult equivalent per day. The minimum and maximum amounts were 152.6 and 5832.6 kcal per adult equivalent per day, respectively. DEC per adult equivalent per day was higher in households not affected by HIV/AIDS where it was 1944.1 kCal while among households affected by HIV/AIDS it was 1833.2 kCal per adult equivalent per day. Of the 131 households from which the amounts of maize and rice consumed were available, 70.2% were food insecure in the sense that they had consumed less than 2200 kCal per adult equivalent per day; the rest (29.8%) were food secure.

The proportion of food insecure households based on DEC per adult equivalent per day based on one week's data was higher than that in households not affected by HIV/AIDS. It was 73.3% in households affected by HIV/AIDS and 69.3% in households not affected by HIV/AIDS.

4.4.4.3 Dietary energy consumed per capita per day from 60 days' data

Household Income and Expenditure Survey (HIES) was conducted emulating the procedure that is normally used by the Tanzania National Bureau of Statistics (NBS) whereby data are collected for 30 consecutive days and values are expressed over 28

days. This was done in order to get data comparable with those of NBS, which are obtained using the same procedure. However, unlike NBS that collects such data for only 30 days, in this study data were collected for 60 days: 30 consecutive days during a period of food shortage and 30 consecutive days during a period of food abundance. The aim was to get more accurate data since food consumption levels fluctuate much depending on food supply, which fluctuates greatly. The amounts of grains consumed per capita and per adult equivalent per day based on 60 days' data are presented in Table 28.

Table 28: Grains and DEC per day based on 60 days' data

Grains and dietary energy consumed	Households affected by HIV/AIDS (n=50)	Households not affected by HIV/AIDS (n=172)	All (n=222)
Total grains consumed per capita per day based on 60 days' data (kg)	0.3686	0.3100	0.3231
Total grains eaten per adult equivalent per day based on 60 days' data (kg)	0.5171	0.4327	0.4517
Average DEC per capita per day based on 60 days' data (kCal)	1543.5	1298.1	1353.0
Average DEC per adult equivalent per day based on 60 days' data (kCal)	2165.4	1811.9	1891.5

Using the data presented in the 2nd and 3rd rows in Table 28 and the procedure described in Sub-section 3.6.1, the data presented in the last two rows of Table 28 were generated using the SPSS computer programme. For example, the average DEC per capita per day based on 60 days' data which is 1353.0 kCal in the whole sample, was obtained as follows: (0.3231 kg x 3350 kCal) x 100/80 = 1353.0 (See the details in Sub-section 3.6.1). The minimum and maximum DEC amounts per capita per day were 150.5 and

12 527.6 kCal, respectively. The food insecure households in the whole sample were 88.0% while they were 86.0% in households affected by HIV/AIDS and 88.6% in households not affected by HIV/AIDS.

4.4.4.4 Dietary energy consumed per adult equivalent per day from 60 days' data

Using the data presented in Table 28 and following the same procedure as that in 4.3.4.3 (but using 0.4517 kg in lieu of 0.3231 kg of grains) the average DEC per adult equivalent per day based on 60 days' data (kCal) was 1891.5 kCal in the whole sample. The minimum and maximum amounts of DEC per adult equivalent per day were 243.2 and 12 527.6 kCal, respectively. Based on the DEC per adult equivalent per day obtained, 71.2% of the households were food insecure while only 28.8% were food secure in the whole sample. The households that were food insecure among those affected by HIV/AIDS were 66.0% and the households that were food insecure among those not affected by HIV/AIDS were 72.7%.

4.4.4.5 Dietary energy consumed per capita per day based on annual data

Using the results summarised in Table 27, the average dietary energy consumed per capita per day equals [116.04/365 x 3350 kcal] x 100/80, which is 1331.3 kcal. Division by 365 was due to the results in Table 27 being per year. The results have been inflated by multiplying them by 100/80 to take into account energy from non-grain foods. The minimum and maximum amounts were 7.7 and 11 051.9 kcal, respectively. The figure (1331.3 kcal) shows that on average all households were food insecure since it is below the 2100 kcal cut-off point. However, not all of them were food insecure; food insecure households (those in which less than 2100 kcal had been consumed per capita per day) were 82.6%. The rest (17.4%) were food secure since they had consumed at least 2100 kcal per capita per day. Among the households affected by HIV/AIDS the average DEC

was 368.5 kCal while the minimum and maximum amounts of DEC were 23.0 and 4523.5 kCal per capita per day. Among the households affected by HIV/AIDS 80% were food insecure while 83.3% were food insecure among households not affected by HIV/AIDS. Among the households not affected by HIV/AIDS the average amount of DEC was 1321.5 while the minimum and maximum amounts of DEC were 7.7 and 11 051.9 kCal, respectively, per capita per day.

4.4.4.6 Dietary energy consumed per adult equivalent per day from annual data

Based on the amount of grains obtained per adult equivalent per day given in Table 27, the average dietary energy consumed per adult equivalent per day is (167.91/365 x 3350) x 100/80, which is 1926.4 kcal. Since households in Tanzania are said to be food secure if they consume at least 2200 kCal per adult equivalent per day, these results show that on average all the households were food insecure. The minimum and maximum amounts were 10.3 and 12 851.1 kcal per adult equivalent per day, respectively, with a standard deviation of 18 96.4. Based on kcal consumed per adult equivalent per day, 29.9% of the households were food secure while 70.1 % were food insecure in the whole sample. Among the households affected by HIV/AIDS, the average was 2073.8 kCal while the minimum and maximum amounts were 27.4 and 7381.0 kCal, respectively, and 60.0% of them were food insecure. Among the households not affected by HIV/AIDS, the average was 1887.5 kCal while the minimum and maximum amounts were 10.3 and 12 851.1 kCal, respectively, and 72.8% of them were food insecure. Those with very low amounts of calories consumption must have eaten more non-grain energy sources, especially cassava, which is another main foodstuff in the area, especially in Kibiti Division. However, in Ikwiriri Division less cassava is consumed in comparison with Kibiti Division since at Ikwiriri cassava production is little in comparison with Kibiti.

4.4.5 Food security based on anthropometric measures of under-5 years old children

The 225 households contained 259 under-five-year old children in 135 households. However, only 88 children were available for anthropometric measures in terms of height and weight. Their ages, heights and weights are given in Table 29.

Table 29: Ages, heights and weights of under-five years old children

Anthropometrics among under-five years old children	Statistics				
	n	Mean	Std. Dev.	Min.	Max.
Age (months)	88	26.67	16.93	1.00	58.00
Height (cm)	88	74.37	19.14	5.20	105.00
Weight (kg)	88	10.83	3.06	4.00	17.20

Malnutrition was determined by taking the weights in kg of the under-five-year old children, dividing them by the heights of the children in cm and finding the z-scores of the ratios of weight-by-height (W/H) using the SPSS computer programme. According to WHO cited by Muinde *et al.* (2006), severe acute malnutrition exists when Z-scores for W/H < -3; acute malnutrition exists when -3 ≤ W/H Z-scores < -2; and malnutrition is said to be absent when W/H ≥ -2. The minimum and maximum z-scores were -1.95167and +4.62829, respectively. This means there was no malnutrition among under-five-year old children included in the research since all the z-scores were above -2. Albeit the finding is similar to what Staaz *et al.* (1990), cited by Maxwell and Frankenberger (1992) found in Mali using anthropometric measures to determine household food security, it was not expected in this study and is in stark contrast with the findings of food security levels found in this study, which show that more than 70% of the households were food insecure. The plausible explanation for the unexpected results is that anthropometric measures do not always correlate directly with food availability and access as seen above.

Using a t-test to compare the z-scores among households affected and those not affected by HIV/AIDS, it was found that they were not significantly different ($p = 0.424$), which means that under-five- year old children in households affected and those not affected by HIV/AIDS were likely to have more or less the same nutrition status.

4.4.6 Levels of food security obtained using various methods

The levels of food security obtained using various methods of food security determination are summarized in Table 30. The data show that using various methods to determine food security in terms of kilocalories consumed, which is the actual indicator of food security (not a proxy one), per capita per day and per adult equivalent per day, one gets almost the same results. This is shown by the mean kCal amounts consumed per capita per day in the first, second and third rows (which are almost the same) and the kcal amounts consumed per adult equivalent per day in the fourth, fifth and sixth rows (which are also almost the same).

Table 30: A summary of DEC based on various methods of food security determination

Method of food security determination	n	Dietary energy consumed per day		
		Min.	Max.	Mean
Grains eaten per capita per week	131	119.6	5 832.7	1 351.5
Grains eaten per capita per month	225	150.5	12 527.6	1 352.8
Grains harvested, bought and received freely per capita per year	144	7.7	11 051.9	1 331.3
Grains eaten per adult equivalent per week	131	152.6	5 832.6	1 918.7
Grains harvested, bought and received freely per adult equivalent per year	144	10.3	12 851.1	1 926.3
Grains eaten per adult equivalent per month	222	243.2	12 527.6	1 891.5

Based on the amounts of DEC presented in Table 30, the proportions of households below (food insecure) and at and above (food secure) the cut off points of 2100 kCal per

capita per day and 2200 kCal per adult equivalent per day that are the minimum values for people to be considered food secure, are presented in Table 31 and Fig. 8.

Table 31: A summary of food security levels obtained using various methods

Method of food security determination	Food security incidence (%)					
	Affected by HIV/AIDS		Not affected by HIV/AIDS		All	
	Food insecure	Food secure	Food insecure	Food secure	Food insecure	Food secure
Households' self-appraisal	84.0	16.0	74.3	25.5	76.4	23.6
Number of meals eaten per	20.5	79.5	16.0	84.0	17.1	82.9
Grains obtained per capita per year	83.3	16.7	86.0	14.0	85.4	14.6
Grains obtained per adult per year	60.0	40.0	72.8	27.2	70.1	29.9
DEC per capita per day based on annual data	80.0	20.0	83.3	16.7	82.6	17.4
DEC per adult per day based on annual data	60.0	40.0	72.8	17.2	70.1	29.9
DEC per capita per day based on 7 days' data	90.0	10.0	86.1	13.9	87.0	13.0
DEC per adult per day based on 7 days' data	73.3	26.7	69.3	30.7	70.2	29.8
DEC per capita per day based on 60 days' data	86.0	14.0	88.6	11.4	88.0	12.0
DEC per adult per day based on 60 days' data	66.0	34.0	72.7	17.3	71.2	28.8

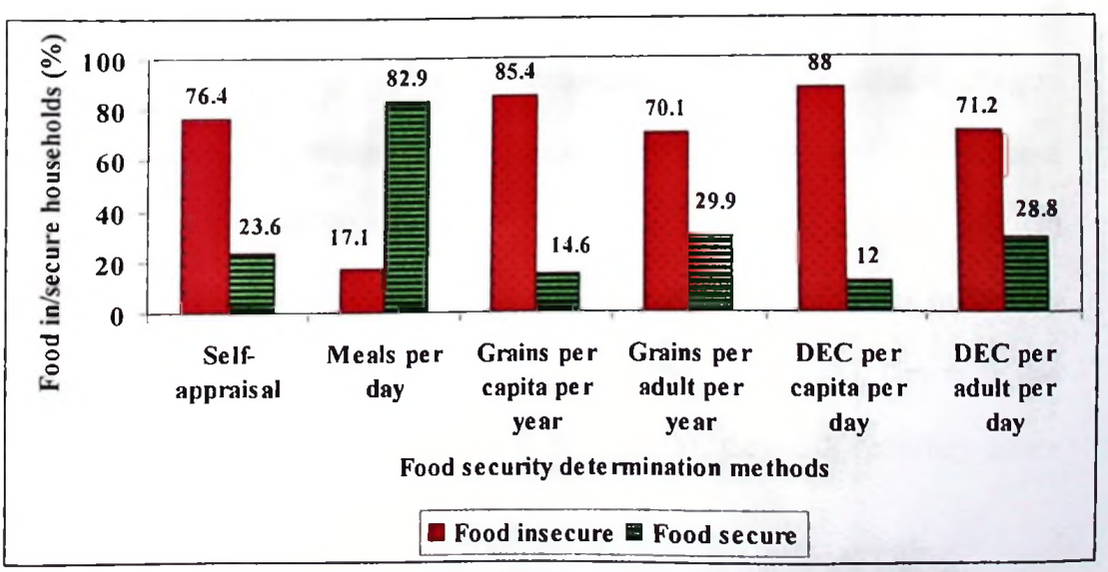

Figure 8: Food security levels based on various methods of food security determination

Looking closely at the results in Table 31 and Fig. 8 one realizes that food insecurity is much higher than the Tanzanian figure of 19% food insecurity (NBS, 2002) in 2001. There are a number of plausible explanations for obtaining high figures of food insecurity, namely (a) the area where the research was done was one of the places in Tanzania with relatively high food insecurity; (b) food production was low mainly due to almost all the youth and most men neglecting agriculture while the main occupation of the majority of household heads was crop production; (c) low use of agricultural technologies and (d) most people had low income to buy food while food buying was the main source of food.

One also finds that food security based on meals per day was outstandingly different from food security based on other methods. It is because determination of food security based on meals eaten per day is unreliable since counting the number of meals does not take into account the amounts of foodstuffs and energy eaten. Self-appraisal of household food security produced results comparable with those produced by other methods, leaving alone meals per day. This means that if households appraise themselves or are appraised by people of the same area who know them well reasonable levels of food security can be obtained, which may inform preliminary planning for food security improvement. However, such information may be unreliable if villagers are interviewed without first pre-empting them of their expectations and worries about outcomes of a food assessment interview. If they expect nothing good or bad, they will definitely tell the truth; if they suspect that by underestimating their food status they will get food aid they will deflate the amounts of food they have; and if they think that by telling their real food insecurity they will be jeered at, they will definitely inflate their food status.

In Table 31, food security incidences based on per capita and on per adult equivalent dietary energy consumed values were much different, the former being lower. This might have been due to an unrealistic cut off point of 2100 kcal per capita per day. Otherwise, values per capita are easier to determine than values per adult equivalent since counting the number of household members on which to divide DEC values of households is more objective than determining adult equivalent units. Of all the values of food security incidence in Table 31, the most reliable figure is that based on dietary energy consumed (DEC) per adult equivalent per day from data collected daily for 30 days (i.e. 28.8% food security incidence, which is equivalent to 71.2% food insecurity incidence). The reliability is due to the data having been based on good memory of the actual amounts of foods consumed which were based on three days' memories and the data involving all the 225 households of the sample. The reliability is also shown by the last pair of bars in Fig. 8 being almost an average of the other bars. With annual data, memory lapse of amounts of food consumed may be a source of error; with seven days' data, seasonality might be a major source of error. Therefore, according to this research, the proportion of food insecure households was 71.2% while that of food secure households was 28.8%. But the DEC amounts in Table 31 would be different if a different ratio for inflating DEC values were used. The ratio of 100/80 was used to inflate DEC figures based on literature which says that grains contribute 80% of dietary energy in Tanzania (Sheshamani, cited by Ashimogo, 1994), but Rosen and Caswell (2006) contend that in Sub-Saharan Africa the share of dietary energy from grains is nearly 50%.

Besides the percentages of food secure and food insecure households given in Table 31, the levels of food security obtained using various methods were compared, and the results are given in Table 32. The results show that the levels of food security obtained

using various methods did not differ significantly. This means that all the methods used had the potentiality to give good results. The average kilocalories in Table 32 are different from those given in Table 30 since the number of households (n) are different due to the fact that paired-samples t-test deals with the same number of cases for variables compared hence it neglects some cases.

Table 32: Paired-samples t-test results to compare DEC based on various methods

Methods of food security determination compared	n	Mean kCal eaten per day	t-value	Sig. (2-tailed) (p-value)
Grains eaten per capita per week	82	1249.1	-1.190	0.237
Grains harvested, bought and received freely per capita per year	82	1452.6		
Grains eaten per capita per week	131	1351.5	0.466	0.642
Grains eaten per capita per month	131	1310.2		
Grains harvested, bought and received freely per capita per year	144	1331.3	0.616	0.539
Grains eaten per capita per month	144	1255.3		
Grains eaten per adult equivalent per week	82	1863.0	-0.982	0.329
Grains harvested, bought and received freely per adult equivalent per year	82	2085.7		
Grains eaten per adult equivalent per week	129	1901.1	0.742	0.459
Grains eaten per adult equivalent per month	129	1816.8		
Grains harvested, bought and received freely per adult equivalent per year	142	1931.7	0.674	0.501
Grains eaten per adult equivalent per month	142	1821.8		

Besides the comparisons in Table 32, food security (in terms of the amounts of dietary energy consumed (DEC) was compared between households affected and those not affected by HIV/AIDS. The results, which are presented in Table 33, show that the DEC amounts did not differ significantly between the two groups of households. The results in Table 33 are contrary to the mainstream thinking whereby food security in households affected by HIV/AIDS is expected to be significantly lower than that in households not affected by HIV/AIDS. However, the results are similar to what the Zambian National Vulnerability Assessment Committee (VAC) found in Zambia after

studying the food security situation in Zambia linking it with HIV/AIDS. VAC (2003), cited by Bolton (2003) found the following: "In terms of reduction in food produced ... the data...on the whole showed no real difference between households categorised by the presence of one of the proxy variables indicating HIV/AIDS and households not affected by HIV/AIDS."

Table 33: Independent-samples t-test results for food security between affected and not affected households

Variables compared	Affected by HIV/AIDS		Not affected by HIV/AIDS		t-value	Sig. (2-tailed) (p-value)
	n	Mean	n	Mean		
Maize and rice harvested per adult equivalent in 2005/06	30	124.6	114	115.5	0.288	0.774
Number of meals eaten per week before the survey	39	19.8	131	20.1	-0.076	0.448
All maize and rice obtained per adult equivalent per year	30	180.7	114	164.5	0.477	0.634
DEC per capita per day based on one week's data	30	1 221.4	101	1 390.1	-0.811	0.419
DEC per adult equivalent based on one week's data	30	1 833.2	101	1 944.1	-0.426	0.671
DEC per adult equivalent per day based on annual data	30	2 073.8	114	1 887.5	0.477	0.634
Maize and rice harvested per adult equivalent	30	124.6	114	115.5	0.288	0.774
DEC per adult equivalent per day based on 60 days' data	50	2 165.5	172	1 811.8	1.706	0.089

The plausible explanations for the lack of significant differences in DEC are (a) although the ability to produce food had decreased in households affected by HIV/AIDS, they were receiving some food and cash assistance from their relatives who knew of their disadvantaged position and (b) they had members of extended families who might have contributed to food security. The latter situation was partly indicated by the finding that age dependency ratios did not differ significantly between households affected and those not affected by HIV/AIDS.

4.4.7 Food situation quarterly

The year was divided into four quarters based on insights gained during PRA about the months during which food insecurity escalates. The quarters were September to November 2005, December 2005 to February 2006, etc. as seen in Table 34. The results in Table 34 show that the March 2006 to May 2006 quarter was the one with the most plenty food and that the December 2005 to February 2006 quarter was the one with the most scarce food. This result is consistent with PRA results which showed that December and January were some of the months with critical food shortage.

Table 34: Levels of food availability quarterly

Food status (n = 191)	Very plenty	Plenty	Scarce	Very scarce
	%	%	%	%
Sept. 2005 – Nov. 2005	1.6	44.0	36.1	18.3
Dec. 2005 – Feb. 2006	1.6	40.3	34.6	23.6
Mar 2006 – May 2006	7.9	55.5	29.8	6.8
Jun. 2006 – Aug.2006	18.3	62.3	16.2	3.1

4.4.8 Crop products harvested a year before

Food security was further assessed by finding the amounts of various crop products that had been harvested a year before the survey, that is the harvests of the agricultural year 2004/05, and the number of months maize and rice harvested had been consumed. The results are presented in Table 35. The data in Table 35 show that more rice than maize was harvested and hence the rice was eaten for more days compared to maize. However, the durations that the grains harvested had been consumed were very little putting in consideration the fact that the main economic activity in most of the households was crop production. It was only three households in which maize harvested could last for at least 12 months. None of the households whose harvested rice sufficed for 12 months; the maximum number of months that harvested rice had lasted was 10 in only two households. Some of them had grown both rice and maize, and others had cassava.

Others had non-agricultural activities that were giving them some income to buy food, among other needs. These factors helped them to mitigate food insecurity.

Table 35: Food crop products harvested in 2004/05 and the months they lasted

Crop product harvested	Affected by HIV/AIDS			Not affected by HIV/AIDS			All		
	n	kg per capita	Months lasted	n	kg per capita	Months lasted	n	kg per capita	Months lasted
Maize	40	47.3	4.9	76	47.3	4.5	116	41.5	4.7
Rice	33	64.9	4.8	50	64.9	5.2	83	86.5	5.1
Cassava	19	210.9	-	56	210.9	-	75	145.8	-
Sorghum	2	26.9	-	19	26.9	-	21	35.2	-
Sesame	0	-	-	4	-	-	4	5.5	-
Beans	0	-	-	3	-	-	3	1.1	-
Cashew nuts	12	173.4	-	42	173.4	-	54	117.6	-
Cow peas	6	3.3	-	32	3.3	-	38	5.1	-
Pigeon peas	4	5.0	-	22	5.0	-	26	4.7	-

4.4.9 HIV/AIDS and food security in the research area

Descriptive and inferential analyses were done to determine distributions of HIV/AIDS factors and their linkages with food insecurity, respectively. The results are presented below.

