CONTRIBUTION OF URBAN AGRICULTURE IN FOOD AND NUTRITION SECURITY TO THE LOW INCOME HOUSEHOLDS OF KASARANI DISTRICT OF KENYA

BY

EVAYLINE MUTHONI NKIRIGACHA

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF SCIENCE IN APPLIED HUMAN NUTRITION IN THE DEPARTMENT OF FOOD SCIENCE, NUTRITION AND TECHNOLOGY, FACULTY OF AGRICULTURE, UNIVERSITY OF NAIROBI.

DEPARTMENT OF FOOD SCIENCE, NUTRITION TECHNOLOGY

2012

DECLARATION

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

..... Date 16/08/2012

Evayline Muthoni Nkirigacha

This dissertation has been submitted for examination with our approval as University Supervisors

.....

Prof. Jasper K. Imungi Date 19/11/2012

Department of Food Science, Nutrition and Technology

.....

Dr. George Cheming'wa Date 20/11/2012

Department of Plant Science and Crop Protection

DEDICATION

I feel privileged to declare this work to my beloved husband and my son and daughter who not only sponsored my studies but were constantly there to encourage me to settle for nothing less than excellence especially when academic challenges were hard to bear. My father and mother, my sister Idah and parents in law. Thank you and May the Almighty God bless you.

ACKNOWLEDGMENTS

First and foremost I am grateful to God for his grace that has forever been sufficient in my life. I appreciate His great love and compassion that has made me a partaker in the academic world.

I extend my sincere thanks to my beloved husband Mr Patrick Miriti for not only funding my studies but also being patient with me as I took family time to pursue my studies, thank you for the patience and understanding. Same gratitude are extended to my son Malcolm and daughter Carol for their unfailing support throughout the study period. My dear sister Idah for her constant prayers.

I am highly thankful to my supervisor Professor Jasper. K. Imungi for the great assistance during the entire period of my studies. It is my great pleasure to appreciate him for the dedication and commitment which he demonstrated in teaching and offering the guidance so much needed in the course of my study. I am also thankful to Doctor George Chemin'ngwa for his words of encouragement. Special thanks go to Professor Wambui Kogi – Makau for her commitment in teaching of the course that was compulsory and relevant for the induction of this study.

I am also indebted to all the staff of the Applied Human Nutrition Unit, University of Nairobi for their support and assistance during my study. Special thanks to Joan, Mugo, Ruto and Wamuyu for their great contribution in making my studies in the department successful.

I extend my thanks to all the field assistants for their excellent work during data collection.

Last but not least; I appreciate every other person who directly or indirectly contributed to the success of the study.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

WHO	World Health Organisation
UNICEF	United Nations Children's Fund
SPSS	Statistical Package for Social Sciences
SD	Standard Deviation
ACC	Administrative Committee on Coordination
HH/hh	Household
Kg	Kilograms
UN	United Nations
SCN	Standing Committee on Nutrition(of United Nations)
USAID	United States Agency for International Development
FAO	Food and Agricultural Organisation of the United Nations
NALEP	National Agriculture and Livestock Extension Programme
UPA	Urban and Peri urban Agriculture
WTO	World Trade Organisation
CAST	Council on Agriculture, Science and Technology
UK	United Kingdom
CFSC	Community Food Security Coalition
UA	Urban Agriculture

MAR	Mean Adequacy Ratio
NAR	Nutrient Adequacy Ratio
MUAC	Middle Upper Arm Circumference

OPERATION OF DEFINITIONS

Dietary Diversity- is the sum of the number of different foods or food groups consumed by an individual or household over a specific period of time.

Food poverty incidence- refers to those whose expenditures on food are insufficient compared to the FAO/WHO recommended daily allowances of 2250 calories per adult as per WMS III.

Chronic food insecurity - continuously inadequate diet that is caused by the inability to acquire food

Permanent source of income- Steady monthly salaried form of employment or stabilized business

Quantitative data- Numerical observations or measurements

Qualitative data- Observations which are categorical rather than numerical, such as attitudes, intentions and perceptions

Food accessibility- A condition when households have adequate incomes or other resources to purchase or barter to obtain appropriate levels of foods needed to maintain consumption of food and adequate diet/nutrition level (USAID 1992)

Food availability- A condition when sufficient quantities, necessary types of food from domestic production, commercial imports or donors are consistently available to individuals or are within reasonable proximity to them or are within their reach (USAID 1992)