4.4.9.1 Relatives' perceived causes of death of people who died due to AIDS

Of the people who had passed away due to AIDS 66.0% were female while 34.0% were male household members. The average age of those who had passed away due to AIDS was 39.1 years while their minimum and maximum ages at death were 16 and 71 years, respectively. Since the death causes were confidential, the respondents in the households where deaths had occurred due to AIDS stated the reasons for death summarised in Table 36.

Table 36: Perceived causes of death by relatives of people who had died from AIDS

Cause of death (n = 50)	%
Tuberculosis (TB)	14.0
Paralysis	8.0
HIV/AIDS	6.0
Swelling the stomach	4.0
Malaria	4.0
Swelling the urinary bladder	2.0
Swelling legs and arms	2.0
Old age	2.0
Epilepsy	2.0
Diarrhoea, malaria and anaemia	2.0
Don't know	54.0
Total	**100.0**

The data in Table 36 show that only 6.0% of the respondents knew specifically that their relatives had passed away due to AIDS. However; the data in the same table which show that tuberculosis ranks high in the list attests to the fact that the people had died due to AIDS since TB is an important AIDS opportunistic disease.

4.4.9.2 Relationships between the deceased and the respondents

Where at least one household member had passed away, regardless of the cause of death, respondents were asked to say what had been the family relationship between the household head and the person who had passed away. The family relationships are summarized in Table 37. The data in Table 37 show that a bigger proportion of wives had passed away due to AIDS compared to the proportion of male household heads that had passed away.

4.4.9.3. Months passed from death to the time of the survey

Among households affected by HIV/AIDS, the average time that had passed from death of household members to the time of the survey was 27.7 months. The minimum and

maximum numbers of months that had passed were seven and 44 months, respectively. About one-fifth (18%) of the households affected by HIV/AIDS had lost a member due to AIDS within a year before the survey while 24% of them had been affected in that way within 13 to 24 months prior to the survey and the rest 58% had been affected 24 to 44 months prior to the survey. The above time durations between death and the survey were reasonably short for the respondents to remember various facts related to agricultural production and food security. With respect to remembering various facts, the durations were advantageous, but for gauging changes in agricultural production and well being the durations were rather too short to find much impact.

Table 37: How the deceased were related to the household head

Relationship with household head (n=50)	%
Wife	44.0
Male household head	18.0
Daughter aged 15 yrs and above	12.0
Son aged 15 yrs and above	8.0
Brother	8.0
Daughter aged less than 15 yrs	0.0
Sister	0.0
Grand son	2.0
Brother-in-law	2.0
Grand daughter	0.0
Father	2.0
Uncle	0.0
Sister-in-law	2.0
Aunt	2.0
Total	**100.0**

4.4.9.4 Agricultural factors in households affected by HIV/AIDS

Various agricultural factors in households affected by HIV/AIDS are presented in Table 38 to show how they varied between the season when a household member died due to AIDS and in the agricultural season 2005/06 that was the time frame for this study.

The data in Table 38 show that for acreage, cash capital spent on agriculture, hours spent on agriculture, number of workers on farm, maize harvested and cassava harvested the condition of the households worsened after losing a household member due to AIDS. However, for rice and cashew nuts production the condition improved. Since there was deterioration in most of the agricultural factors the results do not support PRA participants' arguments that eventually when an AIDS patient dies after long time illness there is improvement in well being since labour, time and financial resources that were being used to take care of the sick are saved, as seen in Section 4.2.6.2.

Table 38: Some agricultural factors in households with death of a member due to AIDS

Variable	n	Mean	Mean change (%)
Acreage one season before death	40	2.7938	-7.38
Acreage in 2005/06	40	2.5875	
Cash capital used on agriculture before death	32	4 6906.56	-13.34
Cash capital used on agriculture in 2005/06	32	4 0647.25	
Hours spent on agriculture before death	35	6.71	-14.01
Hours spent on agriculture in 2005/06	35	5.77	
Agricultural labourers before death	37	18.22	-47.04
Agricultural labourers in 2005/06	37	9.65	
Maize harvested before death	33	252.91	-23.15
Maize harvested in 2005/06	34	194.35	
Rice harvested before death	32	436.75	200.95
Rice harvested in 2005/06	33	1 314.42	
Cassava harvested before death	20	360.85	-35.02
Cassava harvested in 2005/06	21	234.48	
Cashew nuts harvested before death	15	165.20	35.97
Cashew nuts harvested in 2005/06	13	242.15	

4.4.9.5 Linkage between HIV/AIDS and food security

Linkages between a household member having died due to AIDS and food security in the household were analysed using descriptive statistics presented in Tables 38. They were also analysed using a chi-square test as seen in Table 39 to determine whether having lost a household member due to AIDS and being food insecure were significantly associated.

Table 39: Cross-tabulation results indicating relationships between having been affected by HIV/AIDS and being food insecure

Having been affected by HIV/AIDS	Statistics	Food security status	
		Food insecure	Food secure
Households not affected by HIV/AIDS	Frequency	127	48
	%	73	27
Households affected by HIV/AIDS	Frequency	33	17
	%	66	34

Note: Pearson chi-square = 0.817 (p = 0.366)
Linear association = 0. 814 (p = 0.367)
Phi-statistic = 0.060 (p = 0.366)

In Table 39, since levels of significance (p-values) for Pearson's chi-square, linear association and Phi-statistic are greater than 0.05, which is the lowest level of significance, there is no significant association between having been affected by HIV/AIDS and being food insecure. The phi value is a measure of the strength of association between nominal variables. If it is 0 to 0.10 it means weak association; if it is 0.11 to 0.30 it means moderate association while if it is greater than 0.30 it means strong association (Healey, 2005). Therefore, in Table 39 where the phi value is within the 0 to 0.10 range there is weak association between having been affected by HIV/AIDS and being food insecure as far as the data for this research are concerned.

The results in Table 39 mean that a household affected by HIV/AIDS and another one not affected by HIV/AIDS may have the same status of food security. However, this is likely to be so when the affected household has entitlements like money and productive assets with which to acquire food. In the long run, if such a household is affected for a prolonged duration, its entitlements may be eroded; hence it is very likely to become more food insecure than households not affected by HIV/AIDS.

Besides, the linkages were analysed by calculating the amounts of food and cash spent on mourning and funeral of relatives who had passed away due to AIDS. The foods and costs are presented in Table 40.

Table 40: Cash and food spent on mourning loss of relatives due to AIDS

Items	n	Mean
Total cash spent on mourning deceased relatives	39	79 824.62
Total rice used on mourning deceased relatives	43	19.53
Total maize used for mourning deceased relatives	43	20.77
Total cassava used on mourning deceased relatives	43	16.02

Besides the above types of foodstuffs eaten during mourning relatives who had passed away due to AIDS, the following foodstuffs were also eaten during the same mourning days, with the proportions of households where they were consumed in brackets: wheat buns (11.6%), beef meat (18.6%), sugar (20.9%), beans (39.5%), coconut (4.7%), cooking oil (6.3%) and round potatoes (4.%).

4.5 Strategies for Coping with Food Insecurity

The respondents in households where there had been food shortage were asked to state options they had taken to get food. The main options they stated are presented in Table 41.

Table 41: Strategies for coping with food insecurity

Strategy	Households which used the strategy		
	Affected (n=42)	Not affected (130)	All (n = 172)
	%	%	%
Eating fewer meals	54.8	50.0	51.2
Eating inferior foods	50.0	42.3	44.2
Being assisted by relatives	28.6	38.5	37.8
Borrowing cash	23.8	35.4	32.6
Seeking remittances from relatives	31.0	25.4	26.7
Borrowing food	11.9	26.9	23.3
Doing casual work	16.7	23.1	21.5
Selling their livestock	16.7	16.9	16.9
Eating wild foods	16.7	14.6	15.1
Being assisted by neighbours	19.0	10.8	12.8
Working for food	7.1	6.2	6.4
Selling some family assets	92.9	3.8	2.9
Being assisted by the Government	2.4	3.1	2.9
All members migrating temporarily	92.9	2.3	1.7
Temporary migration of some members	92.9	1.5	1.2

The data in Table 41 show that, generally, the major strategies by which food insecure households were coping with food insecurity were: (a) eating fewer meals; (b) eating inferior foods; (c) being assisted by relatives; (d) borrowing cash; (e) requesting for remittances from relatives and (f) borrowing food. Some of the major ways of coping with food insecurity are graphed in Fig. 9 to illustrate the variation in coping strategies between households affected and those not affected by HIV/AIDS.

The data in Fig. 9 show that bigger proportions of households affected by HIV/AIDS were selling household assets, migrating temporarily and permanently, eating fewer number of meals, eating inferior foods, applying for remittances from relatives living away, and getting neighbours' assistance. It is worth noting that for every strategy of coping with food insecurity used, higher proportions of household affected by HIV/AIDS used it. This implies that it is very likely that they were more food insecure

than their fellow non-HIV/AIDS affected households. The above strategies used to cope with food insecurity in Rufiji District are very similar to the ones illustrated in Fig. 2.

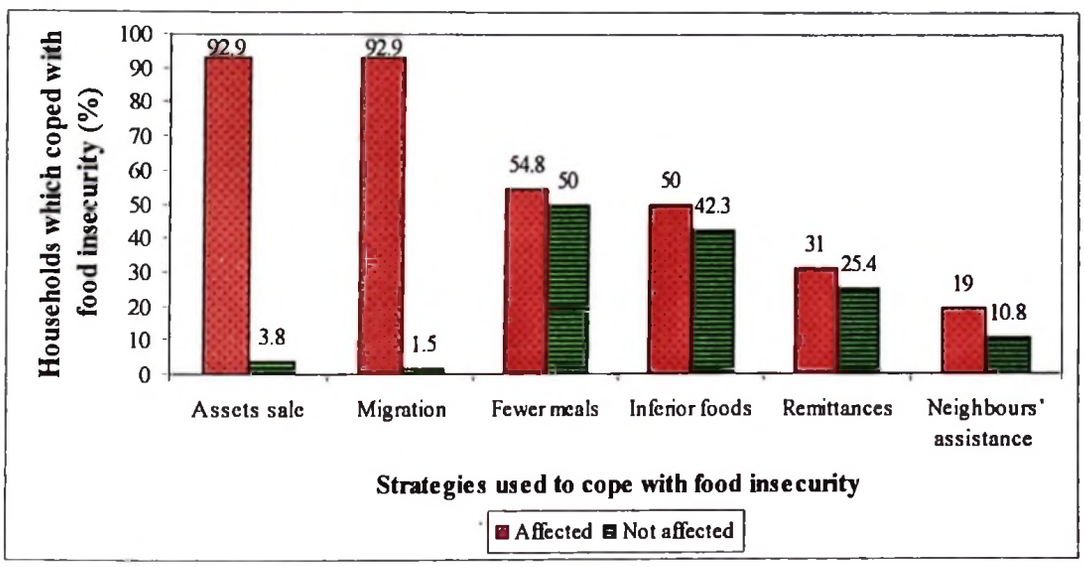

Figure 9: Major strategies used to cope with food insecurity

4.6 Non-HIV/AIDS Determinants of Food Security

In this section food security is analysed based on non-HIV/AIDS determinants, namely (a) revenue from non-farm activities, (b) cash expenditure, (c) assets owned, (d) gender division of labour, (e) illness of household members, (f) entitlements, (g) traditional celebrations and (h) death of some household members due to non-AIDS causes. These factors are discussed in the following sub-sections.

4.6.1 Revenue from non-farm activities

Non-farm activities (NFA) were defined as non-crop and non-livestock production and service provision activities. Almost three-quarters of the households (169 out of 225) reported having undertaken such activities, which included charcoal making, lumbering,

and trade. The costs incurred on the activities, and gross and net revenues from the non-farm activities are given in Table 42.

Table 42: Revenue from non-farm activities per adult equivalent per year

Costs and revenues	Mean (TSh)		
	Affected (n = 50)	Not affected (n = 175)	All (n = 225)
Total costs	104 030.18	26 067.06	43 392.20
Gross revenue	168 473.05	93 825.56	110 413.90
Net revenue	64 442.87	67 758.50	67 021.69

The results in Table 42 show that households affected by HIV/AIDS in the sample had less net income per adult equivalent from non-farm activities (NFA) than those not affected by HIV/AIDS. This result is in agreement with literature which says that HIV/AIDS contributes to the decrease in income. Comparing the net incomes from NFA between households affected by HIV/AIDS (HAHA) and households not affected by HIV/AIDS (HNAHA) revealed that they were not significantly different ($p = 0.091$). However, dietary energy consumed (DEC) was significantly different between households whose net revenue was at least TSh 100 000 and those whose net revenue was less than that amount ($p = 0.027$). The amounts of DEC in the two groups were 2279.2 and 1800.5 kCal per adult equivalent per day, respectively.

4.6.2 Cash expenditure

Expenditures indicate various things, one of them being that the higher the proportion of expenditure on food the poorer the people. Also, households affected by HIV/AIDS are likely to spend more on healthcare than other households. Therefore, the main items on which the respondent households had spent their income were asked for, and the responses are presented in Table 43 and Fig. 10.

The data in Table 43 and Fig. 10 show that households affected by HIV/AIDS spent more on health, buying assets, and buying food than households not affected by HIV/AIDS. Households affected by HIV/AIDS spending more on buying assets than those not affected by HIV/AIDS might have been due to decreased demand for resources for agricultural production, which they were doing less than the other households. Households affected by HIV/AIDS spending more on health than those not affected by HIV/AIDS was due to increased costs of medical care due to having a member of household who was HIV positive. Households affected by HIV/AIDS spending more on buying food than those not affected by HIV/AIDS was due to the fact that they had less labour and they were working fewer hours on farm after a member of the household had passed away hence food production had declined, necessitating buying more food than before being affected by HIV/AIDS.

4.6.3. Assets owned

Assets owned are entitlements which can help to increase people's access to food, for example by the assets being used as factors of production.

Table 43: t-test results for expenditures in affected and not affected households

Variables compared	Affected		Not Affected		t	Sig. (2-tailed)
	n	Mean	n	Mean		
Education expenditure*	50	3 160.5	175	3 443.5	-0.131	0.896
Health expenditure*	50	6 435.1	175	5 665.2	0.428	0.669
Assets expenditure*	50	6 972.1	175	3 675.3	1.400	0.163
Food expenditure*	50	56 622.6	175	44 893.0	0.907	0.366
Others expenditure*	50	2 877.5	175	6 227.6	-1.264	0.208
Total expenditure*	50	76 067.8	167	63 904.6	0.871	0.385
Expenditure on education (%)	45	6.4	167	6.4	-0.002	0.999
Expenditure on health (%)	45	14.4	167	16.0	-0.409	0.683
Expenditure on assets (%)	45	13.6	167	6.9	2.177	0.031
Expenditure on food (%)	45	58.9	167	58.6	0.046	0.964
Expenditure on others (%)	45	6.8	167	12.1	-1.378	0.170

*The expenditures are in TSh per adult equivalent per year

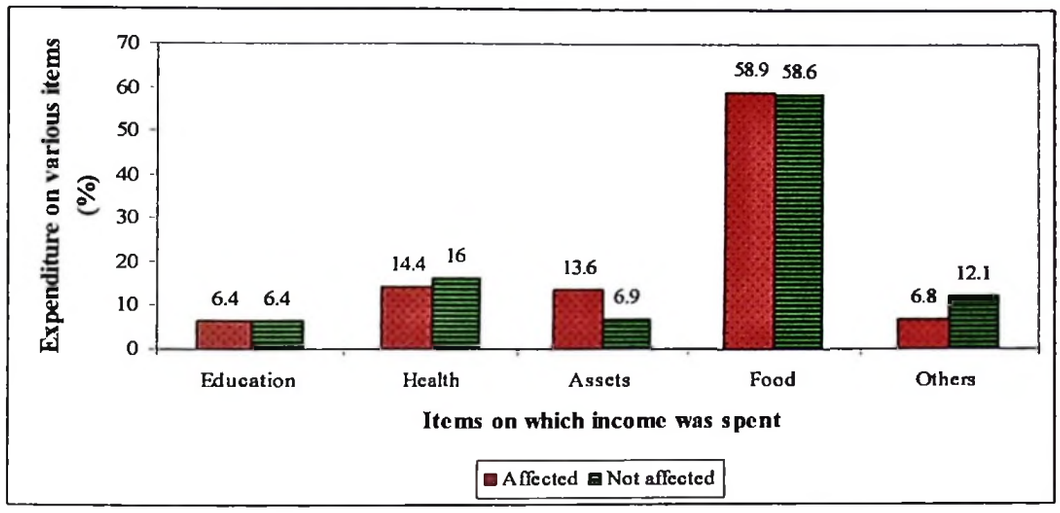

Figure 10: Expenditures per annum per household

4.6.3.1 Households which owned the assets

Ownership of assets, especially more valuable ones like automobiles, motorcycles, TV sets, bicycles, mobile phones, and houses is an indicator of well-being. Such valuable assets indicate high consumption expenditure. Moreover, ownership of productive assets like milling machines, sewing machines, fishing equipment, or lumbering equipment indicate well being since they are used for production of material goods for sale or provision of services. For these reasons, assets owned in the sampled households were asked for and are presented in Table 44.

Table 44: Households owning various assets in 2004 and 2006

Types of assets owned	Households owning the assets in 2004			Households owning the assets in 2006		
	Affected by HIV/AIDS (n=50)	Not affected by HIV/AIDS (n=175)	All (n=225)	Affected by HIV/AIDS (n=50)	Not affected by HIV/AIDS (n=175)	All (n=225)
	%	%	%	%	%	%
Automobile	2.0	1.1	1.3	2.0	1.1	1.3
Bicycle	49.0	54.6	53.3	51.0	60.3	58.2
Cattle	0.0	0.6	0.4	0.0	0.0	0.0
Cellular phone	11.8	2.3	4.4	25.5	9.8	13.3
Chicken	43.1	45.4	44.9	47.1	49.4	48.9
Cupboard	25.5	17.2	19.1	19.6	19.0	19.1
Fan	5.9	1.1	2.2	5.9	1.1	2.2
Fishing nets	0.0	0.6	0.4	3.9	1.7	2.2
Goat	2.0	1.1	1.3	3.9	1.1	1.8
Hand hoe	94.1	90.8	91.6	94.1	89.1	90.2
House	92.2	76.4	75.1	92.2	85.1	86.7
Machete	90.2	80.5	85.8	88.2	83.9	84.9
Mattresses	47.1	50.0	49.3	51.0	51.1	51.1
Mosquito net	64.7	59.2	60.4	74.5	75.3	75.1
Motorcycle	2.0	0.6	0.9	3.9	1.7	2.2
Press iron	19.6	12.1	13.8	19.6	13.2	14.7
Radio	78.4	67.2	69.8	72.5	71.8	72.0
Refrigerator	5.9	0.0	1.3	3.9	0.0	0.9
Satellite dish	2.0	0.0	0.4	3.9	0.0	0.9
Sewing machine	11.8	3.4	5.3	11.8	4.6	6.2
Sheep	0.0	1.7	1.3	2.0	4.0	3.6
Sofa set	15.7	4.6	7.1	13.7	8.6	9.8
TV set	9.8	0.0	2.2	7.8	1.7	3.1
Watch/clock	45.1	39.7	40.9	45.1	41.4	42.2
Water pump	2.0	0.6	0.9	5.9	0.6	2.2
Wooden bed	56.9	55.2	55.6	56.9	58.6	58.2

4.6.3.2 Number of assets owned

The numbers of various assets owned in 2004 and 2006 are summarised in Table 45 while the proportions (%) of the households whose assets had decreased, increased and hadn't changed are given in Tables 46 and 47.

4.6.3.3 Changes in the assets and reasons for the changes

Increase, decrease and no change in the assets owned between 2004 and 2006 and reasons for the situation were asked for from respondents in order to find the association between the change and food security. Buying an asset for the first time was also considered to be increase in assets. The results are summarised in Table 46. For every household, the amounts by which each of the assets had changed were computed by subtracting the amounts of assets owned in 2004 from the amounts owned in 2006.

Table 45: Numbers of assets owned in 2004 and 2006

Assets owned	In the whole sample						Among only those owning the assets					
	2006			2004			2006			2004		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Automobile	0	3	0.03	0	1	0.01	1	3	2.0	1	1	1.00
Bicycle	0	3	0.68	0	3	0.59	1	3	1.18	1	3	1.11
Cattle	0	0	0.00	0	1	0.00	1	0	0.00	1	1	1.00
Cellular phone	0	10	0.21	0	2	0.05	1	10	1.60	1	2	1.10
Chicken	0	50	4.49	0	70	5.68	1	50	6.5	1	70	12.78
Cupboard	0	4	0.27	0	7	0.27	1	4	1.40	1	7	1.46
Fan	0	2	0.04	0	3	0.04	1	2	1.60	1	3	2.00
Fishing nets	0	5	0.04	0	1	0.00	1	5	2.00	1	1	1.00
Goat	0	15	0.13	0	18	0.15	1	15	7.50	1	18	11.00
Hand hoe	0	10	2.76	0	10	2.72	1	10	3.06	1	10	2.97
House	0	4	1.00	0	4	0.92	1	4	1.15	1	4	1.14
Machete	0	5	1.41	0	5	1.37	1	5	1.66	1	5	1.66
Mattress	0	8	1.20	0	6	0.96	1	8	2.34	1	6	2.08
Mosquito net	0	8	1.75	0	6	1.22	1	8	2.33	1	6	2.04
Motorcycle	0	1	0.02	0	2	0.01	1	1	1.00	1	2	1.50
Press iron	0	2	0.15	0	2	0.14	1	2	1.03	1	2	1.03
Radio	0	5	0.92	0	4	0.80	1	5	1.27	1	4	1.14
Refrigerator	0	1	0.01	0	2	0.02	1	1	1.0	1	2	1.33
Satellite dish	0	1	0.01	0	1	0.00	1	1	1.0	1	1	1.00
Sewing machine	0	1	0.06	0	3	0.06	1	1	1.0	1	3	1.17
Sheep	0	10	0.18	0	5	0.04	1	10	5.13	1	5	3.00
Sofa set	0	10	0.16	0	10	0.13	1	10	1.64	1	10	1.88
TV set	0	5	0.05	0	2	0.03	1	5	0.00	1	2	1.20
Watch/clock	0	3	0.56	0	3	0.52	1	3	1.33	1	3	1.26
Water pump	0	3	0.04	0	3	0.02	1	3	1.60	1	3	2.00
Wooden bed	0	6	1.34	0	6	1.20	1	6	2.30	1	6	2.14

Table 46: Proportions (%) of households with and without changes in assets

Change	Affected by HIV/AIDS (n = 50)	Not affected by HIV/AIDS (n = 175)	All (n = 225)
	%	%	%
Didn't change	16.0	16.0	16.0
Decreased	36.0	35.4	35.6
Increased	48.0	48.6	48.4
Total	**100.0**	**100.0**	**100.0**

The data in Table 46 show that a slightly higher proportion (36.0%) of households affected by HIV/AIDS had decrease in assets owned vis-à-vis the proportion (35.4%) of households not affected by HIV/AIDS. Since the difference was slight, a scale to gauge the decrease was constructed to generate numbers that could show better the difference. The scale was constructed by summing up the differences in the numbers of assets owned and taking the averages for comparison between the households affected and those not affected by HIV/AIDS. For households in which assets had decreased the score on the scale was negative. The minimum score was -29 while the maximum score was + 35. The average score in the whole sample was -0.5644; it was +0.88 in households not affected by HIV/AIDS and -0.54 in households affected by HIV/AIDS. However, comparing the scores on the scale using a t-test showed that the changes in asset ownership were not significantly different between households affected and those not affected by HIV/AIDS ($t = -0.916$; $p = 0.360$). The changes in assets are given presented in Table 47.

The main reasons for increase in assets owned were using income from selling crop products to buy the assets such as bicycles and mobile phones; getting assistance such as of mosquito nets from NGOs; increased household size hence more needs of such assets like beds, hand hoes and mattresses; undertaking a new income generation activity hence buying related assets like sewing machines and fishing nets; aging; tear

and wear of previous assets such as hand hoes and machetes; reproduction of the assets like poultry; getting a bigger salary among salaried employees; and dilapidation of houses, which necessitated construction of new ones.

Table 47: Households (%) in which assets owned changed and didn't change

Assets owned	n		Decreased		Increased		Didn't change	
	Affected*	Not affected	Affected	Not affected	Affected	Not affected	Affected	Not affected
Automobile	1	2	50.0	0.0	50.0	100.0	0.0	0.0
Bicycle	25	106	20.0	7.5	28.0	24.5	52.0	67.9
Cattle	0	1	0.0	0.0	0.0	100.0	0.0	0.0
Cellular phone	13	17	0.0	11.8	61.5	88.2	38.5	0.0
Chicken	24	110	62.5	51.8	37.5	37.3	0.0	24.5
Cupboard	10	33	30.0	6.1	10.0	30.3	60.0	63.6
Fan	3	2	33.3	50.0	33.3	0.0	33.3	50.0
Fishing nets	2	4	0.0	25.0	50.0	75.0	100.0	0.0
Goat	2	4	50.0	25.0	50.0	0.0	0.0	75.0
Hand hoe	48	155	12.5	11.0	8.3	16.8	79.2	72.3
House	47	149	6.4	2.0	8.5	8.1	85.1	89.9
Machete	45	146	8.9	6.8	4.4	16.4	86.7	76.7
Mattress	26	89	0.0	5.6	26.9	30.3	73.1	64.0
Mosquito net	37	131	18.9	6.9	37.8	56.5	43.2	36.6
Motorcycle	2	3	50.0	0.0	50.0	66.7	0.0	33.3
Press iron	10	23	10.0	13.0	10.0	21.7	80.0	65.2
Radio	37	125	21.6	5.6	18.9	18.4	59.5	76.0
Refrigerator	2	7	100.0	0.0	0.0	28.6	0.0	71.4
Satellite dish	2	0	0.0	0.0	50.0	0.0	50.0	0.0
Sewing machine	6	8	16.7	12.5	16.7	37.5	66.6	50.0
Sheep	1	7	0.0	28.6	100.0	71.4	0.0	0.0
Sofa set	7	15	14.3	0.0	0.0	46.7	85.7	53.3
TV set	4	3	50.0	0.0	50.0	100.0	0.0	0.0
Watch/clock	23	72	8.7	6.9	8.7	18.1	82.6	75.0
Water pump	3	1	0.0	0.0	66.7	100.0	33.3	0.0
Wooden bed	29	102	0.0	9.8	13.8	22.5	86.2	67.6

*Affected and not affected are abbreviations for affected by HIV/AIDS and not affected by HIV/AIDS

The main reasons for decrease in assets owned were the assets (especially the liquid ones) being sold including bicycles, watches, mobile phones, radio receivers and chickens; tear and wear and dilapidation of the assets until becoming useless including mosquito nets, cup boards and houses (collapsing); giving some of the assets to relatives

including mosquito nets; the assets being stolen including hand hoes, machetes, chickens, mobile phones, mattresses, and watches; the assets being lost like watches and mobile phones; poultry diseases especially Newcastle Disease killing the birds; and predators eating poultry.

Comparing food security (Table 48) in terms of dietary energy consumed (DEC) per adult equivalent per day based on household income and expenditure survey (HIES) data in households where there was no change, decrease and increase in assets, using one-way ANOVA, it was found that the amounts of DEC were the smallest (1649 kCal) in households where assets had increased followed by those where assets had not changed (2094 kCal), and lastly by households where assets had decreased (2139 kCal). This implies that in households where assets had decreased the assets might have been sold to get cash to buy food. This resulted in the households becoming more food secure than other households.

Table 48: One-way ANOVA results comparing food security according to changes in assets

Change in assets owned	Mean DEC per adult equivalent per day (kCal)			Between and within groups	Sum of Squares	df	Mean Square	F	Sig.
	Affected	Not affected	All						
Didn't change	2362	2017	2094	Between Groups	12 791 114	2	6 395 557	3.96	0.020
Decreased	2552	2019	2139	Within Groups	35 8621 727	222	1 615 413		
Increased	1810	1603	1649						
All	**2165**	**1817**	**1894**	**All**	**371 412 841**	**224**			

Since the level of significance (p = 0.020) was smaller than 0.05, which is the lowest level of significance, the data in Table 48 show that, overall in the whole sample, differences in food security among the three categories of households with respect to change in assets owned were significant. The food situation was the best where assets had decreased, followed by where assets had not changed. The least food secure households were the ones where assets had increased. The food situation in the households where assets had increased might have been due to buying assets on the expense of cash that would have been spent on buying food or on the expense of selling food harvested to buy assets.

Multiple comparisons (Table 49) that were computed concomitantly with the above ANOVA results show that the mean differences in DEC consumed were significant at the 1% level of significance (p = 0.009) between households where assets had increased and where they had decreased, which means that the levels of food security were much different between the two groups of households.

Table 49: Multiple comparisons in mean differences in food security

Categories of change in assets (I)	Categories of change in assets (J)	Significance of mean differences					
		Affected		Not affected		All	
		Mean Difference (I-J)	Sig.	Mean Difference (I-J)	Sig.	Mean Difference (I-J)	Sig.
Didn't change	Decreased	-189.26	0.767	-2.34	0.993	-45.36	0.859
	Increased	552.10	0.369	413.67	0.116	444.86	0.070
Decreased	Didn't change	189.26	0.767	2.34	0.993	45.36	0.859
	Increased	741.36	0.118	416.01(*)	0.040	490.23(**)	0.009
Increased	Didn't change	-552.10	0.369	-413.67	0.116	-444.86	0.070
	Decreased	-741.36	0.118	-416.01(*)	0.040	-490.23(**)	0.009

*The mean difference is significant at the 5% level of significance.
** The mean difference is significant at the 1% level of significance

The above one-way ANOVA-based differences were also supported by t-tests results, which showed significant differences between households where assets had not changed and where they had increased ($p = 0.011$). The difference in DEC consumed was also significant between households where assets had decreased and where they had increased ($p = 0.010$). However, there was no significant difference in DEC between households where assets had not changed and where they had decreased ($p = 0.888$)

4.6.4 Gender division of labour and food security

Gender division of labour has implications for food production. For example, if labour for food production is left for a certain category of people, let's say women while household chores are also theirs, little food is likely to be produced, hence food insecurity is likely to occur. That is why the number of hours various household members did various activities were estimated and are summarised in Table 50.

Table 50: Hours spent on various activities by household members

Category of household members	n	Agricultural activities	Non-agricultural activities	Household chores	Leisure activities	Sleeping at night	Other activities
Men	179	4.96	5.69	0.93	3.72	8.42	0.28
Women	211	5.59	1.62	6.05	2.31	8.38	0.11
Young men	106	1.95	4.54	1.38	4.75	8.56	2.82
Young women	83	1.41	1.58	5.18	3.95	8.94	2.94
Children	148	0.08	0.10	1.18	7.86	10.61	4.17

Discounting hours for sleeping at night, leisure and other activities, the data in Table 50 show that the total number of hours that men, women, young men and young women worked were 11.6, 13.3, 7.9, and 8.2, respectively, in 24 hours. This shows that young men and young women worked much fewer hours than men and women. Looking at the hours spent on agriculture, which is the most important source of food in the area, it is disappointing to note that young men spent on agriculture only 39.3% of the time spent

by men on the same activities and that young women spent on agriculture only 25.2% of the time spent by women on agricultural activities. Food security was compared on the basis of hours that men and women had worked. The results are presented in Table 51.

Table 51: Differences in food security based on hours men and women worked

Variables compared	Hours men did agricultural activities	n	Mean	t	Sig. (2-tailed)
Maize and rice harvested per adult	Five and above	89	110.8	0.162	0.872
	Less than five	36	106.4		
DEC per adult per day based on 60 days' data	Five and above	116	1 788.2	-1.113	0.267
	Less than five	63	2 024.6		
Cash spent on food for 28 days per adult	Five and above	115	9 546.7	-3.241***	0.001
	Less than five	62	13 904.0		
	Hours men did non-agricultural activities	**n**	**Mean**	**t**	**Sig. (2-tailed)**
Maize and rice harvested per adult	Five and above	76	114.3	0.484	0.629
	Less than five	49	102.2		
DEC per adult per day based on 60 days' data	Five and above	106	1 903.0	0.374	0.709
	Less than five	73	1 825.6		
Cash spent on food for 28 days per adult	Five and above	105	11791.4	1.320	0.188
	Less than five	72	10 025.2		
	Hours women did agricultural activities	**n**	**Mean**	**t**	**Sig. (2-tailed)**
Maize and rice harvested per adult	Five and above	113	120.9	0.824	0.411
	Less than five	26	93.6		
DEC per adult per day based on 60 days' data	Five and above	147	1 732.7	-1.441	0.151
	Less than five	63	1 937.4		
Cash spent on food for 28 days per adult	Five and above	146	9 490.5	-3.962***	0.000
	Less than five	61	14 306.0		
	Hours women did non-agricultural activities	**n**	**Mean**	**t**	**Sig. (2-tailed)**
Maize and rice harvested per adult	One and above	60	128.7	0.872	0.385
	Less than one	79	106.0		
DEC per adult per day based on 60 days' data	One and above	89	1 795.1	0.044	0.965
	Less than one	122	1 789.2		
Cash spent on food for 28 days per adult	One and above	88	11 579.0	1.021	0.308
	Less than one	120	10 399.2		

*** Means are significantly different at the 0.1% level of significance

Comparing food security between households whose members had spent different hours on agricultural and non-agricultural activities revealed that food security in terms of cash spent on food for 28 days per adult equivalent was significantly different ($p = 0.001$) between households where men had spent at least five hours and when they had spent more than five hours on agricultural activities. More food secure households were those where men had spent fewer hours on agricultural activities. This is because food security was more dependent on buying food hence most of the men who were working fewer hours on farm were doing income generating activities like charcoal making and casual labour work. Most of the income was being used to buy food.

4.6.5 Illness and food security

4.6.5.1 Health status of the people during the research

All the 225 households surveyed contained a total of 1193 people. The respondents were asked to state the health status of each of their household members in terms of very healthy, healthy, ill, and very ill based on their own experience and knowledge of what illness was. Such information was available for 1181 out of the 1193 people and is summarized in Table 52.

Table 52: Health status of household members

Health status (n = 1181)	Health status (%)
Very healthy	80.7
Healthy	6.3
Ill	6.7
Very ill	6.3
Total	**100.0**

The data in Table 52 show that 80.7% of the people were reported to be very healthy. Collapsing the four categories of health status into two categories of healthy and ill by combining very healthy and healthy into healthy, and ill and very ill into ill, it is found

that 87.0% of the people were said to be healthy while 13.0% were said to be ill. The data give good information that very many people felt that they were healthy. However, this is because they were asked the question late in a dry season (September) when disease incidences are normally few. During that period there are few mosquitoes that spread malaria and there is less water contamination that causes water-borne diseases unlike during a rainy season like March to May when mosquitoes are many and water contamination is high, partly due to wastes from pit latrines soaking away into some water sources that are used as sources of water for domestic uses.

Had the question been asked during a rainy season, the percentage of people being ill would have been higher. And if the judgement of being healthy or ill had been based on medical diagnosis including testing blood, urine, and faecal samples, the number of ill people would have been much higher. A thorough look into the data revealed that those who were ill were living in 41.3% of the 225 households, while the rest were living in 58.7% of the households.

4.6.5.2 Diseases the people were suffering from

The household heads or their representatives were also asked to state the diseases which their household members were suffering from. The diseases they said are listed in Table 53. Although some of what the respondents mentioned to be diseases were not diseases *per se*, like fever that is a symptom of various diseases, it is evident that malaria was the most important disease in the area. The fact that some diseases that are opportunistic ones for HIV/AIDS, particularly TB, were mentioned shows that HI/AIDS was prevalent in the area.

Table 53: Diseases the people were suffering from

Disease(n=154)	%
Malaria	29.8
Joints/body pains	20.7
Fever	9.0
Chest/TB	5.8
Headache	5.8
Stomach aches	4.4
Asthma	3.2
Eyes	3.2
UTI/STI	2.6
Diarrhoea	1.9
Psychiatry	1.9
Coughing	1.3
Skin rushes	1.3
Epilepsy	0.7
Scrotal hernia	0.7
Madness	0.7
Dizziness	0.7
Mumps	0.7
Deafness	0.7
Paralysis	0.7
Blood pressure	0.7
Toothache	0.7
Wounds	0.7
Anaemia	0.7
Pneumonia	0.7
Numbness	0.7
Total	**100.0**

4.6.5.3 Number of days the ill persons had been ill

The respondents were asked the number of days that the ill persons had been ill. Weeks, months and years were converted into days by multiplying them by seven, 30 and 365 days, respectively. It was found that the people had been ill for one to 18 250 days. The highest number of days was for one who had asthma for 50 years. The number of days the people were ill are presented in Table 53. The number of days they were ill were used to identify some of them who were chronically ill. Being chronically ill was defined as an adult aged 15-49 years being ill for at least three consecutive months during the last 12 months that received external unpaid help in caring for the patient or replacing the lost income" (USAID/UNAIDS/UNICEF/ WHO/CDC, 2006).

Table 54: Number of days of illness

Number of days of illness	n	Min.	Max.	Mean	Std. Dev.
1st person	45	3	3 825	569.36	876.575
2nd person	42	1	18 250	839.21	2 845.197
3rd person	20	2	3 650	432.95	971.250
4th person	12	2	365	44.83	102.184
5th person	14	2	4 380	679.71	1413.990
6th person	9	1	180	39.67	61.327
7th person	3	4	62	24.33	32.655
8th person	2	7	2 555	1 281.00	1 801.708
9th person	4	2	1 825	466.00	906.082
10th person	2	3	14	8.50	7.778
11th person	1	7	7	7.00	-
All	154	-	-	548.44	1346.00

Although the respondents were not asked whether they had received external unpaid help in caring for them during their illness, it is obvious that those who were ill for at least three consecutive months had not been able to work as much as they could have worked if they had not been ill. Therefore, it is obvious that they lost some income for not working, which is in conformity with the above definition. Based on these factors, it was assumed that those who had been ill for at least 90 consecutive days were chronically ill.

4.6.5.4 Proportions of chronically ill persons

The proportions of chronically ill persons are presented in Table 55. The proportions show that the first persons (who were the household heads) were more numerous of the chronically ill persons. The 63 chronically ill people were living in 45 households. The respondents who said that some members of their households were chronically ill said that they were suffering from the diseases listed in Table 56. In accordance with literature, a household is said to be highly affected by HIV/AIDS if it has a member aged 15 to 49 years who is chronically ill for at least three months consecutively while it has lost another member due to HIV/AIDS, and it is said to be just affected by

HIV/AIDS if either it has lost a member due to AIDS or it has a member aged 15 to 49 years who is ill for 3 consecutive months (SADC and FANR, 2003; Stokes, 2003).

Table 55: Proportions (%) of chronically ill people

Chronically ill people (n = 63)	%
1st person (Household head)	46.0
2nd person	30.2
3rd person	9.5
4th person	1.6
5th person	6.3
6th person	3.2
7th person	0.0
8th person	1.6
9th person	1.6
10th person	0.0
11th person	0.0
All	100.0

The illnesses that chronically ill persons were suffering from were mentioned for only 56 of the 63 chronically ill persons and are presented in Table 56.

The data in Table 56 show that the leading diseases that the chronically ill people were suffering from were joints and body pains, stomach aches, chest/TB, asthma, fever, and headaches. Fever being among the major diseases mentioned while it is not a disease *per se* but a symptom of various diseases shows that the respondents had little knowledge of diseases.

4.6.5.5 Food security among households with different durations of illness

Food security in terms of dietary energy consumed (DEC) per adult equivalent per day was compared among three groups of households not affected by HIV/AIDS, households affected by HIV/AIDS, and households highly affected by HIV/AIDS, as defined above, using one-way analysis of variance (ANOVA) to find if there was any

significant difference in DEC among the three groups. The results are presented in Table 57.

Table 56: Diseases chronically ill individuals were suffering from

Disease (n = 56)	%
Joints/body pains	42.8
Stomach aches	10.7
Chest/TB	7.1
Asthma	5.3
Fever	5.3
Headaches	3.6
Psychiatry	3.6
Blood pressure	1.8
Deafness	1.8
Dizziness	1.8
Epilepsy	1.8
Eyes	1.8
Scrotal hernia	1.8
Madness	1.8
UTI/STI	3.6
Anaemia	1.8
Malaria	1.8
Pneumonia	1.8
Total	**100.0**

The results in Table 57 show a mixed trend whereby households highly affected by HIV/AIDS had consumed the least amount of DEC as expected, but households not affected by HIV/AIDS had consumed less DEC than those just affected by HIV/AIDS, something which was not expected. According to the mixed trend, the DEC data do not differ significantly, as shown by the p-value which is 0.334. However, the results that those affected highly had the least consumption of DEC show that the more a household is affected by HIV/AIDS, the more it is likely to have lower food security.

Moreover, an independent-samples t-test was used to compare DEC between households which had a chronically ill person and those which did not. The results

showed that the mean DEC in households with chronically ill individuals and the ones without such individuals were 1662.7 and 1948.0 kCal, respectively and that the means were not significantly different at the 5% level of significance (p = 0.191). The results also show that the mean DEC between households with "just ill" individuals and the ones without such individuals were 1669.8 and 1948.0 kcal, respectively, and that the means were not significantly different at the 5% level of significance (p = 0.134). These results show that although households with ill and chronically ill individuals were less food secure than households having no ill individual, food security did not differ significantly between the two groups.

Table 57: One-way ANOVA results comparing means of dietary energy consumed

Groups of households	n	Mean DEC	Between and within groups	Sum of squares	df	Mean square	F	Sig.
Highly affected	9	1711	Between groups	3 692 042	2	1 846 021	1.101	0.334
Affected	46	2139	Within groups	367 244 810	219	1 676 917		
Not affected	167	1833						
All	**222**	**1891**	**All**	**370 936 852**	**221**			

Since food security was measured at the household level, the number of days each household member was ill were added up into the "total number of days that household members had been ill", to measure illness at the household level. Then the numbers of days were regrouped into three groups (many, moderate, and few) to further compare DEC in the households using One-way ANOVA. The results are presented in Table 57.

The results in Table 58, like those in Table 57, show a mixed trend whereby households which had people ill for many days had consumed the least amount of DEC while households which had people ill for few days had consumed less than those which had

individuals ill for a moderate number of days. According to the mixed trend, the DEC data do not differ significantly, as shown by the p-value in Table 58, which is 0.616. However, the results that household which had individuals ill for many days had consumed the least amount of DEC shows that the more the number of days a household has ill individuals, the more it is likely to have lower food security.

Table 58: One-way ANOVA results comparing DEC per capita per day

Days of illness	n	Mean DEC	Between and within groups	Sum of Squares	df	Mean square	F	Sig.
Few	37	1607	Between groups	1 025 904	2	512 952	0.487	0.616
Moderate	23	1833	Within groups	93 804 430	89	1 053 982		
Many	32	1575						
Total	**92**	**1653**	**All**	**94 830 334**	**91**			

Further, the households were divided into five groups at the following convenient cutting points based on inclusion of reasonable numbers of households in each of the categories: first group (up to seven days), second group (eight to 30 days), third group (31 to 120 days), fourth group (121 days to three years), and fifth group (more than three years). The comparison results are summarized in Table 59.