Consumer unit- It is the nutrient requirement of an individual as a requirement of an individual as a ration of the requirement of an arbitrary chosen person (nominal adult male) whose requirement is equivalent to one and the rest is expressed as a fraction of it (WHO/FAO/UNU. 1985)

Coping strategy/mechanism- The methods which households employ to deal with food inadequacies in crisis e g making greater use of wild foods, selling assets, migration

Food security- when all people at all times have both physical and economic access to sufficient and good quality food to meet their dietary needs for productive and healthy life (USAID, 1992)

Drought tolerant crops- Crops that can withstand water stress to some degree and relatively produce some yields

Prevalence- the proportion of the population that has a condition of interest (e.g. stunting) at a specific point

Vulnerability- The extent to which an individual, household, community, socio-economic system is likely to be affected by a foreseeable bad event

Household- Defined as members of the same family eating from the same pot with the same head and not necessarily blood relatives

Mean Adequacy Ratio- the sum of all the nutrient adequacy ratios of the nutrients of interest divided by the number of nutrients

Nutrient adequacy- The achievement of recommended intakes of energy and other nutrients

Nutrient adequacy ratio- The ratio of subjects' daily intake to the current recommended allowance for the subjects' sex and age category

ABSTRACT

Urban agriculture is the practice of cultivating, processing and distributing food in, or around (peri-urban), a village, town or city as is practiced in many countries of the world. In Kenya though there are no legal municipal laws Urban agriculture is widely practiced to supply the diet of the poor. Mwiki location experiences chronic food and nutrition insecurity. Many of the households practice subsistence agriculture to supplement their diets and may be acquire some income. The objective of this study was therefore to assess the contribution of urban agriculture to food and nutritional security in the low income families in peri-urban area of Mwiki Location of Kasarani Division Kasarani District. A descriptive cross-sectional survey was used. The study population consisted of households who practice urban agriculture either as fulltime farmers or part time farmers but not in salaried employment. The required information for dietary diversity was collected using a questionnaire comprising 14 food groups. Energy, protein, and vitamin A were the nutrients considered and their adequacy and their association with dietary diversity assessed. Dietary diversity scores were developed to measure diet diversification, while nutrient adequacy ratio for each nutrient was calculated to reflect specific nutrient adequacies in the diet.

A pre-tested structured questionnaire and focused group discussion were used to collect information on various areas in the study. Data was then analysed using stastical packages for social sciences (SPSS). The findings showed that most of the heads of households relied on casual labor to earn more livelihoods. More than half of the study population keep small livestock such as poultry, rabbits, dairy goats and some keep dairy cows, there are also those who rely on crops such as kales, cabbage, sarget. Although the study showed that up to 78% of residents engage in urban agriculture, they are not able to obtain sufficient food for own consumption from their production and rely on purchases to a large extent.

Demographic characteristics of the households were recorded using a previously pre-tested structured questionnaire. Results were analysed using Statistical Packages for social sciences (SPSS version 12.0). Descriptive statistics, analysis of variance and correlations were performed and $p \leq 0.05$ was considered as statistically significant.

There is a significant relationship between dietary intake of protein, energy and vitamin A and the age of the respondents. However the study shows a positive but insignificant relationship between dietary intake and type of roofing, type of wall and type of floor. This means that, occupation and age determined a lot about the dietary intake of protein, energy and vitamin A. The study shows that there was a positive and significant relationship between reducing the frequency of meals and food sufficiency as showed by $p = 0.008$; and between reducing the meal size and food sufficiency as shown by p 0.042. The study further showed a positive but insignificant relationship between sale of assets and food sufficiency as shown by $p=0.387$. This implies that reduction of the frequency of meals served well as a coping measure to ensure food sufficiency in the household.

CHAPTER ONE: INTRODUCTION

Poverty and food insecurity are the twin challenges of the 21st Century among other issues such as HIV/AIDS, conflicts and disasters. The Millennium Development Goal addresses extreme poverty and chronic hunger (ACC/SCN, 2004).The absolute number of food insecure people in the developing countries increased from 780 million to 798 million from mid 1990s to 2000 (SCN,2004). Many people lack adequate amount of foods that are rich in the nutrients needed for health and a productive life. Chronic under nutrition affected about 603 million people in the sub-Saharan Africa between 1999 and 2001, representing 33 % of the population (SCN, 2004). One billion people, approximately 20% of the global population, live in households too poor to obtain food necessary for sustaining normal work. One out of every five persons in the developing world is chronically undernourished.