Table 59: Multiple ANOVA comparisons of DEC based on duration of illness

Groups	n	Mean DEC	Between and within groups	Sum of Squares	df	Mean Square	F	Sig.
First	25	1 454	Between groups	7 277 357	4	1 819 339	1.808	0.135
Second	16	1 857	Within groups	87 552 977	87	1 006 356		
Third	9	1716						
Fourth	24	2 000						
Fifth group	19	1 276						
All	**92**	**1 653**		**94 830 334**	**91**			

The p-value (0.135) in Table 59 is better than the one in Table 58, albeit both show that the average amounts of DEC were not significantly different among various groups. This prompted the author to undertake multiple comparisons of the differences in the average amounts of DEC in the five groups presented in Table 59; the results are presented in Table 60. The results in Table 60 show that, with many days of illness, DEC amounts differ significantly. This is authenticated by the mean difference (723.96) between the 4th and 5th quintiles that was significant (p = 0.021).

Table 60: Multiple comparisons of the differences in mean DEC per capita

(I) Five groups of days of illness (n=92)	(J) Five groups of days of illness	Mean Difference (I-J)	Sig.
1st group (Fewest days of illness)	2nd group	-403.20	0.213
	3rd group	-261.34	0.523
	4th group	-545.78	0.060
	5th group	178.17	0.561
2nd group	1st group	403.20	0.213
	3rd group	141.85	0.745
	4th group	-142.58	0.661
	5th group	581.37	0.091
3rd group	1st group	261.34	0.523
	2nd group	-141.85	0.745
	4th group	-284.44	0.489
	5th group	439.52	0.301
4th group	1st group	545.78	0.060
	2nd group	142.58	0.661
	3rd group	284.44	0.489
	5th group	723.96(*)	0.021
5th group (Most days of illness)	1st group	-178.17	0.561
	2nd group	-581.37	0.091
	3rd group	-439.52	0.301
	4th group	-723.955(*)	0.021

* The mean difference is significant at the 5% level of significance.

4.6.5.6 Illnesses and their effects on food security

The respondents were asked to rank diseases that were the most problematic in their villages. The numbers of times various diseases were mentioned were recorded with intent to find the ten most problematic diseases and whether HIV/AIDS and opportunistic infections (OIs) associated with it were problematic. The frequencies are summarized in Table 61. As expected, malaria was the most problematic disease.

Table 61: Problematic diseases in the research area

Disease/Infection (n = 489)	%
Malaria	25.6
Fever	13.9
Headache	11.3
Joints pains	11.2
Chest/coughing	9.2
Stomach-aches	8.8
Eyes	5.1
Diarrhoea	3.3
Asthma	2.5
TB	1.4
Tooth aches	1.4
Scrotal hernia	1.4
Blood pressure	1.0
UTI/Bladder pains	0.6
Skin rushes	0.6
Pneumonia	0.6
Peptic ulcers	0.4
Diabetes	0.2
Paralysis	0.2
Madness	0.2
Typhoid fever	0.2
Convulsions	0.2
Anaemia	0.2
Witchcraft	0.2
Herpes zoster	0.2
Total	**100.0**

The overall number of times various diseases/infections were mentioned was 489, as seen in Table 61. The commonest 10 diseases/illnesses, according to having been mentioned more than the other diseases, were malaria, fever, headache, joints pains,

chest/coughing, stomach-aches, eyes, diarrhoea, asthma, and tuberculosis. However, since fever and headache that are in the list are symptoms of malaria, which is also in the list, tooth-aches and hernia may be included in the list of the 10 commonest diseases. The data in Table 61 show that some HIV/AIDS opportunistic diseases were common, notably tuberculosis (TB), skin rushes, Herpes Zoster, chest diseases, and pneumonia. This further attests to HIV/AIDS presence in the research area.

The analysis of diseases did not end up there; besides, the respondents were asked if any illness had had any impact on food production. Forty out of the 225 respondents responded positively and mentioned the diseases that were responsible for lowering food production in their households. The diseases that were said to have caused low food production are the ones listed in Table 62.

Table 62: Diseases that contributed to lowering agriculture

Disease (n = 40)	%
Malaria	22.5
TB	15.0
Joints pains	12.5
Stomach aches	10.0
Chest/coughing	5.0
UTI/Urinary bladder infection	5.0
Diarrhoea	5.0
Paralysis	5.0
Hernia	5.0
Fever	2.5
Headache	2.5
Asthma	2.5
Diabetes	2.5
Blindness	2.5
Bad spits	2.5
Total	**100.0**

Those who said that diseases had caused reduction in their agricultural production were asked a number of questions aimed at gauging the extent to which the diseases had affected food production. Their responses are discussed below.

In the households where illness had affected agricultural production, the time duration for which household members were ill were two to 18 250 days (i.e. 50 years) while the average was 713.1 days. Based on the definition of chronic illness given above (Sub-section 4.6.5.3), 45.0% of the ill individuals had been chronically ill. The respondents said that illness had affected agricultural production in their households in the ways summarised in Table 63. The results in the table show that less cultivation was the most important adverse effect on agricultural production. This is partly because illness constrains labour use and makes people spend cash on treatment in lieu using it to buy agricultural inputs or pay labourers on farm.

Table 63: Ways in which illnesses affected agricultural production

Effect (n = 40)	%
Less cultivation	57.5
Using much time to care for the sick	45.0
Buying medicines not agricultural inputs	30.0
Less harvest	10.0
No cultivation at all	2.5
Buying special food for the sick not agricultural inputs	2.5

The estimated amounts of acreage; agricultural costs (cash capital); family members who participated in agriculture; hours that were spent on agriculture; and maize, rice, cassava and cashew nuts that were harvested in spite of illnesses were recorded, and are presented in Table 64 vis-à-vis the amounts that would have been realised if no household member had been ill.

Table 64: Levels of various agricultural factors with and without illness

Agricultural factors	n	Mean		
		Affected	Not affected	All
Acreage despite illness	30	1.83	2.17	2.07
Acreage if illness was not there	30	2.78	3.12	3.03
Agricultural costs despite illness	26	16 977.78	24 117.65	21 646.15
Agricultural costs if illness was not there	26	40 888.89	39 858.82	40 215.38
Family members participated in agriculture	31	1.90	1.86	1.87
Family members that would have participated	31	2.70	3.10	2.97
Hours spent on agriculture despite illness	29	7.70	4.47	5.59
Hours that would have been spent	29	10.00	7.24	8.19
Maize harvested despite illness	28	40.88	67.45	59.86
Maize that would have been harvested	28	159.75	156.40	157.36
Rice harvested despite illness	29	115.00	98.75	103.79
Rice that would have been harvested	29	537.56	218.00	317.17
Cassava harvested despite illness	24	190.86	398.47	337.92
Cassava that would have been harvested	22	467.57	734.40	649.50
Cashew nuts harvested despite illness	15	51.75	6.55	18.60
Cashew nuts that would have been harvested	15	254.75	93.45	136.47

A step was taken forward to analyse percentage changes in the agricultural factors presented in Table 64 by subtracting the amounts that would have been attained if there had not been illness from those attained in spite of illness, dividing the answer by the former and expressing it as a percentage. The results; albeit they are descriptive, not inferential; show that illnesses caused a lot of decline in agricultural production. For example, acreage declined by 37.3%, family labour decreased by 38.2%, and hours spent on agriculture decreased by 40.1%, as seen in Table 65.

Besides the descriptive data presented in Table 65, which show that there was much decrease in various indicators of agricultural production, something which shows that illness had affected agricultural production substantially, the amounts of various variables presented in Table 65 were compared using paired-samples t-test, and the results are presented in Table 66. The results in Table 66 show that there were significant differences in actually realised and the would-be-values of various indicators of agricultural production.

Table 65: Changes in various agricultural factors due to illness

Some agricultural production indicators	n	Mean change		
		Affected	Not affected	All
Change in acreage due to illness	30	-0.9	-0.9	-0.9
Chang in agricultural costs due to illness	26	-23 911.1	-15 741.2	-18 569.2
Change in family labour due to illness	31	-0.8	-1.2	-1.1
Change in hours spent on agric	29	-2.3	-2.7	-2.6
Change in maize harvested due to illness	27	-118.9	-104.2	-108.5
Change in rice harvested due to illness	28	-422.6	-149.2	-237.1
Change in cassava harvested due to illness	22	-276.7	-336.1	-317.2
Change in cashew nuts harvested due to illness	15	-203.0	-86.9	-117.9
% change in acreage due to illness	29	-40.87	-35.7	-37.3
% change in costs on agric due to illness	19	-70.378	136.5	71.2
% change in family labour due to illness	31	-33.33	-40.5	-38.2
% change in hours spent on agriculture	26	-37.04	-41.7	-40.1
% change in maize harvested due to illness	24	-79.13	-68.5	-71.6
% change in rice harvested due to illness	20	-87.18	-71.7	-77.1
% change in cassava harvested due to illness	20	-52.14	-57.9	-55.9
% change in cashewnuts harvested due to illness	11	-60.05	-83.4	-77.0

Table 66: t-test results comparing various agricultural factors with and without illness

Some agricultural production indicators	Affected		Not affected		All	
	t	Sig. (2-tailed)	t	Sig. (2-tailed)	t	Sig. (2-tailed)
Acreage despite illness Acreage if illness was not there	-3.213	0.012	-3.173	0.005	-4.222	0.000
Costs on agriculture despite illness Costs if illness was not there	-2.054	0.074	-1.717	0.105	-2.605	0.015
Members participated despite illness Members that would have participated	-2.228	0.053	-5.701	0.000	-5.848	0.000
Hours spent despite illness Hours that would have been spent	-2.863	0.019	-3.058	0.007	-4.031	0.000
Maize harvested despite illness Maize that would have been harvested	-2.904	0.023	-3.706	0.002	-4.757	0.000
Rice harvested despite illness Rice that would have been harvested	-1.430	0.191	-2.636	0.017	-2.328	0.028
Cassava harvested despite illness Cassava that would have been harvested	-2.124	0.078	-2.718	0.017	-3.435	0.002

4.6.6 Entitlements and food security

4.6.6.1 Indicators of entitlements

Entitlements, which are defined by Sen (1981) and Leach *et al.* (1999) as seen in Sub-section 2.3.5.2 (c), contribute substantially to food security if they are favourable, and

vice versa. Therefore, since no research had been done to determine the role of entitlements in food security in Rufiji District, in this research the extent to which lack of entitlements explains food insecurity was determined by ranking indicators of entitlement vis-à-vis those of Malthusians', Anti-Malthusians', and Woldemeskel's contentions with regard to their effect on food security. The Malthusian and Anti-Malthusian theories as well as Woldemeskel's contentions have been reviewed in Sub-section 2.3.5.2, and their indicators that are summarized in Table 8 and described thereafter are used in this research.

4.6.6.2 Qualitative influence of entitlements on food security

The research involved a qualitative assessment of experiences of households which had had food shortage any time during the 2005/06 agricultural season. While the sample had 225 households, only households whose respondents said that their households had experienced food shortage (172) were involved in the qualitative assessment. However, 10 of the 172 households did not respond to all of the questions aimed at gauging the extents. Therefore, 162 households took part in the assessment through a pair-wise ranking exercise that was based on the tool presented in Table 67. These were the ones which, according to their knowledge of their own households, had experienced food shortage, and were willing to respond to the questions to gauge the extents. The major issues of contention in Malthus's, Anti-Malthus's, Sen's and Woldemeskel's presentations that are given in Table 67 were first clarified to the respondents.

Table 67: A pair-wise ranking tool used to rank entitlements

	1. Large household size	2. Poor agricultural technologies	3. Lack of entitlements	4. Low food availability in the market	5. High food prices in the market	6. Unfavourable institutional factors
1. Large household size						
2. Poor agricultural technologies						
3. Lack of entitlements						
4. Low food availability in the market						
5. High food prices in the market						
6. Unfavourable institutional factors						

In the study, six statements were used to compose 15 questions on which of the two items of a pair had been a bigger cause of food shortage in a household. One of the questions was: "Between large household size and poor agricultural technologies, what was a bigger cause of food shortage in your household?" The pairs for the 15 questions were: (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 3), (2, 4), (2, 5) , (2,6), (3, 4), (3, 5),(3, 6), (4, 5), (4, 6), and (5, 6). The above question belonged to the (1, 2) pair.

Each of the six contentious factors had equal chances of scoring zero to five times for every respondent. For example, large household size had the possibility of scoring and appearing in all the un-shaded cells in the second row; bad institutional factors had the possibility of appearing in all the un-shaded cells of the last column; and lack of entitlements had the possibility of appearing thrice in the fourth row and twice in the fourth column. For every household, the table was filled up with 15 choices in the 15 un-shaded cells. Since the respondents were 162, the maximum number of times each of the six contentious factors had the possibility of being chosen was 810 (that is 5 chances times 162). The data in Table 67 summarise the number of times each of the contentious

factors was chosen in the whole group of 162 respondents. Using 810 as the denominator and expressing the scores of each contentious factor as a percentage, the extents to which each of the factors was perceived to have contributed to food shortage is given in Table 68.

Table 68: Extents to which the contentious factors contributed to food shortage

Statistics	House hold size	Use of poor technology	Lack of entitlements	Low food supply in market	High prices of food	Institutional factors	Total
Mean scores out of 5	1.3	3.8	2.3	1.4	3.7	2.6	15
Mean scores out of 810	205.0	613.0	378.0	218.0	599.0	417.0	2430
Mean % scores	8.0	25.0	16.0	9.0	25.0	17.0	100

Therefore, from the results in Table 68 the major factors that were perceived to have contributed to food shortage were use of poor technology, high food prices in the market, institutional factors, and lack of entitlements. Large household size and supply of foodstuffs were minor causes of food shortage. The qualitative assessment was used as a preliminary look at the factors and their causes of food shortage; more empirical analysis was done using Pearson's moment correlation to compare the levels of correlation and significance between factors reflecting the above 6 contentious factors and food security in terms of dietary energy consumed per capita per day, which are given in the following paragraphs.

In order to assess the correlation between the six contentious issues and food security, each of them was represented by an indicator or a number of indicators measurable in continuous numbers (at the ratio level) using variables that were deemed the most explanatory ones, which are indicated in Table 69.

4.6.6.3 Descriptive statistics

Descriptive statistics of the indicators of theoretical determinants of food insecurity are summarised in Table 69.

Table 69: Descriptive statistics of the variables used

Variables	n	Min.	Max.	Mean
Household size	225	1.00	11.00	5.28
Overall scores on use of technologies	31	1.00	2.00	1.16
Extent to which low food supply in market caused food shortage	162	0.00	4.00	1.35
Acreage in hectares per capita	174	0.02	2.02	0.28
Cash spent on maize and rice per capita per day	225	5.75	740.50	103.10
Number of chickens owned per capita	110	0.14	13.00	1.89
Maize and rice received from relatives per capita	108	0.00	222.75	5.12
Extent to which high prices of food caused food shortage	162	0.00	5.00	3.70

The maximum possible scores for technologies, food supply in market places, and prices of food in market places were 5 in each case. The numbers were not categorical; they were interval/ratio measurements. For technologies the scores represented the numbers of technologies used. The number of households using the five types of technologies (Irrigation, tillage mechanisation, use of improved seeds, use of fertilisers, and use of pesticides) in the research was found. The results in Tables 69 and 70 show that only 31 households had used at least one of the five types of technologies and that the highest number of technologies used in a household was two, which is very low!

4.6.6.4 Correlation between food security and some theoretical factors

Using the indicators of various contentious issues affecting food security listed in Table 8 to correlate each of them with the dependent variable (Dietary energy consumed per capita per day), the correlation coefficients and their concomitant levels of significance are presented in Table 70. Besides, the correlation coefficients are used in Fig. 11.

Table 70: Correlation between theoretical factors and dietary energy consumed

Category of theoretical factors	Independent variables	(r-value)	p-value
Population	Household size (n= 225)	- 0.388(***)	0.000
Technology	Scores on use of technologies (n=31)	+0.198 (ns)	0.143
Food supply	Extent to which low food supply in market caused food shortage (n= 162)	- 0.071 (ns)	0.186
Entitlement	Acreage in hectares per capita (n=174)	+0.324 (***)	0.000
Entitlement	Cash spent on maize and rice per capita per day (n= 225)	+0.803 (***)	0.000
Entitlement	Number of chickens owned per capita (n= 110)	+ 0.148 (ns)	0.061
Institutions	Maize and rice received freely and eaten per capita per day (n = 108)	+0.462 (***)	0.000
Markets	Extent to which high prices of food caused food shortage (n= 162)	- 0.009 (ns)	0.545

*** Correlation is significant at the 0.01 level (1-tailed)
ns Correlation is not significant

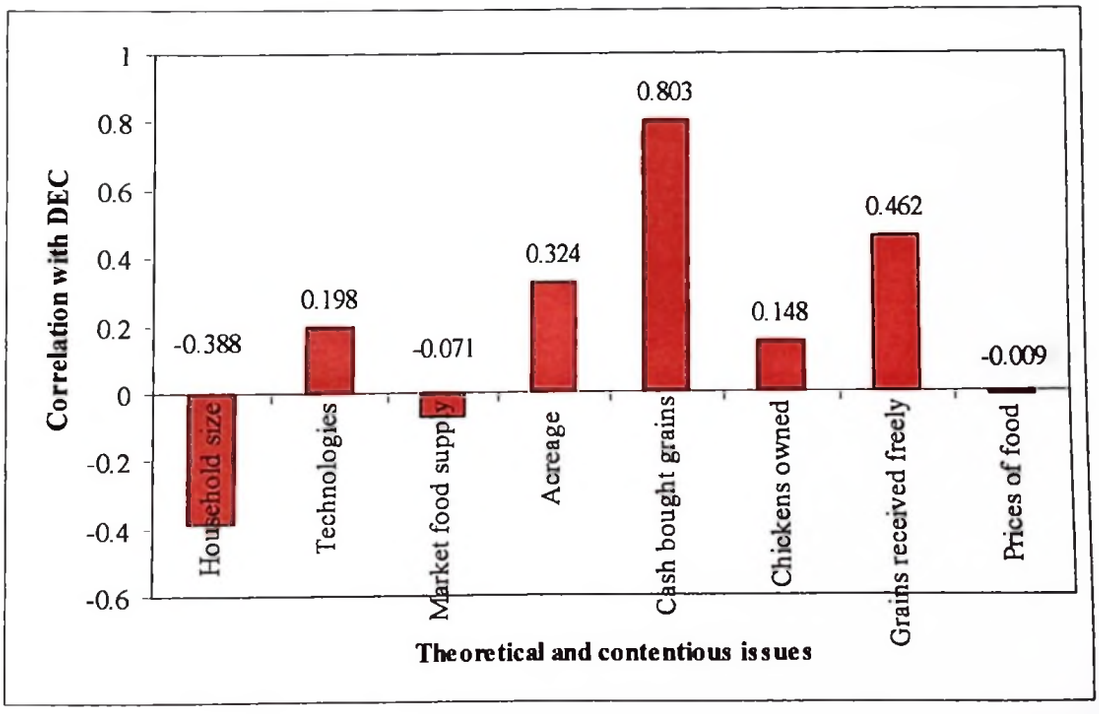

Figure 11: Associations between theoretical issues and food security

According to Cohen and Holliday (1982), cited by Bryman and Cramer (1992), correlation coefficients (regardless of positive or negative signs) are interpreted as follows: below 0.19 is very low, 0.20 to 0.39 is low, 0.40 to 0.69 is modest, 0.70 to 0.89

is high and 0.90 to 1.00 is very high. The correlation results in Table 69 show that, of the six theoretical factors causing food insecurity, the most explanatory one was entitlement to food. The correlation coefficient between entitlement in terms of cash spent on buying maize and rice, which are the most important staple foods in the research area, was high (the highest of all the theoretical factors) ($r = +0.803$), and it was significant at the 0.1% level of significance ($p = 0.000$). Moreover, the correlation coefficient between entitlement in terms of land cultivated for maize and rice production was positive and significant ($r = +0.324$; $p=0.000$).

Cash spent on buying grains being highly positively correlated with food security was due to the facts that buying food was a common source of food and all the households were buying some grains. This means that one with more purchasing power was more food secure than others with less purchasing power. The results support Sen's (1981) arguments that food security is mainly explained by entitlements, as described in Sub-section 2.3.5.2(c). The correlation between acreage and food security being positive and significant was due to the fact that more than three-fourths (77%) of the households in the sample were dependent on food production for their food security.

Household size was negatively correlated with food security, and the correlation was significant ($r = - 0.388$; $p = 0.000$). This result is in conformity with Neo-Malthusian contention that population increase has negative influence on food security. However, some previous researches elsewhere in Tanzania have shown positive correlation between household size and food security/poverty. For example, Kayunze (2000) found this in Mbeya Region, and Kamuzora (2001) found less poverty in larger households in Kagera Region. In both cases the plausible explanation for the findings was that it happens more where households have more labour force in terms of a bigger proportion

of adult members who work either on farm or otherwise. Kayunze (2000) argues that in households with higher dependency ratios or where households depend on one or a few members who are working, the bigger the household size the less the food security. This view is partly shared by Kamuzora (2001) who argues that in Africa less poverty with large household size is common in less developed countries and that in more developed African countries like South Africa, there is less poverty with smaller household size.

During Participatory Rural Appraisal (PRA) exercises that were undertaken as part of this study, there were complaints among PRA participants that most men and young people (both male and female) tend to dodge agricultural activities. This is confirmed by the results in Table 51, which shows that the numbers of hours that men, young men and young women participated in agricultural activities were less than those that adult women did the same activities. As a result, there was shortage of agricultural labour because agriculture was being done more by older women. This partly explains the significant negative association between household size and food security in the district.

Technology in the sample was positively associated with food security. This supports Boserup's (1993) contention that technological development can boost food production enough to keep up with high population. However, the correlation was not significant, not because Boserup's contention was not strong but because in the sample very few of the households had used appropriate technologies. The extent to which low food supply in market places caused food shortage and the extent to which high prices of food caused food shortage were both negatively associated with food security. Although the correlations were not significant, they support Woldemeskel's (1990) contention that market forces affect food security. The correlation coefficients (r) being -0.071 ($p = 0.186$) and -0.009 ($p = 0.545$) for low food supply in market places and high prices of

food in the market places respectively (Table 70) means that the former was more negatively associated with food security than the latter.

The finding that grains received freely and eaten had positive correlation (r = +0.462), which was significant at the 0.1% level of significance (p = 0.000), with food security, while the grains were a proxy indicator of institutions in terms of customs, means that institutions were very effective in increasing food security. This result highly supports Woldemeskel's (1990) contention that institutional elements are important for food security. In this research the only indicator of institutions, but the main one in the research area, was used. If more indicators of institutions had been used probably more significant association would have been found.

4.6.6.5 Levels of the factors analysed

In the analysis above, the levels of various factors analysed were given in general terms, e.g. households using technologies were few. Such generalisation is not very informative. Therefore, in this section, elaboration is given in terms of the levels of the factors analysed, with some comparisons between the research area and other places in Tanzania. To start with, major pertinent factors are summarised in Table 71.

The average household size in the whole sample of 225 was 5.3 while it was 5.4 in the 172 households which had had food shortage but 4.8 in the 53 households which said they had not had food shortage. In the whole sample, 55% of the households had at most 5 members. This was so for 52% of the households which had had food shortage and 66% for those which had not had food shortage. Although the largest household had 11 members, overall the household size was not very much; the average household size in Tanzania is 4.9 (URT, 2003), but some districts have much larger households.

Table 71: Households which used various agricultural technologies

Technology	Used the technology		Didn't use the technology	
	Number	%	Number	%
Practised irrigated farming	5	2.2	220	97.8
Used a tractor to till land for maize production	1	0.7	140	99.3
Used a tractor to till land for rice production	3	3.1	93	96.9
Used improved maize seeds	14	9.9	127	90.1
Used improved rice seeds	0	0.0	96	100.0
Used inorganic fertilizers on maize	1	0.7	129	91.5
Used organic fertilizer on maize	11	7.8	129	91.5
Used inorganic fertilizers on rice	1	1.0	87	90.6
Used organic fertilizer on rice	8	8.3	87	90.6
Used pesticides on maize	3	2.1	138	97.9
Used of pesticides on rice	3	3.1	93	96.9

*Those who produced maize were 141
**Those who produced rice were 96

With regard to technology, only 31 households out of the sample of 225 having reported that they had used at least one of the five agricultural technologies considered in the research shows that the use of agricultural technologies was extremely low. This makes it easy to realise why during pair-wise ranking non-use of agricultural technologies was ranked as the biggest factor affecting food security. Unlike in some other places of Tanzania where oxen and ox-ploughs are used to till land, this technology is not used in Rufiji District. Therefore, most farmers rely on the hand hoe using their household labour and/or hired labour. In the sample, 85.8% of the households used their own labour to till land for maize production using hand hoes and 13.5% used other means to till land for maize production. The other means included zero tillage and use of manual labourers. For rice land tillage, 80.2% of the households that grew the crop used their own labour to till the land using the hand hoe and 16.7% used manual labourers.

Comparing the levels of agricultural technologies use in Rufiji with figures of use of the same technologies in other districts in Tanzania reveals that Rufiji District lags far behind other districts. For example, Isinika *et al.* (2005) found that in Iringa and

Morogoro regions 82% of households used local maize seeds in 2002 (unlike 90.1% in Rufiji District in 2005/06); 26% of households used chemical fertilizers on maize, (unlike 0.7% in Rufiji in 2005/06; 39% used pesticides (unlike 2.1% in Rufiji District), and 13% of rice growers used improved rice seeds in 2002 but no one used such seeds in a sample of 96 rice growers in this study in Rufiji District.

Livestock ownership is a good entitlement for gaining access to food since livestock and their products are sold to get cash to buy food. Therefore, ownership of livestock was assessed in the research area. It was found that the only important livestock species was chicken. Chickens were owned by 48.9% of the households while only eight households 3.6% owned sheep, 1.8% owned goats and none of them owned cattle in 2006. The above proportion of households owning chickens obtained quantitatively was much lower than that estimated during PRA (95%). One of the reasons for the difference might be fluctuation in the number of chickens which changes seasonally.

4.6.7 Food security and traditional celebrations

The Local Government of Rufiji District was concerned that traditional celebrations were too many and they were impinging negatively on food security. Therefore, it had formulated a by-law that anyone wanting to do such a ceremony should first pay a fee to the government. Partly, this was aimed at discouraging the celebrations lest they contribute much to food insecurity. In spite of the fee, the traditional celebrations were being done as usual. For example, forty out of the 225 households had such celebrations between 1 July 2005 and 30 June 2006 and used food on the celebrations.

The leading celebrations were banquets whereby people who are happy with their success economically prepare much delicious food and drinks and invite their

neighbours to eat and drink free of charge. Religiously, this is believed to increase blessing from the Almighty God to the persons who have been kind in that way to their neighbours and relatives and enables them to get more wealth. Other major events were celebrating daughters' attainment of sexual maturity and sons' circumcision. The celebrations were linked to both HIV/AIDS transmission risk and food insecurity. They were risky for HIV transmission since they were being done for a number of days, day and night, bringing various people together hence encouraging sexual activities. They were potential for food insecurity since much of the food harvested was being consumed in a short time. The types of the celebrations that had been held are listed in Table 72.

Table 72: Types of traditional celebrations held

Type of celebration (n = 40)	%
Banquet	40.0
Sons' circumcision	25.0
Daughters' attainment of sexual maturity	17.5
Bad spirits	7.5
Daughters' and sons' attainment of sexual maturity and circumcision respectively and Banquet	2.5
Sons' circumcision and Banquet	2.5
Daughters' attainment of sexual maturity and sons' circumcision	2.5
Daughters' attainment of sexual maturity and banquet	2.5
Total	**100.0**

The amounts of grains spent on the celebrations per household are given in Table 73. The results show that on average 59.77 kg of grains had been consumed during such celebrations. However, in some households the amounts of grains consumed during traditional celebrations were not reported. The amounts of grains used on traditional celebrations that are considerable imply that such celebrations can contribute to food insecurity.

Table 73: Amounts of grains used on traditional celebrations

Foodstuffs consumed during traditional celebrations (n = 40)	Statistics				
	n	mean	Std. Dev.	Min.	Max.
Bad spirits	1	19.00	-	19	19
Daughters' sexual maturity	6	53.00	46.15	15.00	139.00
Sons' circumcision	14	22.18	24.53	0.00	62.00
Banquets	11	59.77	49.12	5.00	170.00
Traditional dances	44	29.66	58.16	0.00	359.00

4.6.8 Deaths not due to AIDS and food security

The respondents were asked if any members of their households had passed away between 1 January 2003 and 31 December 2006 and what they thought were the causes of the deaths. This was aimed at capturing deaths due to non-AIDS causes; deaths due to AIDS were already known from the database of Rufiji DSS. It was already known that 50 households had lost household members due to AIDS. More 27 deaths not due to AIDS were reported, and their thought causes are presented in Table 74.

The data in Table 74 show that in the households not affected by HIV/AIDS deaths were not due to AIDS. Although tuberculosis that is among the causes of death in Table 74 is an opportunistic infection for AIDS, it is not always associated with HIV/AIDS, and identification of opportunistic infections was too subjective to use, especially because the author had no medical expertise. Comparing food security in terms of the amounts of dietary energy consumed (DEC) using one-way ANOVA in households where there was death due to AIDS, death due to non-AIDS causes and no death revealed that they were not significantly different ($p= 0.078$).

Table 74: Non-AIDS causes of death

Cause (n = 27)	Frequency	%
Tuberculosis	5	18.5
Malaria	4	14.8
Multiple infections (Diarrhoea, malaria and anaemia)	3	11.1
Diarrhoea	2	7.4
Paralysis	1	3.7
Being stabbed with a knife	1	3.7
Road accident	1	3.7
Urinary bladder	1	3.7
Diabetes	1	3.7
Swelling legs and arms	1	3.7
Stroke	1	3.7
Jaundice	1	3.7
Hernia	1	3.7
Pneumonia	1	3.7
Swelling the stomach	1	3.7
Spinal cord aches	1	3.7
Kwashiorkor	1	3.7
Total	**27**	**100.0**

4.6.9 Linkage between food security and non-HIV/AIDS factors

Since some researchers contend that it is difficult to disentangle the impact of HIV/AIDS from the impact of other causes (for example Bannett *et al.*, 1995) and others criticize researchers for describing the impact of HIV/AIDS on food security rather than quantifying it (for example Scicchitano and Whitlock 2002), in this research efforts were made to separate effects of HIV/AIDS and those of non-HIV/AIDS factors on food security, using the variables listed in Table 75. The results in Table 75, which are about differences in food security in terms of kilocalories consumed per adult equivalent per day based on differences in non-HIV/AIDS factors, show that food security was significantly different in households with different non-HIV/AIDS factors. The more food secure households were those which had fewer than five members ($p = 0.000$); those where at least TSh 100 000 per capita per year had been spent on buying food ($p = 0.000$) and those with dependency ratio less than 100 ($p = 0.006$).

4.6.10 Disentangling effects of AIDS from those of other factors on food insecurity

The disentanglement (separation) of effects of HIV/AIDS and of other factors on food insecurity was done qualitatively and quantitatively, as discussed in Sub-sections 4.6.10.1 and 4.6.10.2.

Table 75: Differences in food security based on some non-HIV/AIDS factors

Variables	n	Mean kCal eaten per adult per day	t-value	Sig. (2-tailed)
Maize and rice acreage >=0.10 ha per adult	128	1 938.30	0.591	0.555
Maize and rice acreage < 0.10 ha per adult	97	1 835.77		
Years of schooling of household head >= 5	96	1 977.55	0.838	0.403
Years of schooling of household head < 5	129	1 832.00		
Household size >= 5	130	1 608.84	-4.016***	0.000
Household size < 5	95	2 284.45		
Adjusted Adult Equivalent Units >= 3.00	136	1 641.96	-3.734***	0.000
Adjusted Adult Equivalent Units < 3.00	89	2 279.39		
Dependency ratio >= 100	135	1 666.04	-2.979*	0.003
Dependency ratio < 100	80	2 190.18		
Owning land elsewhere from home	96	1 933.06	0.391	0.696
Not owning land elsewhere from home	129	1 865.10		
At least TSh 100 000 spent on food per adult	137	2 386.35	8.207***	0.000
Less than TSh 100 000 spent on food per adult	86	1 105.05		
Having received food freely	159	1 894.88	0.014	0.989
Having not received food freely	66	1 892.21		
Crop production being the main activity	165	1 834.39	-1.154	0.250
Crop production not being crop production	60	2 058.29		

* Significantly different at the 5% level; *** Significantly different at the 0.1% level

4.6.10.1 Qualitative disentanglement of AIDS and non-AIDS determinants

Qualitative disentanglement of AIDS and non-AIDS determinants was done by taking factors affecting agricultural production as stated by participants in Participatory Rural Appraisal (PRA) and ranking them alongside indicators of HIV/AIDS to find out the extents to which each of the factors was said to have contributed to food shortage. Ranking in order to disentangle AIDS-related and non-AIDS causes of food insecurity was done using 16 factors (Table 75) identified during PRA to be the major stumbling blocks to food security in the research area. The factors were compared by pair-wise ranking, with intent to determine the extent to which non-HIV/AIDS were said to have

led to food insecurity vis-à-vis HIV/AIDS. Although the respondents were 225, complete information to fill in the tool displayed in Table 75 was available from only 135 respondents. The respondents were asked about the 16 factors in pairs, each time asking them to state which of the two was a more serious snag to food security attainment than the other one in their village. The maximum possible number of times each of the 16 factors could be mentioned by one respondent would have been 15. The maximum number of responses every respondent could give was 120 for all the items. Since the respondents were 135 for this pair-wise ranking, it means that the maximum number of responses that were actually given by all the 135 respondents was 120 x 135, which is 16 200. This was made the denominator for gauging the extent to which each of the factors was thought to contribute to food shortage. Among households affected by HIV/AIDS, 31 out of 50 responded to the 16 questions. Therefore, for them the denominator was 31 x 120, which is 3720. Among households not affected by HIV/AIDS, 104 out of 175 responded to the 16 items for gauging the extents to which the factors were thought to contribute to food shortage. Therefore, for them the denominator was 120 x 104, which is 12 480.

During the research, the sixteen statements were used to compose 120 questions on which of the two items of a pair had been a bigger cause of food shortage in a household. One of the questions was: "Between illness of a household member and use of the hand hoe, which is a bigger cause of food shortage in your village?" The pairs for the 120 questions were: (1, 2), (1, 3), (1, 4), ..., (1, 16); then (2, 3), (2, 4), (2, 5), and so on. The above question belonged to the (1, 2) pair. The results obtained using the tool presented in Table 76 are given in Table 77.

Table 76: A pair-wise ranking tool used to rank causes of food insecurity

	1. Illness	2. Hand hoe	3. Rainfall	4. Irrigation	5. Extension advice	6. Tractor	7. Fertilizer	8. Pests and diseases	9. Rodents	10. Seeds	11. Weeding	12. Travelling	13. Crop stealing	14. Death	15. Calamities	16. Cash capital
1. Illness																
2. Hand hoe																
3. Rainfall																
4. Irrigation																
5. Extension																
6. Tractor																
7. Fertilizer																
8. Pests and diseases																
9. Rodents																
10. Seeds																
11. Weeding																
12. Travelling																
13. Crop stealing																
13. Death																
15. Calamities																
16. Cash capital																

Table 77: Extents to which various factors were perceived to contribute to food shortage

Factor (n = 135)	Extent to which the factors had contributed to food shortage					
	Affected by HIV/AIDS (n=31)		Not affected by HIV/AIDS (n=104)		All (n=135)	
	Extent out of 3 720	Extent (%)	Extent out of 12 480	Extent (%)	Extent out of 16 200	Extent (%)
Use of hand hoe	354	9.5	1199	9.6	1553	9.6
Using local maize and rice seeds	330	8.9	1138	9.1	1468	9.1
Crop pests and diseases	311	8.4	1047	8.4	1358	8.4
Lack of extension advice	304	8.2	1018	8.1	1322	8.2
Little rainfall	298	8.0	1018	8.2	1316	8.1
Lack of cash to buy pesticides	280	7.5	1025	8.2	1305	8.1
Inability to hire a tractor	275	7.4	974	7.8	1249	7.7
Rodents	289	7.8	882	7.1	1171	7.2
Illness	248	6.7	759	6.1	1007	6.2
Failure to irrigate	191	5.1	805	6.5	996	6.1
Untimely weeding	205	5.5	762	6.1	967	6.0
Lack of cash to buy fertilizer	169	4.5	512	4.1	681	4.2
Crop stealth in farm	133	3.6	474	3.8	607	3.7
Death of a family member	165	4.4	321	2.6	486	3.0
Family members' travelling	107	2.9	362	2.9	469	2.9
Floods/fire	61	1.6	184	1.4	245	1.5
Total	**3 720**	**100.0**	**12 480**	**100.0**	**16 200**	**100.0**

On the basis of the results in Table 77, the five biggest causes of food insecurity were: (a) use of the hand hoe for land tillage; (b) not using improved seeds; (c) crop pests and diseases; (d) poor agricultural extension services and (e) low cash capital. Direct determination of the extents to which HIV/AIDS and non-HIV/AIDS factors contributed to lowering food security was difficult because, the pandemic being so sensitive an issue in the area, the interest of the research in HIV/AIDS was not disclosed to the respondents, except during PRA.

On the basis of the results in Table 77 which show that deaths and illnesses accounted for 9.2%, it can be argued that HIV/AIDS contributed at most 9.2% to lowering food security while non-HIV/AIDS factors contributed 90.8%. However, since not all the illnesses and deaths were due to HIV/AIDS, the contribution of HIV/AIDS to lowering food production is less than the 9.2% figure reported above. The data also show that the extent to which illness of household members was thought to contribute to food shortage by households affected by HIV/AIDS (6.7%) was larger than that thought of by households not affected by AIDS (6.1%). Moreover, the extent to which death of a household member was thought to cause food shortage by households affected by AIDS (4.4%) was higher than that among households not affected by HIV/AIDS (2.6%).

4.6.10.2 Quantitative disentanglement of AIDS and non-AIDS determinants

In order to determine the effects of death of some household members due to AIDS and not due to AIDS, the amounts of various indicators of agricultural production were compared before and after death of a household member. The results are presented in Table 78.

Table 78: t-test results for some agricultural production indicators with AIDS and non-AIDS causes

Pairs of variables compared	Where death was due to AIDS				Where death was not due to AIDS			
	Mean	n	t	Sig. (2-tailed)	Mean	n	t	Sig.(2-tailed)
Acreage one season before death	3.0	16	1.620	0.126	2.7	23	0.000	1.000
Acreage in 2005/06	2.5	16			2.7	23		
Cash agricultural capital before the death	68542.0	12	2.201	0.050	33 605.8	19	-0.249	0.806
Cash agricultural capital in 2005/06	48416.7	12			35 774.3	19		
Hours spent on agriculture before death	6.6	14	1.014	0.329	6.7	20	1.348	0.194
Hours spent on agriculture in 2005/06	6.0	14			5.5	20		
Agricultural labourers before death	3.8	15	1.417	0.178	5.1	21	1.031	0.315
Agricultural labourers in 2005/06	3.3	15			4.4	21		
Maize harvested before death	189.8	12	-0.374	0.715	303.5	20	0.986	0.336
Maize harvested in 2005/06	283.2	12			148.0	20		
Rice harvested before death	245.2	12	-0.983	0.347	590.8	18	1.494	0.154
Rice harvested in 2005/06	3057.4	12			284.8	18		
Cassava harvested before death	659.6	8	1.890	0.101	161.7	12	0.985	0.346
Cassava harvested in 2005/06	412.50	8			135.3	12		
Cashew nuts harvested before death	70.8	5	0.026	0.981	128.0	8	-1.050	0.329
Cashew nuts harvested in 2005/06	70.0	5			349.8	8		

The results in Table 78 show that decrease in acreage after death of a household member due to AIDS was considerable while there was no change in acreage where death was due to non-AIDS causes. The results also show that cash capital used on

agriculture declined significantly ($p = 0.050$) after a household member died due to AIDS while the change in agricultural capital was insignificant ($p = 0.806$) after a household member died due to non-AIDS causes. Moreover, the data show that the amount of cassava produced decreased substantially in households where death of a household member had been due to AIDS but the production of the same crop decreased little in households where death of a household member had occurred due to non-AIDS causes. Overall, the results show that death due to AIDS had more adverse impact on food production which is substantiated by the three scenarios just described.

4.7 The Odds and Odds Ratios of Households Being Food Secure

Odds means chances, probability or likelihood of an event occurring. The chances of the event of being food secure occurring in households affected by HIV/AIDS and in those not affected by HIV/AIDS, which was the concern of the third hypothesis of this research, were determined using binary logistic regression.

4.7.1 Justification for using binary logistic regression

Binary logistic regression, which is also called binomial logistic regression, is a form of regression that is used when the dependent variable is a dichotomy and the dependent variables are of any type (Agresti, 2002; Xie, 2000). Therefore, binary logistic regression was the model of choice for testing the third hypothesis of this research because the dependent variable (food security) in the hypothesis was nominal dichotomous in terms of food insecure = 0 and food secure = 1. The model was also used because it is a powerful and a popular one in social sciences at predicting a dependent variable on the basis of continuous and or categorical independent variables, determining the percent of variance in the dependent variable explained by the independent variables, gauging the impact of covariate control variables (which are

otherwise called independent variables), and ranking the relative importance of independent variables.

Prediction of the dependent variable is done by computing the odds of the dependent variable occurring. The percent of variance in the dependent variable explained by the independent variables is determined by computing Cox & Snell R Square and Nagelkerke R Square, which are analogous to the coefficient of determination (R^2) in Ordinary Least Square (OLS) regression. Gauging the impact of independent variables on the dependent variable is done by observing the signs of the logistic regression coefficients (B values), which bear negative or positive signs meaning negative or positive impact, respectively, on the dependent variable. The relative importance of independent variables is determined by observing the magnitudes of Wald statistics and their concomitant levels of significance, which test the significance of the B value for each individual variable (Garson, 2008).

Linear regression was not used because it assumes that variables are linearly related while they are actually not, but logistic regression assumes they are not linear, hence it is better than linear regression. Logistic regression is of three types, namely binary logistic regression, ordinal logistic regression, and multinomial logistic regression. Multinomial logistic regression is a form of logistic regression that handles the case of dependent variables with more than two classes. Ordinal logistic regression is a form of logistic regression that is preferred to multinomial logistic regression when multiple classes of the dependent variables can be ranked. The independent variables entered in the model were a mixture of ratio level and nominal level ones, as seen in Table 79.

Table 79: Variables entered in the binary logistic regression model

Variable	Justification for inclusion	Level (and unit of measurement)
Food security	Was the dependent variable obtained by grouping the values of dietary energy consumed per adult per day into food insecure (0) and food secure (1)	Nominal dichotomous
Dependency ratio	Is normally higher with old household heads and in households affected by HIV/AIDS due to death of some adults	Ratio (whole numbers)
Maize and rice acreage	Is one of the main determinants of food security in rural areas where the main occupation is crop production	Ratio (ha)
Maize and rice eaten from own harvests	Harvests are a good indicator of food supply. Own harvests are one of the main determinants of food security where the main occupation is crop production	Ratio (kg)
Maize and rice bought	In one of the main determinants of food security in terms of entitlement to food	Ratio (kg)
Maize and rice received freely	Is one of the important determinants of food security in Rufiji District where the custom of relatives giving one another food is common	Ratio(kg)
Health expenditure	Reduces food security by cash that would be spent on buying or producing food being spent on solving health problems. It tends to be higher in households affected by HIV/AIDS due to treating opportunistic infections.	Ratio (TSh)
Death due to AIDS	Reduces food security due to death of adults who might be contributing much to food security	Nominal dichotomous
Death due to non-AIDS causes	Effect of death due to AIDS is likely to be higher than that due to other causes	Nominal dichotomous

After inputting the variables presented in Table 79 in the computer and performing binary logistic regression analysis using SPSS, the outputs presented in Tables 80 to 85 and discussed alongside the presentation of each of the tables were obtained. It is worth noting here that only selected outputs have been presented.

4.7.2 Binary logistic regression outputs and the odds of being food secure

One of the vital outputs of the binary logistic regression model was the case processing summary, which is presented in Table 80 and shows that 38.7% of the 225 cases were not included in the analysis. The rest 61.3% of the households included represented the whole sample of 225 households and the population of Rufiji District.

Table 80: Case processing summary

Un-weighted cases (n = 225)		%
Selected Cases	Included in analysis	61.3
	Missing cases	38.7
	Total	100.0
Unselected cases		0.0
Total		**100.0**

Another output was of the Omnibus test of the coefficients of the model. The Omnibus test is a test of the capability of all predictors (independent variables) in the model jointly to predict the response (dependent) variable. A finding of significance means that there is adequate fit of the data to the model and that at least one of the predictors is significantly related to the response variable (Garson, 2008). According to this explanation, and by looking at the results in Table 81, which shows that there was significance at the 0.001 level (p=0.000), the data entered into the model adequately fitted the model, and at least one of the predictors is significantly related to the response variable.

Table 81: Omnibus test of model coefficients

		Chi-square	df	Sig.
Step 1	Step	66.903	8	0.000
	Block	66.903	8	0.000
	Model	66.903	8	0.000

Moreover, the model summary, which is presented in Table 82 showing Cox & Snell R square and Nagelkerke R square, was chosen as an important output of the binary logistic regression model. The Cox-Snell R^2 and Nagelkerke R^2 are attempts to provide a logistic analogy to R^2 in OLS regression; hence are called pseudo R^2. Nagelkerke R^2 is a modification of Cox-Snell R^2 to assure that Cox-Snell R^2 varies from zero to one, as does R^2 in OLS regression. If Cox-Snell R^2 is not modified, its maximum value is usually less than 1, making it difficult to interpret.

Table 82: Model summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	91.511[a]	0.384	0.563

Garson (2008) notes that Nagelkerke R^2 is normally higher than Cox-Snell R^2 and is the most-reported of the pseudo R^2 estimates. Therefore, based on the results in Table 82 which show that Nagelkerke R^2 was 0.563, it means that the independent variables entered in the model explained 56.3% of variance in the dependent variable.

The results of Hosmer and Lemeshow Test (Table 83) were another output of the model. The Hosmer and Lemeshow test, which is also called Hosmer and Lemeshow chi-square, is a test of goodness-of-fit of a logistic regression model, which works by comparing the observed and fitted counts of values according to the estimated probabilities of success. The Hosmer and Lemeshow goodness-of-fit test divides subjects into deciles (as seen in Table 83) based on predicted probabilities, then computes a chi-square from observed and expected frequencies. A finding of non-significance means that the model adequately fits the data (Hosmer and Lemeshow, 1980, cited by Agresti, 2002).

In this study, the value of the Hosmer and Lemeshow chi-square obtained was 7.333, and it was not significant (p = 0.501), as seen in Table 83. Typically, in any case where the Hosmer and Lemeshow chi-square value is greater than 0.05, the goodness of fit is desirable (Garson, 2008). In such cases the implication is that the model's estimates fit the data at an acceptable level (Garson, 2008). Garson (2008) adds that this does not mean that the model necessarily explains much of the variance in the dependent variable, but that it explains the variance to a significant degree. Therefore, according to the explanation above, the model used in this study, which contained eight explanatory variables and the response variable (food security) adequately fitted the data.

Table 83: Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	7.333	8	0.501

Contingency table for Hosmer and Lemeshow Test

		Food security = Insecure		Food security = Secure		Total
		Observed	Expected	Observed	Expected	
Step 1	1	14	13.829	0	0.171	14
	2	14	13.708	0	0.292	14
	3	13	13.536	1	0.464	14
	4	14	13.205	0	0.795	14
	5	13	12.673	1	1.327	14
	6	10	11.565	4	2.435	14
	7	9	10.518	5	3.482	14
	8	8	8.127	6	5.873	14
	9	7	4.246	7	9.754	14
	10	0	0.594	12	11.406	12

Other vital outputs of the model were Wald statistics, which are presented in Table 84. The Wald test is an alternative test which is commonly used to test the significance of individual logistic regression coefficients for each independent variable (that is, to test the null hypothesis in logistic regression that a particular effect coefficient is zero). The Wald statistic is the squared ratio of the unstandardized logistic coefficient to its

standard error. For example in Table 84, the Wald statistic for maize and rice acreage that is 0.664 was obtained from the following relationship: $(1.774/2.176)^2$, which is equal to 0.664. Wald statistic corresponds to significant testing of b coefficients in Ordinary Least Square (OLS) regression. Wald coefficients associated with individual independent variables help us realise the relative importance of each independent variable. In other words, a Wald coefficient is a measure of the unique contribution of each independent variable in the context of the other independent variables and holding constant other independent variables. A bigger Wald statistic implies that the independent variable associated with it has high contribution to the occurrence of the dependent variable.

The effect, which can be negative or positive, of an independent variable on the dependent variable is denoted by the sign (negative or positive) of individual logistic regression coefficients (B values) for the independent variable that is generated concomitantly with the Wald statistic. A negative sign associated with a B coefficient shows that, that particular variable decreases the logit of the dependent variable (i.e. it decreases the probability that that event (in this case food security) will be realised, and vice versa. For example in Table 84, age dependency ratio, death due to AIDS, and death due to non-AIDS causes reduce chances of households to be food secure since their B values are associated with negative signs. By the same token, the other variables increase chances of households to be food secure since they bear positive signs, but health expenditure has no effect on food security since its B value is 0.

Table 84: Variables in the equation

	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for EXP(B)	
							Lower	Upper
Age dependency ratio	-0.002	.003	0.310	1	0.578	0.998	0.993	1.004
Maize and rice acreage	1.774	2.176	0.664	1	0.415	5.892	0.083	419.047
Maize and rice eaten from own harvests	0.001	0.003	0.066	1	0.797	1.001	0.996	1.006
Maize and rice bought	0.188	0.036	27.197	1	0.000	1.207	1.125	1.296
Maize and rice received freely	0.089	0.188	0.225	1	0.635	1.093	0.757	1.579
Health expenditure	0.000	0.000	2.149	1	0.143	1.000	1.000	1.000
Death due to AIDS	-0.350	0.698	0.251	1	0.617	0.705	0.179	2.771
Death due to non-AIDS causes	-1.054	0.793	1.765	1	0.184	0.349	0.074	1.650
Constant	-4.163	1.275	10.661	1	0.001	0.016	-	-

In order to be certain that certain explanatory variables are significantly important in affecting the variance of the response variable, both the B values and the correlations should be significant. This requirement helps to contain the problem whereby sometimes logistic regression coefficients are found to be significant when the corresponding correlations are found to be insignificant, and vice versa (Garson, 2008). The disparity of that nature is due to three main reasons, which are: (a) logistic coefficients are partial coefficients, controlling for other variables in the model, whereas correlation coefficients are uncontrolled; (b) logistic regression coefficients reflect linear and nonlinear relationships, whereas correlation coefficients reflect only linear relationships; and (c) a significant parameter estimate (b) means there is a relationship of the independent variable to the dependent variable for selected control groups, but not necessarily overall (Garson, 2008). Based on this knowledge, the amount of grains bought per adult equivalent that had the highest Wald statistic (27.197), which was significant at the 0.1% level of significance ($p = 0.000$) as seen in Table 84, while the correlation between the same variable and the dependent variable was also highly

significant ($p = 0.000$), was the most explanatory variable. If the decision to determine the importance of the predictor variables was based only on correlation results, dependency ratio, acreage, and expenditure on health would also be judged to be significantly important determinants of the probability of households being food secure.

The Wald statistics shown in Table 84 are presented in Fig. 12 to illustrate the extent to which each of them contributed to the probability of households being food secure. Although all the Wald statistics in Table 84 are positive, the Wald statistics for dependency ratio, having lost a household member due to AIDS, and having lost a household member due to non-AIDS causes were given negative values for the sake of Fig. 12 since their logistic regression coefficients (B values) were negative implying that they had negative effects on the dependent variable.

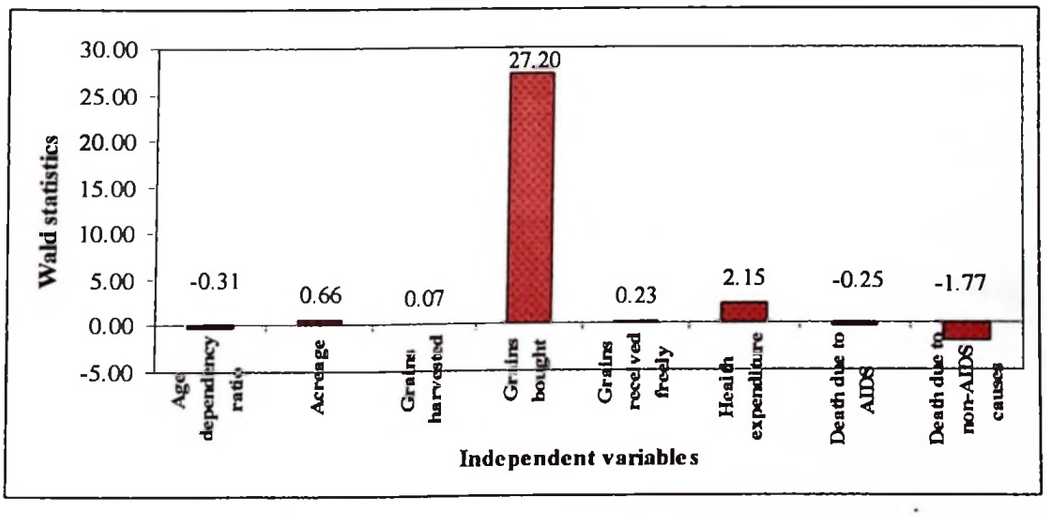

Figure 12: Contributions of independent variables to the odds of being food secure

According to the results presented in Table 84 and Fig. 12, one easily realises that the most important variable that contributed positively to food security was maize and rice bought. The magnitudes of effects of other independent variables on the dependent variable (food security) are as seen in Table 84 and Fig. 12. The data in the table and in

the Figure show that age dependency ratio, death due to AIDS and due to non-AIDS causes had negative effects on food security in terms of dietary energy consumed but that death due to AIDS had less negative impact on food security than death due to non-AIDS causes. The reason might be that death due to AIDS occurs after some time of inability to work, which means, for many days before death due to AIDS, the victim has had little contribution to food security. The more negative effect of death due to non-AIDS factors is due to such death being relatively sudden, which means a few days before death one is likely to have been contributing more to food security vis-à-vis the extent to which one who dies from AIDS might have been contributing to food security.

4.7.3 Odds ratios

Unlike the odds that are a mere probability of an event occurring, the odds ratio is the natural log base, e, to the exponent, B, where B = the parameter estimate. For example in Table 83, the odds ratio (Exp (B)) for maize and rice acreage that is 5.892 has been obtained from the following relationship: $e^{1.774} = 2.718^{1.774} = 5.892$. In Table 83, the "Exp(B)" column is SPSS's label for the odds ratios of the row independent variables vis-à-vis the dependent variable (food security). The odds ratio is the predicted change in odds for a unit increase in the corresponding independent variable. Odds ratios less than 1 correspond to decreases in the odds; odds ratios more than 1.0 correspond to increases in the odds; an odds ratio equal to 1.0 means that the respective independent variable has no effect on the dependent variable; and an odds ratio close to 1.0 means that the respective independent variable almost has no effect on the dependent variable (Wuensch, 2008).

The odds ratio for a given independent variable represents the factor by which the odds (event, in this research food security) change for a one-unit change in the independent

variable. In this example, each additional hectare for maize and or rice production increases (because B is positive) the odds of being food secure (because 0= food insecure and 1 = food secure) by a factor of about 5.892, controlling for other variables in the model. Conversely, each additional death of a household member due to AIDS reduces (because B is negative) the odds of being food secure by a factor of about 0.705, unlike each additional death of household member due to non-AIDS, which reduces the odds of being food secure by a factor of about 0.349.

Based on the above Exp(B) value for households affected by AIDS, here now comes the ultimate results of the model, the main aim of which was to test the odds of households affected by HIV/AIDS vis-à-vis those of households not affected by HIV/AIDS to be food secure. The odds ratio, which was the odds of households affected by HIV/AIDS to be food secure divided by the odds of household not affected by HIV/AIDS to be food secure, was 0.705. This means that the odds for households affected by HIV/AIDS to be food secure were 0.705 times as high as the odds for households not affected by HIV/AIDS to be food secure. This conclusion is arrived at because affected was coded as 1 and food secure was also coded as 1, and logistic regression considers higher values, in this case 1. The alternative coding for having not been affected by HIV/AIDS and for being food insecure was 0, which is smaller than 1. Conversely, the odds that households not affected by AIDS were food secure were 1.419 times as high as the odds for households affected by AIDS to be food secure. This is easily arrived at by taking the inverse of the above 0.705 or interchanging the codings for having and having not been affected by HIV/AIDS and re-computing the odds ratios.

4.8 Levels of Food Poverty

The results in this section are about meeting the fifth objective of this study, which was to establish the level of poverty in the households in terms proportions of households below, at, and above food and basic needs poverty lines. Poverty in this study was operationally defined as low expenditure on food and non-food items for 28 days per adult equivalent. Expression of the expenditures per adult equivalent for 28 was based on 60 days' data that were collected on 30 days during a period of food shortage and on another 30 days during a period of food abundance. Expression of expenditures per adult equivalent for 28 days was aimed at getting results comparable with those of the Tanzania Household Budget Survey of 2000/01 which determined poverty based on a monetary food poverty line of TSh 5295 per adult equivalent for 28 days in 2001 prices and a basic needs poverty line of TSh 7273 per adult equivalent for 28 days in 2001 prices. The average expenditures on food and on non-food items are summarized in Table 85, which shows that expenditure on food was as high as 75.5% of all expenses while the minimum and maximum expenditures on food were 34% and 96%, respectively. Given that the national average expenditure on food is 65% (NBS, 2002); respondents were spending much more on food. This is a sign of high poverty.

Table 85: Average expenditures per adult equivalent for 28 days

Expenditures (n=221)	Mean (TSh)		
	Affected (n=50)	Not affected (n=171)	All (n=221)
Monetary value of food harvested and eaten per adult	5 201.08	5 185.80	5 189.25
Cash spent on food per adult	13 749.32	10 916.62	11 557.50
Monetary value of food received freely per adult	1 338.77	1 750.07	1 657.01
Value of non-food items consumed per adult	1 592.46	866.65	1 030.86
Value of non-food items received freely per adult	125.00	129.10	128.17
Total monetary value of food per adult	20 289.17	17 852.49	18 403.77
Total monetary value of non-food consumption per	1 717.42	995.75	1 159.02
Overall expenditure per adult	22 006.60	18 848.24	19 562.80
Food expenditure per adult as a % of all expenditures	93.67	94.94	94.66

The poverty lines were first adjusted for inflation using 2001 National Consumer Price Index (NCPI) as the base year. Then the adjustment was done by cross multiplication whereby the 2007 NCPI was divided by the 2001 NCPI and multiplied by the poverty lines, as exemplified in Table 86.

Table 86: How food and basic needs poverty lines were adjusted

Year	National Consumer Price Index* (NCPI)	Food and basic poverty lines in 2001 (TSh)	How the lines were adjusted to get them in 2007 prices	Food and basic needs poverty lines in 2007
2001	100.0	Food poverty line = 5 295	(138.1/100 x 5,295	7 312
2007	138.1	Basic needs poverty line = 7253	(138.1/100) x 7,253	10 016

*The indices were quoted from BoT (2007; 2001)

Comparing the expenditures of the households in the sample with the food monetary poverty line of TSh 7312 and the basic needs poverty line of 10 016 obtained in Table 86 after adjusting the 2001 monetary food poverty and basic needs poverty lines for inflation, one finds that poverty incidence was as seen in Table 87. Using a t-test to compare the overall expenditure averages between households affected and those not affected by HIV/AIDS revealed that they were not significantly different ($p = 0.112$), which means that households affected and those not affected by HIV/AIDS were likely to be at the same levels of poverty and well being.

Table 87: Incidence of poverty based on the poverty lines presented in Table 86

Poverty and well being	Affected (n=50)	Not affected (n = 175)	All (n = 225)
	%	%	%
Food poor	6.0	1.8	2.7
Food non-poor	94.0	98.2	97.3
Basic needs poor	12.0	9.4	10.0
Basic needs non-poor	88.0	90.6	90.0

The results in Table 87, which are based on monetary food and basic needs poverty lines show high proportions of non-poor households based on the monetary food and basic needs poverty lines documented in the 2000/2001 Household Budget Survey Report (NBS, 2002). The high proportions of non-poor households based on the above poverty lines are in stark contrast with the levels of the results of food insecurity reported in Sub-section 4.4.4.6 based on the national caloric food poverty line of 2200 kCal consumed per adult equivalent per day. They were expected to be more or less the same as those reported here that are based on the national food monetary poverty line TSh 5295 per adult equivalent for 28 days in 2001 prices, which have been adjusted for inflation in this study. The plausible reason for the discrepancy is that the poverty lines used in the 2000/01 Household Budget Survey are very low. For example, the TSh 7253 basic needs poverty line per adult equivalent for 28 days equals 94,548 (i.e. 7253/28 days x 365 days) per adult per year in 2001 prices, which is just slightly above the previously famous national poverty line of TSh 73 677 per adult per year in 1995 prices (World Bank, 1996a, b). The results in Table 87 meet the fifth objective of the research.

4.9 A critical View of the Results

The results obtained by assessing the impact of HIV/AIDS using PRA and by comparing households affected by HIV/AIDS before and after being affected showed that HIV/AIDS had much negative impact on food security. This is sound since it is in line with the mainstream thinking about the linkage between HIV/AIDS and food security. However, the results obtained by comparing food security between households affected and those not affected by HIV/AIDS showed that they were not significantly different which implies that HIV/AIDS had little impact on food security, albeit binary logistic regression results showed that the households affected by HIV/AIDS had less chances of being food secure vis-à-vis those not affected HIV/AIDS.

The lack of significant differences in food security between the two groups of households might have been due to the limitation of the research whereby only one indicator of HIV/AIDS at the household level (adult death due to AIDS) was mainly used without much use of the other indicators of HIV/AIDS at the household level (chronic illness due to AIDS, opportunistic infections, and AIDS orphans). Another plausible explanation is that in some households where an adult member had died due to AIDS life might have normalised after the death, which means that they were no longer spending time, labour and financial resources which they were spending previously to care for their late relative. This might have enhanced food security. This point was also raised by PRA participants that after death of a household member who was chronically ill due to AIDS some households were getting some improvement in food security.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Overview

In this chapter, conclusions in terms of implications of the findings of the research are given. Then, recommendations that are derived from the conclusions are given specifying not only the levels at which strategies to control HIV/AIDS and improve food security should be addressed but also the stakeholders that are urged to take a lead in undertaking the strategies. Lastly, areas for further research are suggested.

5.2 Conclusions

Based on the findings of the study, background information, specific objectives, hypotheses, and theoretical and contentious issues on the determinants of food security and linkages between HIV/AIDS and food security, the following conclusions have been arrived at. Despite the finding that the people of Rufiji have good knowledge of HIV/AIDS and food insecurity which are relatively high in their district, they are seemingly making unsatisfactory efforts to stem HIV/AIDS and food insecurity. With regard to HIV/AIDS, this conclusion is indicated by the youth having a number of statements persuading in a way naïve participants in sexual intercourse to participate more actively in it. With regard to food security, this conclusion is indicated by the people of Rufiji abiding by traditional ceremonies in which substantial amounts of food are consumed without budgeting for food covering the whole year as if they were not aware of food insecurity that lingers their district.

Based on the findings of the research, which showed that in 90.9% of households there were no arrangements for under-five years old children to eat when adults were not

eating, it is concluded that the under-five-year old children might not only be more food insecure than other members of their households but also nutrition insecure in the sense that some of them might be getting inadequate nutrients, including the micro ones like Vitamin A, iron and iodine. The amount of cash used to buy food that was the factor most positively correlated with food security implies that having cash to buy food is the biggest determinant of food security in Rufiji District despite the fact that the main occupation is crop production in most of the households. Therefore, it can be said confidently that one's main occupation being crop production does not assure one to be food secure; buying food was the main source of food. Almost 70% of grains eaten in Rufiji District originating from purchasing the grains instead of coming from own production substantiates the validity of Sen's contention that food insecurity is due to lack of entitlements to get access to food, including lack of money to buy food. However, relying on food purchasing while one's main occupation is crop production is paradoxical. Despite the paradox, the problem is likely to linger in Rufiji District if the use of improved agricultural technologies is not increased. The finding that only 13.8% of the households used at least one of the five agricultural technologies assessed implies that low use of agricultural technologies is among the major stumbling blocks to the realisation of food security in the district.

On the basis of the findings of this research that showed that differences in food security based on differences in non-HIV/AIDS factors (particularly acreage, household size, age dependency ratio, and cash spent on buying food) while food security was not significantly different between households affected and those not affected by HIV/AIDS implies that some non-HIV/AIDS factors have higher influence on food insecurity than HIV/AIDS has.

The impact of HIV/AIDS on agriculture and food security is found to be high when assessed by using qualitative methods, but it is found to be little when it is assessed by using quantitative methods. For example in this research, the lack of significant differences in food produced and dietary energy consumed between households affected and those not affected by HIV/AIDS, and the lack of significant correlation between points scored on having lost a household member due to HIV/AIDS and food security while the correlation was significant between grains bought and food security back up this concluding remark in the sense that the results do not clearly support literature that dramatises the impact of HIV/AIDS on agriculture and food security. However, this conclusion does no mean that HIV/AIDS has negligible impact on agriculture and food security.

On the basis of the findings which showed that bigger proportions of households affected by HIV/AIDS had coped with food insecurity by selling assets and migrating, it is concluded that decrease in assets owned is worse among households affected by HIV/AIDS in comparison with households not affected by HIV/AIDS. Although the decrease in asset ownership may not be significant in a short run like it was found in this research, over a long run this can definitely culminate in impoverishment, especially because chances of replacing the assets decrease in households affected by HIV/AIDS due to being continuously afflicted, unlike in households not affected by HIV/AIDS where chances to buy assets like the ones sold are higher.

Since the odds for households affected by AIDS to be food secure were 0.705 times as high as the odds for households not affected by HIV/AIDS to be food secure, which means that the food status of households affected by HIV/AIDS was lower than that for households not affected by HIV/AIDS; HIV/AIDS impacts negatively on food security.

Owing to the finding that Malthusian, anti-Malthusian, and Entitlement to food theories explain food insecurity in Rufiji District while the majority of the people in the district are crop producers and the youth of the district try hard to avoid agriculture asserting that it is punishment since it mainly depends on the hand hoe, use of poor agricultural technologies and little participation of the youth in agricultural activities are among the major impediments to realisation of food security in the district.

Since after death of a household member there were decreases in acreage, cash capital invested in agriculture, hours spent on agriculture, number of agricultural labourers and hours spent on agriculture, HIV/AIDS had negative impact on agriculture. Since logistic regression results showed no significant impact of healthcare expenditure on food security while costs spent on mourning relatives passed away due to AIDS were substantial, expenditure on healthcare in Rufiji District among households affected by HIV/AIDS is not much but expenditure on mourning relatives passed away is much.

On the basis of the finding that the incidences of food and basic needs poverty obtained based on the national food poverty and basic needs poverty lines of TSh 5295 and TSh 7253 per adult equivalent for 28 days, respectively, in 2001 prices were much lower than the national 19% and 36% food and basic needs poverty incidences in 2001, the poverty lines are too low. This conclusion is based on the fact that the finding implies that the households surveyed were relatively better off, which is unlikely since food insecurity that is the most important indicator of well being in Tanzania was found to be high.

In Rufiji District, based on the sample of this research, the ten commonest diseases are malaria, fever, headache, joints pains, chest/coughing, stomach-aches, eyes, diarrhoea, asthma, and TB. Moreover, elephantiasis of the scrotum, tooth aches, and abdominal hernia are big problems. The presence of TB and chest in the list of the commonest diseases implies that HIV/AIDS is prevalent in the area. The finding that more than two-fifths of the households had at least one individual who was ill during the survey that took place late in a dry season when malaria and most water borne diseases were on the decline shows that the problem of diseases is high.

Determination of the linkages between HIV/AIDS and food security mainly using the indicator of having lost a household member due to AIDS in lieu of using the four main indicators of HIV/AIDS at the household level; which are (a) having lost an adult member due to AIDS, (b) having an adult household member who is chronically ill due to AIDS, (c) having an adult household member who is suffering from AIDS-related opportunistic infections and (d) having orphans whose parents passed away due to AIDS; might have contributed to getting statistically insignificant differences in food produced and dietary energy consumed between households affected and those not affected by HIV/AIDS.

5.3 Recommendations

In order to control HIV/AIDS and improve food security in Rufiji District, the following recommendations, which have been derived from empirical findings of this study and the above conclusions, are worth heeding. To facilitate their consideration, the recommendations are divided into policy level, district level, NGOs and other development partners' level, and household level.

5.3.1 Policy level recommendations

(a) Nutrition education should be disseminated regularly using group and mass media methods not only in Rufiji District but also in other districts to urge parents to feed their under-five-year old children about five times a day unlike the situation found during this study that such children were eating twice to thrice a day only when adults were eating. The nutrition education should also include knowledge of the sources of micro nutrients like Vitamin A, iron and iodine and how to process various foodstuffs to keep up the nutrients in order to balance well the diets of not only children but also of adults.

(b) Based on the conclusion that non-HIV/AIDS factors were more linked to food security than HIV/AIDS factors were, interventions by the Government and TACAIDS to help households affected by HIV/AIDS increase food security should go hand in hand with interventions to contain non-HIV/AIDS factors affecting agriculture, particularly factors of food supply through production, factors of access to food like non-farm income generating activities to get income to buy food, and actual food donations to households hit the hardest by HIV/AIDS.

(c) In order for the people of Rufiji District to become net sellers of food unlike during this research when most of them were net buyers of food while 74.7% of them had crop production being their main occupation but only 13.8% used any improved agricultural technology during the 2005/06 agricultural season, the Ministry of Agriculture, Food Security and Cooperatives is urged to help farmers of the district apply modern agricultural technologies (particularly tractors, improved seeds, fertilisers, pesticides and herbicides) for more production of food crops (especially maize and rice), cashew crops (especially cash nuts, and fruits), and livestock (especially poultry and goats) for food security and for selling the surplus to get income to meet other needs.

(d) Since Malthusian, anti-Malthusian, and Entitlement to food theories explain food insecurity in Rufiji District while the majority of the people in the district are crop producers and the youth of the district try hard to avoid agriculture claiming that it is punishment since it depends on labour intensive technologies that are dominated by the hand hoe, one of the major strategies to improve agricultural production for increasing food security in the district should be mobilisation of the youth to come forward when new agricultural technologies will be being introduced in the district so that they can take up them and participate more actively in agricultural production.

(e) Since the commonest diseases in Rufiji District are known, and the Millennium Development Goals stipulate an objective to halt and reverse HIV/AIDS and other diseases, including malaria, the Government is urged to scale-up health services in the district to ensure good health of the people so that they can undertake economic activities more effectively. Reducing the percentage of individuals ill and of households having ill individuals at any time should be the aim of interventions to stem the commonest diseases.

5.3.2 District level recommendations

(a) Since in Rufiji District there are slogans instigating (at least connotatively) naïve participants in sexual intercourse to participate more actively in it, as seen in the concluding remarks, this study recommends that Rufiji District Council should conduct more campaigns on how to avoid HIV/AIDS. Such campaigns should have strategies to target the association between traditional ceremonies like celebrating girls' attainment of sexual maturity and traditional circumcision of boys so that practices which are risky for HIV transmission are avoided during the ceremonies. This recommendation is targeted at the district level since the above cultural

practices are stronger than the way they are in most other districts of Tanzania and the District Council staff members are better placed to deal with the practices.

(b) Since some common diseases in Rufiji District are rather peculiar, like elephantiasis of the scrotum, and a sizeable proportion of people in the area know little about diseases, for example calling fever a disease while it is a symptom of various diseases, Rufiji District Council is urged to educate the people about the commonest diseases in the district and assist them by controlling them more strategically.

5.3.3 Household level recommendations

(a) The people of Rufiji District should be educated that relying on food purchasing while one's main occupation is crop production is a paradox. Besides, as part of efforts to contain the paradox, they should be urged to grab opportunities for agricultural improvement which may be created by the government like a green revolution that is envisaged in Tanzania, NGOs and other development partners, for example introduction of agricultural technologies and credit so that the people can increase agricultural production to improve food security and get surplus food to sell.

(b) The people of Rufiji should always go forward to be medically checked whenever they feel ill so that they can be treated timely to avoid becoming chronically ill, which has more adverse effects on food security. Moreover, they should be urged to contribute to health services like community health funds (CHFs) and other social services so that the same can go on being provided to them in sustainable ways.

5.3.4 Recommendations for non-governmental organizations

(a) Since households affected by HIV/AIDS are more likely to be food insecure than those not affected by HIV/AIDS and experience decline in various agricultural

factors including acreage and labour decline, while the government budget is not enough to do many activities to control the pandemic and mitigate the adverse effects of the pandemic, NGOs like Care International (which is already working on HIV/AIDS in Rufiji District) and other development partners are urged to increase activities to control HIV/AIDS in the area, including more campaigns against HIV/AIDS transmission, providing credit for agricultural and non-agricultural activities in households affected by HIV/AIDS, voluntary counselling and testing (VCT), and free anti-retroviral treatment and treatment of opportunistic infections. The free services will save households affected by HIV/AIDS from selling assets and migration, which they were doing more than households not affected by HIV/AIDS.

(b) Since Rufiji HDSS has records of all deaths due to AIDS in the Rufiji HDSS Area, it is high time a mechanism were worked out to counsel the households affected by HIV/AIDS and communicate to them their HIV/AIDS status. This will enable them to be targeted specifically with interventions to mitigate the effects of HIV/AIDS. It will also enable other members of the households affected to go for VCT and plan better for their life taking into account their HIV/AIDS status.

(c) Since cash is the biggest determinant of food security in Rufiji District in spite of the main occupation of the people of the district being crop production and this cannot change overnight, NGOs and other development partners are urged to support opportunities for people to generate income through small and medium enterprises (SMEs). The income can be used to buy food and other necessities.

5.4 Suggested Areas for Further Research

(a) Further research on linkages between HIV/AIDS and food security is suggested using the four indicators of HIV/AIDS at the household level which are having lost

an adult household member due to AIDS, having an adult household member who is chronically ill due to AIDS, having an adult household member who is suffering from AIDS-related opportunistic infections, and having orphans whose parents passed away due to AIDS. This suggestion is based on the findings of this research which showed that the amounts of food produced and dietary energy consumed did not differ significantly between households affected and those not affected by HIV/AIDS. Probably the lack of significance was partly due the limitation of this research whereby only one (having lost an adult household member due to AIDS) of the above four indicators of HIV/AIDS at the household level was mainly used in lieu of using all the four indicators.

(b) Since anthropometric measures among under-five-year-old children showed that no child was malnourished, which is doubtful since the incidence of food insecurity was found to be high (more than 70%), the proportion of malnourished children and the reasons behind their nutrition status in the research area is not empirically known. Therefore, further research is suggested to determine the nutrition status of under-five-year old children, using anthropometry, and the reasons for their nutrition status.

(c) After new poverty lines are formulated, a study should be conducted in Rufiji District to determine the incidences of food and basic needs poverty to update the incidences found in this study that seem to be too low due to having used the 2001 food and basic needs poverty lines of TSh 5295 and 7253 per adult equivalent respectively for 28 days that are too low. The new poverty lines were expected to be published in the Household Budget Survey of 2007 that had not yet been published at the time of submitting this thesis.

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APPENDICES

Appendix 1: A matrix of issues and a checklist of items discussed during PRA

Appendix 1 (a): Issues studied and PRA techniques used to study them

No.	Issues	PRA Techniques to study them
1.	Natural resources	• Resource mapping • Transect walk • Semi – structured interviews
2.	Households and family relations	• Social mapping • Semi-structured interviews
3.	Institutional aspects	• Institutional mapping • Semi-structured interviews
4.	Cultural elements affecting food & diseases	• Semi-structured interviews • Pair wise ranking
5.	Cultural acceptability of foods	• In-depth interviews • Pair-wise ranking
6.	Household perception of food insecurity	• In-depth interviews
7.	Seasonal food availability	• Seasonal calendars • In-depth interviews
8.	Strategies for coping with food shortage	• Seasonal calendars • In depth interviews
9.	Wealth ranking	• Participatory poverty assessment
10.	Constraints to food production	• Pair wise ranking • Causal-flow diagrams
11.	Food frequency assessment	• In-depth interviews
12.	Food storage	• In-depth interviews
13.	Vulnerability to food insecurity	• In-depth interviews
14.	Cultural perception of food security	• In-depth interviews
15.	Food insecurity and cultural elements association	• In-depth interviews
16.	Incidence of the top ten diseases	• In-depth interviews
17.	Awareness of HIV/AIDS: transmission, symptoms and prevention	• In-depth interviews
18.	How households with members sick for a long time are affected in terms of food security and how they ensure food security	• In-depth interviews
19.	How households with orphans are affected in terms of food security	• In-depth interviews
20.	How widows are affected in terms of food security	• In-depth interviews
21.	How households with members who are sick for a long time cope with food shortage	• In-depth interviews
22.	How households with orphans cope with food insecurity	• In-depth interviews
23.	How widows cope with food security	• In-depth interviews
24.	Presence of widows and widowers	• In-depth interviews
25.	HIV/AIDS and food insecurity association	• In-depth interviews
26.	HIV/AIDS and cultural elements association	• In-depth interviews

Appendix 1 (b): A checklist of issues discussed during PRA

FOOD SUPPLY INDICATORS

1. Indicators of rainfall being sufficient
2. Whether rainfall was sufficient during the three previous years
3. Whether agricultural land is very fertile, a little fertile or infertile
4. Whether water for irrigation and land for irrigation are available
5. What they gain from natural forests
6. Acreages and amounts of food harvested per acre or hectare
7. Proportions of people whose previous season's foods reach the next season
8. Proportions of people buying staple foods
9. Proportions of people storing some food products

ENTITLEMENT TO FOOD INDICATORS

10. Portion of land owned that is cultivated
11. Proportions of residents keeping cattle, sheep and goats, and poultry
12. Types of wild foods collected and % of households collecting them
13. Months in which wild foods are collected
14. Meals of wild foods per day per week and per month
15. Proportions of households owning, bicycles, radio, sewing machines, livestock, land, etc.
16. Season in which some of the above assets are sold more
17. Proportions of households affected by floods, drought, crop pests & diseases during the last 3 years
18. Proportions of crop products obtained from irrigated farm plots

FOOD SUFFICIENCY INDICATORS

19. Amounts of foods per day, per month, and per year
20. Proportions of income spent on food items
21. What are superior and inferior carbohydrate foods and why
22. What are superior and inferior protein foods and why
23. The meaning of food poverty according to local people's perception
24. Number of meals of inferior carbohydrate and protein foods per month
25. Number of meals of superior carbohydrate and protein foods per month
26. Proportions of households whose adults get at least 2 meals per day
27. Proportions of households whose children aged 6 to 59 months get at least 3 meals per day
28. Any cultural elements aggravating food poverty
29. Any diseases exacerbating food poverty
30. Any cultural elements exacerbating risks of diseases infection

STRATEGIES FOR COPING WITH FOOD SHORTAGE

31. Months in which people eat more and fewer meals
32. Months in which people eat superior and inferior foods
33. Months in which more people do casual labour work
34. Months in which more people seek loans for consumption
35. Months in which more people sell livestock and other assets
36. Months in which more people migrate for casual employment
37. Whether any villagers have ever got food aid from anywhere

Appendix 2: A copy of the household income and expenditure survey form used

RUFIJI DEMOGRAPHIC SURVEILLANCE SYSTEM (RDSS)
P. O. Box 40 IKWIRIRI, RUFIJI, TANZANIA
Phone Ikwiriri 31

RESEARCH ON HIV/AIDS AND FOOD SECURITY IN RUFIJI DISTRICT

FORM HIES "A": RECORDS OF AMOUNTS AND MONETRARY VALUES OF FOOD CONSUMED BY ALL HOUSEHOLD MEMBERS FOR 30 CONSECUTIVE DAYS (21/11 - 20/12/2007 AND 21/6/2006 – 20/7/2006) AND NON-FOOD ITEMS BOUGHT AND RECEIVED FREELY FROM (1/7/2005 – 30/6/2006)

Types of foodstuffs	Amounts of foods eaten by all household members per day and their monetary values						Amounts of non-food items bought and received freely from July 2005 to June 2006				
	Food harvested		Food bought		Food obtained in other ways		Goods bought and/or obtained freely	Goods bought		Goods obtained freely	
	Amount	Value (TSh)	Amount	Value (TSh)	Amount	Value (TSh)		Amount	Value (TSh)	Amount	Value (TSh)
1. Green gram							1. Entertainment (Radio and video cassettes, music, newspapers)				
2. Salt							2. Education (School uniforms, books, school fees, etc.)				
3. Sardines											
4. Ground nuts							3. Livestock				
5. Cashew nuts							4. Radio receivers, bicycles, telephones, watch, etc.				
6. Cow peas							5. House rent, renting various instruments and equipments				
7. Lemon/Lime											
8. Cooking oil							6. Paying own labourers				
9. Beans							7. Buying farms				
10. Maize							8. Medical treatment (Diagnosis, drugs, traditional medicines, etc.)				
11. Water											
12. Fruits							9. Expenditure on festival days (Idd, girls sexual maturity, boys' circumcision, Maulid, Noël, etc).				
13. Milk											
14. Pigeon peas							10. Communication by letter and telephone				
15. Vegetables							11. Fuel for cooking (Fire wood, wood charcoal, kerosene, etc.)				
16. Rice/Rice buns											
17. Cassava							12. Light (Costs for electricity, kerosene, candles, etc.)				
18. Bread/Buns/ Pastry											
19. Sorghum							13. Shoes and sandals				
20. Coconut							14. Clothes (bed sheets, blankets, coats, socks, hats, sweaters, etc.)				
21. Banana							15. Furniture (Chairs, tables, beds, cupboards, etc.)				
22. Meat							16. Cigarettes and other forms of tobacco				
23. Tomatoes							17. House construction and renovation				
24. Pepper							18. Cleanliness (Soap, bodyline oil, mirror, perfume, etc.)				
25. 25. Alcoholic drinks											
26. Fish							19. Transport costs (Fuel for cars and motorcycles, and costs for maintaining them and bicycles)				
27. Soft drinks											
28. Sugar							20. Fare payment for transport				
29. Potatoes							21. Taxes				
30. Onions							22. Utensils				
31. 31. Wild foods											
32. Other foodstuffs							23. Agricultural tools & equipment				

Appendix 3: A copy of the household questionnaire used

SN	Family_id	Family_num

RUFIJI DSS
RUFIJI DEMOGRAPHIC SURVEILLANCE SYSTEM (RDSS)
P. O. Box 40 IKWIRIRI, RUFIJI, TANZANIA
Phone Ikwiriri 31

RESEARCH ON THE RELATIONSHIPS BETWEEN HIV/AIDS AND FOOD SECURITY IN RUFIJI DISTRICT, TANZANIA

By
Kim A. Kayunze, PhD Student, Sokoine University of Agriculture, P. O. Box 3024, Morogoro
Telephone +255754 496960, E-mail: kayunze@suanet.ac.tz and kakayunze@yahoo.co.uk

FORM "HQNR": HOUSEHOLD QUESTIONNAIRE, SEPTEMBER 2006

Dear Respondent,

Your household has been selected randomly to participate in a research that is on-going in Rufiji District. The research, which has been sanctioned by the District Commissioner, is about Diseases and Food Security. The aim of the research is to get views of the residents of the district about the linkages between the two issues. Results of the research will be useful for drawing recommendations to Rufiji District Management on how best to control diseases and improve food security. All the responses you will give about your household and in general will be treated confidentially. Therefore, you are kindly requested to respond to all questions openly and truthfully.

A: Where the household resides (Circle the appropriate answer)

1. Division	1. Ikwiriri	2. Kibiti				
2. Ward	1. Ikwiriri	2. Umwe	3. Mgomba	4. Kibiti	5 Mchukwi	6. Bungu
3. Village	1. Ikwiriri South	2. Umwe Central	3. Mgomba South	4. Kibiti A	5. Kibiti B	6. Kimbuga
	7. Bungu A	8. Jaribu Mpakani	9. Uponda	10. Pagae	11. Mchukwi B	12. Mlanzi

B: HOUSEHOLD SOCIO-DEMOGRAPHIC ATTRIBUTE

To begin with, please let me ask you about all members of your household including their marital and health status

4. Household members

Serial numbers	1	2	3	4	5	6	7	8	9	10
Name (Only one)										
Sex (1 = M; 2 = F)										
Date of birth										
Yrs of schooling										
Marital status										
Relationship with household head										
Main occupation										
Health status										

Key to Question Number 4

Marital status	Household head	Relationship with the household head	Main occupation	Health status on the day of research			
				Serial No.	Status*	Illness	Duration
1. Married	1. Adult male	1. Household head	1. Crop production				
2. Never married	2. Adult female	2. Household head's spouse	2. Livestock keeping				
3. Widower	3. Orphan male	3. Household head's child	3. Government employment				
4. Widow	4. Orphan female	4. Household's grand child	4. Non-government employment				
5. Divorced		5. Household heads nephew/niece	5. Technical employment				
6. Separated		6. Household head's brother/sister	6. Service provision				
7. Too young to be married		7. Household head's son/daughter-in law	7. Licensed trade				
		8. Household head's father/mother	8. Non-licensed trade				
		9. Other type of relationship	9. Student/Pupil				
			10. Too young to go to school				

*1. Very healthy; 2. Moderately healthy; 3. Moderately ill; 4. Very ill

5. For every household member who is neither your spouse nor your biological child, please tell me when he/she came, why he/she lives with you, and when he/she expects to leave.

Name	Sex	When he/she came	Why he/she came	When he/she expects to leave

6. Please tell me the history of your marriage by responding to the following questions:

History	1st spouse	2nd spouse	3rd spouse	4th spouse
What was your age at first marriage?				
When were you married for the 1st time?				
How many wives do you have now?				
What is the number of spouses have you had?				
Where are your former spouses living now?				
Can you tell if you have ever married a widow of your deceased relative?				
How many of your children whom you do not live with?				

7. Please tell me if your former household members who are married now have been married voluntarily or by force.

Name	Sex (1 = M; 2 = F)	Voluntarily? (1 = Yes; 2. = No)	Type of marriage

C: ASSETS OWNED BY HOUSEHOLD MEMBERS AND HOUSE CONDITIONS

Now, please let me ask you about assets you and your household members own and the conditions of your house(s)

8. Types of assets you own this year (2006) and the ones you owned two years ago (in 2004)

Asset	Ownership of the assets in 2004		Ownership of the assets in 2006		Has the amount: 1. Increased 2. Decreased 3. Not changed 4. Not applicable	Reasons for change in the assets
	Amount	Owner: 1 = Father 2 = Mother 3 = Son 4 = Daughter 5 = Father and mother; 6 = All	Amount	Owner: 1 = Father 2 = Mother 3 = Son, 4 = Daughter 5 = Father and mother 6 = All		
Bicycle						
Mosquito net						
Sewing machine						
Satellite dish						
Fan						
Refrigerator						
Automobile						
Mattress						
Hand hoe						
Cupboard						
Wooden bed						
Sheep						
Chickens/Ducks						
Sofa set						
Goats						
Cattle						
House						
Water pump						
Machete						
Press iron						
Motor cycle						
Radio receiver						
Watch						
Cellular phone						
TV set						
Fishing gear						

9. Attributes of the house in which the household members live

House	Attributes of the house		
	2004	2006	Reasons for change in attributes of the house
1. Does your household own the house?	1 = Yes; 2 = No	1 = Yes; 2 = No	
2. Floor of the house	1= Soil, 2= Timber, 3= Floor tiles, 4= Cement, 5=Others	1= Soil, 2= Timber, 3= Floor tiles, 4= Cement, 5= Others	
3. Walls of the house	1 = Block or baked bricks 2 = Mud bricks 3 = Iron sheets/Soil + timber 4 = Thatch/Boxes 5 = Wood and soil 6 = Others	1 = Block or baked bricks 2 = Mud bricks 3 = Iron sheets/Soil + timber 4 = Thatch/Boxes 5 = Wood and soil 6 = Others	
4. Roof of the house	1 = Roofing tiles/Cement 2 = Iron sheets/Asbestos 3 = Timber/ Soil/Thatch 4 = Others	1 = Roofing tiles/Cement 2 = Iron sheets/Asbestos 3 = Timber/ Soil/Thatch 4 = Others	
5. Main source of light used in the light	1 = Electricity/Gas/Solar power, 2. Lantern lamp 3 = Small oil lamp (*Kibatari*), 4. Fire wood, 5 = Wood charcoal, 6 = Others	1 = Electricity/Gas/Solar power, 2. Lantern lamp 3 = Small oil lamp (*Kibatari*), 4. Fire wood, 5 = Wood charcoal, 6 = Others	
6. Main source of power for cooking	1 = Electricity/Gas/Solar power, 2 = Fire wood, 3 = Wood charcoal, 4 = Others	1 = Electricity/Gas/Solar power, 2 = Fire wood, 3 = Wood charcoal, 4 = Others	
7. Where do you get potable water?	1. Inside/Outside house water tap (0 distance) 2. Within 400 m 3. Beyond 400 m	1. Inside/Outside house water tap (0 distance) 2. Within 400 m 3. Beyond 400 m	

D: CLIMATIC AND FARM ASPECTS

Now let's talk about weather and farms that your and your household members own and cultivate

10. Please tell me the sizes of the land plots you own that are located in the places listed in the following table.

Climate	Farm size (acres)	Crops grown	Distance from home, and time of walk, to the farm	
			Distance (km)	Time of walk (hours)
1. Areas where there are sometimes floods (Rufiji River and other rivers)				
2. Areas where there are never floods				
3. Bush/forest areas				

11. During the following seasons, was the rainfall in your village: 1. Excessive, 2. Just enough, or 3. Too little?

Rainfall	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006
Short rains					
Long rains					

E: CULTURAL ASPECTS

Now, please let me ask you amount traditions of your ethnic group that you and your household members still abide by

12. (a) From July 2005 to August 2006, did you have any ceremony in your household? 1. Yes, 2. No

From July 2005 to June 2006 did you celebrate any of the following days? (1 = Yes, 2. No)		Number of people who celebrated	Where the celebration took place	How did you celebrate?		Kg of food consumed			Cash
				1. Traditional dances, 2. Music 3. Video, 4. Choir	Duration of celebration (Hours/ Days)	Maize	Rice	Cassava	
Idd-el- Fitr									
Idd-el-Haj									
Maulid									
Christmas									
Easter									
Bad spits									
Girls' sexual maturity									
Boys' circumcision									
Banquet									
Wedding									

12 b) Where did your boys' circumcision take place? (1. Your home, 2. Circumciser's home, 3. In bush/forest)

12 c) Please tell me why circumcision took place there not elsewhere .....
.....

13. Are there any food types that are prohibited for some of your household members to eat? (1. Yes; 2. No)

14. If the answer to Question 13 is Yes, please tell me the types of food that are prohibited and why.

Food types	Men		Women		Children	
	1. Yes 2. No	Reasons	1. Yes 2. No	Reasons	1. Yes 2. No	Reasons

15. Are there any special food types for some members of your household? (1. Yes; 2. No)

16. If the answer to Question 15 is Yes, which are the food types and why?

Food types	Men		Women		Children	
	1. Yes 2. No	Reasons	1. Yes 2. No	Reasons	1. Yes 2. No	Reasons

17. In the 2005/06 agricultural season, for how many hours in 24 hours did your household members do the activities listed in the following table?

Sex	Activities and hours they were done						
	Agriculture	Non-farm income-generating activities	Household chores	Sleeping at night	Resting, visiting friends, chatting, drinking	Other activities	Total hours
Adult male							24
Adult female							24
Male youths							24
Female youths							24
Children							24

18. Do all members in your household eat at the same time? (1 = Yes; 2. No)

19. If the answer to Question 18 is No, at what times do various members take various meals?

Household members	Breakfast	Lunch	Dinner	Other meals
Men				
Women				
Children (< 5 years)				

20. What types of food do you normally eat during food abundance and during food shortage?

Meals	Types of foods eaten in a meal during food abundance	Types of foods eaten in a meal during food shortage
Breakfast		
Lunch		
Dinner		

F: ORGANISATIONAL AND LEADERSHIP FACTORS

Now let's talk about organisational and leadership factors with their roles in agriculture and HIV/AIDS

21. (a) Have you ever heard about District Agricultural Development Programmes (DADPs)? (1. Yes; 2. No)
    (b) If you have heard of them, are DADPs present in your village? 1. Yes; 2. No
    (c) If DADPs are present in your village, how are they implemented? .....
    .....
    (d) If they are implemented in your village, how have you benefited from them
    .....

22. (a) Have you ever heard of Tanzania AIDS Control Programme (TACAIDS)? 1. Yes; 2. No
    (b) If you have heard of it, does it work in your village? 1. Yes 2. No
    (c) If it does, what has is done in your village?
    .....
    (e) If it has done anything in your village, how have you benefited from it? .....

23. How would you describe the leadership of your village in line with the options given in the following table?

Leadership	Tick against the appropriate answer	Please give reasons for the description
Very good		
Good		
Bad		
Very bad		

24. Are there any non-governmental organisations like NGOs/CBOs/FBOs of which you are a member?

Organisation	1. Yes; 2. No	Name of the organisation	How have you benefited from being a member of the organisation?
1. NGO			
2. CBO			
3. FBO			
4. Others			

G: FOOD SUPPLY INDICATORS

Let's now talk about food supply indicators

25. Please tell me about all the land you and your household members own and the uses of the land.

Land owned and its uses	Farmland size (Acres)				Explanation (If any)
	In 2006		In 2004		
	Irrigated	Not irrigated	Irrigated	Not irrigated	
Land for only food crop production					
Land for only food cash crop production					
Land for both food and cash crops production					
Land area under irrigated crop production in 2005/06					
Land area with field crops affected by floods 2005/06					
Land area hired out to other people in 2005/06?					
Land area left fallow in 2005/06?					
Main means by which farmland owned was obtained (Tick one of the 6 alternatives given)	1. Inheritance				
	2. Open virgin land				
	3. Buying				
	4. Borrowing				
	5. Land allocation by village				
	6. Other means				

26. In your household, which crops did you produce from July 2005 to June 2006?

Crop	Area, if every crop had been monocropped (Acres)		Amount harvested (kg)		Amount sold				Consumed in the household (kg)				Given to relatives and neighbours (kg)		Received from relatives and neighbours (kg)		Bought				Amount in store July 2006 (kg)
					Short rains		Long rains		Short rains		Long rains						Short rains		Long rains		
	Short rains[1]	Long rains	Short rains	Long rains	Amount (kg)	Price per kg	Amount (kg)	Price per kg	On normal days	On festival days	On normal days	On festival days	Short rains	Long rains	Short rains	Long rains	Amount (kg)	Cost (TSh)	Amount (kg)	Cost (TSh)	
Maize																					
Rice																					
Cassava																					
Sorghum																					
Simsim																					
Beans																					
Cashew nuts																					
Cow peas																					
Pigeon peas																					
Green gram																					
Other crops																					

27. After harvesting how did you preserve your crop harvests?

Crop	Container in which the harvests were kept	Place where the harvests were kept	Whether the harvests were treated with any chemical	Type of chemical used
Maize				
Rice				
Cassava				
Sorghum				
Simsim				
Beans				
Cashew nuts				
Cow peas				
Pigeon peas				
Green gram				

[1] The short rains period was from October 2005 to February 2006; the long rains period was from March 2006 to June 2006; and the dray period was from July 2005 to September 2005.

28. Did you grow any crop during the dry season? (1. Yes; 2. No)

29. If you grew any crop during the dry season, please answer the question in the following table:

Crop	Area, if every crop had been monocropped (Acres)	Amount harvested (kg)	Sold		Consumed in the household (kg)		Given to relatives and neighbours (kg)	Received from relatives and neighbours (kg)	Bought		Amount in store July 2006 (kg)
			Amount (kg)	Price per kg	On normal days	On festival days			Amount (kg)	Cost (TSh)	
Maize											
Rice											
Cassava											
Sorghum											
Simsim											
Beans											
Cashew nuts											
Cow peas											
Pigeon peas											
Green gram											
Other crops											

H. ENTITLEMENT TO FOOD INDICATORS

Please let's talk about the ability to get food through production, buying or freely in your household

30. Which agricultural equipments/tools and inputs did your household use in the agricultural seasons 2005/06 and 2003/04 for production of the crops listed in the following table? (Write the number bearing the relevant equipment/tool/input)

Crop	Seeds		Fertilisers		Herbicides		Agric equipment and tools		Reasons for not using the equipment/tools/inputs
	1. Local 2. Improved 3. Others		1. Yes (Inorganic) 2. Yes (Organic) 3. No 4. Not applicable		1. Yes 2. No 4. Not applicable		1. Hand hoe 2. Tractor 3. Ox-plough 4. Manual labourers 5. Zero tillage 6. Others		
	05/06	03/04	05/06	03/04	05/06	03/04	05/06	03/04	
Maize									
Rice/Rice									
Sorghum									
Simsim									
Cashew nuts									
Cow peas									

31. For how log did the crops products you harvested from July 2004 to June 2005 last?

Crop	Amount harvested	Months in which exhausted	Explanation
Maize			
Rice/Rice			
Cassava			
Sorghum/millet			
Simsim			
Beans			
Cashew nuts			
Cow peas			
Pigeon peas			
Green gram			
Other crop products			

32. What livestock and livestock products did you produce from July 2005 to June 2006 in your household?

Types of livestock and their products	Amounts you had in June 2005	Amounts you sold from July 2005 to June 2006		Amounts you ate from July 2005 to June 2006	Amounts you gave to relatives and neighbours from July 2005 to June 2006	Amounts you received freely from relatives and neighbours from July 2005 to June 2006	Amounts you bought from July 2005 to June 2006		Amounts you had in July 2006
		Amount	Mean price per unit				Amount	Price	
Chickens									
Goats									
Cattle									
Ducks									
Milk									
Eggs									
Others									

33. Apart from crop and livestock production, what other economic activities did you and/or your household members do from July 2005 to June 2006? (Please list all the activities done by all household members).

Non-farm activities done by all household members	Household members who did the activities 1. Father 2. Mother 3. Children	Costs incurred on the activities	Gross revenue from the activities	Explanation

I: FOOD SUFFICIENCY ASPECTS

34. (a) Please tell me whether various foodstuffs you ate from various sources in your household from July 2005 to June 2006 were sufficient.

Food eaten and its main source 1. Your own farm 2. Buying 3. Work for food 4. Food aid from relatives 5. Food aid from the government 6. Other sources		Whether the food was sufficient in 2005/2006 1=Yes 2 = No 3 = Not applicable	Explanation	Whether the food was sufficient in 2003/2004 ? 1=Yes 2 = No	Explanation
Food type	Main source				
Maize					
Rice					
Cassava					
Sorghum					
Simsim					
Beans					
Cashew nuts					
Cow peas					
Pigeon peas					
Green gram					
Other foods					

(b) Overall, did you have food shortage between July 2005 and June 2005 in your household? 1. Yes, 2. No

35. If the answer to Question 34 (b) is yes, which was the main cause of the shortage by ranking the causes given below pair-wise?

Reasons for having had food shortage between July 2005 and June 2006	
1. Big household size vis-à-vis our food production level	4. Low food supply in nearby market places
2. Failure to use tractors, improved seeds, fertilisers, pesticides and herbicides	5. High prices of foodstuffs in nearby market places
3. Lack of income or assets to sell to get cash to buy food	6. Lack of Government assistance

	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

36. Please tell me about the food status in your household quarterly from July 2005 to June 2006. by choosing (1=Very plenty, 2=Moderately plenty, 3=Scarce, or 4 = Very scarce)

July 2005 – Sept. 2005	October 2005 – Dec. 2006	January 2006 – March 2006	April 2006 – June 2006

37. What were the main sources of income in your household from July 2005 to June 2006, and what were the main uses of the income?

Main source of income		1 = Yes, 2 = No	Items on which the income was spent	Cost (TSh)
1	Fishing		1. School expenses	
2	Selling food crop products		2. Medical care expenses	
3	Selling cash crop products		3. Buying assets	
4	Trading		4. Buying food	
5	Salaried employment		5. Other expenses	
6	Casual labour work		6.	
7	Selling water		7.	
8	Selling firewood and/or wood charcoal		8.	
9	Selling timber/logs		9.	
10	Bee-keeping		10.	
11	Receiving remittances from relatives		11.	
12	Cooked food vending		12.	
13	Selling alcoholic drinks		13.	
14	Technical activities		14.	
15	Other sources of income		15.	

38. (a) For the last seven consecutive days until yesterday, how many meals did you eat? ……..
(b) Among those meals for which of them did you eat the foodstuffs listed in the following table?

Protein foodstuffs	Frequency and amounts eaten		Carbohydrate foodstuffs	Frequency and amounts eaten		Protein foodstuffs	Frequency and amounts eaten		Carbohydrate foodstuffs	Frequency and amounts eaten	
	Number of times	Kg eaten every time		Number of times	Kg eaten every time		Number of times	Kg eaten every time		Number of times	Kg eaten every time
Chicken meat			Rice			Pigeon peas			Cassava stiff porridge		
Goat meat			Maize stiff porridge			Cassava leaves					
Beef			Buns			Sardines			Boiled cassava		
Fish			Rice buns			Green gram					
Beans			Bread			Shrimp			Banana		
Vegetables											

39. How many meals did your household members who are older than 5 years take yesterday? ……..

40. How many meals did your household members who are less than 5 years old take yesterday? …...

41. From July 2005 to June 2006, on average, how many meals did your household members who are older than 5 years ……. and those younger than 5 years take per day? ……...…

42. Would you let me measure the heights and weights of under-five-year old children of your household?

Name	Age in months	Height in cm	Weight in kg

J: STRATEGIES OF COPING WITH FOOD SHORTAGE AT THE HOUSEHOLD LEVEL

43. If your household got food shortage between July 2005 and June 2006 how did you cope with it?

Strategies used to cope with food shortage	1=Yes; 2=No	Explanation
1 Borrowing food		
2 Working for food		
3 Selling households' assets		
4 Getting food aid from relatives		
5 Getting food aid from the Government		
6 Searching for wild foodstuffs and eating them		
7 Eating fewer meals per day		
8 Borrowing cash for buying food		
9 Doing casual labour work to get cash to buy food		
10 Temporary migration of some household members		
11 Temporary migration of all household members		
12 Getting food aid from neighbours		
13 Selling livestock (poultry)		
14 Soliciting remittances from relatives living in town		
15 Eating foodstuffs they do not prefer		

K: LINKAGES BETWEE HIV/AIDS, OTHER DISEASES AND FOOD SECURITY
Please let's now talk about linkages between diseases and food security

44. What are the most problematic diseases to which your and your household members succumb?

1.	2.	3.	4.	5.
6.	7.	8.	9.	10.

45. (a) During the agricultural season 2005/06 did any of your household members fall so ill that the illness affected agricultural production? (1. Yes, 2. No)
(b) If the answer to Question 45 (a) is yes, who was he/she? ....., what was the illness.....; and for how long was he/she ill?..... (days/months)

46. How did the illness affect agricultural production?

1. Less acreage that if he/she had not been ill	2. Spending the would-be agric. capital on buying special food for the ill	3. Spending the would-be agric. capital on medicines for the ill
4. Spending time taking care of him/her in lieu of doing agricultural activities	5. Little harvests	6. Other adverse effects

47. For each of the adverse effects in Question 46), please estimate how the situation would have been if no one in your household had been ill in the 2005/06 agricultural season

Agriculture		The situation in spite of illness	Estimated situation if no one had been ill
Acreage			
Cash invested in agriculture			
Household members who participated in agric.			
Hours spent on agricultural activities			
Harvests	Maize		
	Rice		
	Cassava		
	Sorghum		
	Simsim		
	Beans		
	Cashew nuts		
	Cow peas		
	Pigeon peas		
	Green gram		

48. If harvests were less than expected, using pair-wise ranking, please state which of the factors listed in the following table were more responsible for the decline in food production.

Reasons for decline in the amounts of harvests	Reasons for decline in the amounts of harvests
1. Household member(s) illness	9. Rodents including birds, rats, and monkeys
2. Using the hand hoe	10. Using local seed varieties
3. Inadequate rainfall	11. Untimely weeding
4. Inability to irrigate	12. Travelling
5. Lack of extension advice	13. Crop products being stolen on farm
6. Lack of cash to hire tractors	14. A household member being deceased
7. Lack of cash to buy fertilisers	15. Calamities, particularly floods and fire
8. Crop diseases and pests	16. Lack of cash to buy pesticides

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																

L: LINKAGE BETWEEN DEATHS AND FOOD SECURITY

The following questions are sensitive; however, I plead with you to respond to them truthfully

49. From 1st January 2003 to 31st December 2005, did any of your household members pass away? (1. Yes 2. No)

50. Excuse me, if the answer to Question 49 is yes, please respond to the following questions:

Sex of the one who passed away	Relationship between the deceased and the household head	Date of birth of the deceased	Date of death	Cause of death

51. After death of your relative (in Question 52), how has your food security been affected? (Please fill in responses in the following table):

Agricultural production		One agricultural season prior to the death	During the agricultural season 2005/2006
Acreage			
Cash invested in agriculture			
Household members who participated in agric.			
Hours spent on agricultural activities			
Harvests	Maize		
	Rice		
	Cassava		
	Sorghum		
	Simsim		
	Beans		
	Cashew nuts		
	Cow peas		
	Pigeon peas		
	Green gram		

52. How much food and cash did you spend on mourning your deceased relative? (Burial and mourning end ceremony)? (To be asked to estimate if he/she doesn't remember)

Foodstuffs eaten during mourning of the deceased due to AIDS (Kg)						Cash spent during mourning of the deceased due to AIDS (TSh)				
Food kg	Source					Source				
	Food contributions by relatives, etc.	Food from own harvests	Borrowed food	Bought food	Total	Cash contributions by relatives, etc.	Cash savings	Cash borrowed	Cash from assets sales	Total
Rice										
Maize										
Cassava										
Other foods										

THANK YOU FOR YOUR COOPERATION