Lack of adequate monetary income is one particular characteristic that has an impact on the health and nutrition of any persons living in an urban environment. The low income urban populations of developing countries are faced with the problem of surviving in towns where income generation is difficult due to diminished employment rates and living costs are relatively high. Unless a family can generate adequate funds, their dietary intake is limited in both quantity and quality, all these due to the limitation of the families' ability to pay for food and health services.

1.1 BACKGROUND OF THE STUDY

Urban agriculture is the practice of cultivating, processing and distributing food in, or around (peri-urban), a village, town or city. Urban agriculture in addition can also involve animal husbandry, aqua-culture, agro-forestry and horticulture. These activities occur in peri-urban areas as well. Urban farming is generally practiced for income-earning or food-producing

purposes although in some communities the main impetus is recreation and relaxation Urban agriculture contributes to food security and food safety in two ways;

1. It increases the amount of food available to people living in cities.
2. It allows fresh vegetables and fruits and meat products to be made available to urban consumers.

A common and efficient form of urban agriculture is the bio intensive method. Because urban agriculture promotes energy-saving local food production, urban and peri-urban agriculture are generally seen as sustainable practices to enhance food security. Despite continued economic growth around the world, food insecurity remains a pressing problem in many parts of Africa. Cities in Sub-Saharan Africa (SSA) are growing at an exceptional rate of about 5% annually (Crush et al., 2006). The UN-HABITAT (2006) reports that the percentage of urban residents in SSA is expected to rise from 30% to 47% of the total population during the period lasting from 2005 to 2030 This will bring about new and critical challenges for urban development policy, especially in terms of ensuring household food security. It is acknowledged that as the world's urban population grows, so too does the population of the urban poor (Beall and Fox 2007).

The overall cost of supplying, distributing and accessing food is also likely to increase as the number of urban households that are food insecure is growing. Unlike in rural areas where most households derive their food requirements from agricultural production, food security in urban areas is market dependant as most households procure their food from the market. Against this backdrop, urban agriculture or food production conducted in or around urban regions seems to provide a realistic and pragmatic solution. Poverty in urban areas is affected by a particular combination of factors which tend to produce a wide range of vulnerabilities. The most important vulnerability involves urban poor dwellers who are more immersed in the

cash economy but earn incomes that are often erratic, unreliable and small (Smith 1998). The urban poor households, especially the female headed ones, are forced to prioritize their basic needs and food is normally one of them. Most of the urban poor receive incomes that are too low to purchase what they need for long-term survival and they spend most of their household budgets on food (Mitlin 2005). In 2008, the world food situation appeared to be in crisis, particularly in the developing world which is paralleled by high food prices and low food reserves. The FAO food price index of commodity prices surged 57% between March 2007 and March 2008 after a 9% increase in 2006. This has created negative implications for household food security of vulnerable groups (FAO 2008). Food crisis and unstable socio-economic environment make the urban poor tend to suffer the most as they lack sufficient income and consumption, lack access to employment and food and have inadequate services, including health and education.

1.1.1 Food Security and Nutrition

Ensuring food security and nutrition in Nairobi, Kenya is a critical challenge. Food security is understood to exist when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (Kodhek-Argwings, 1995). Food security encompasses food availability through production, storage or imports; and the access to food by people through their purchasing power in markets. Access derives from the entitlements a household has to food, either through own-production of foodstuffs or through command over food in markets or other circuits, decisions over the amount and kind of food produced or bought, the internal distribution of household food amongst residents, and the health of individuals which affects the ability to secure nourishment from food.

In Bagachwa's (1992) report, the main elements of food security and nutrition, which are understood to include adequate food availability, adequate food access, and appropriate food use and nourishment, are influenced by several national- or household-level attributes. Food availability and access are influenced by farm production and non-farm factors. The farm factors include farm resources (inputs) such as land and capital assets, research, and extension, while non-farm factors include infrastructural development and wage employment. Food security is further seen as a relationship between household food consumption (which depends on availability and access) on the one hand and household structure (attributes), national- and community-level factors, and farm and non-farm linkages on the other (Amani and Kapunda, 1990).

The concept of food security has been on the international agenda from as far back as 1948, when the Universal Declaration of Human Rights affirmed that "Everyone has the right to a standard of living adequate for the health and well-being of himself and his family, including food....." Article 11 of the International Covenant on Economic, Social and Cultural Rights went further, in 1966, when it affirmed the "right of everyone to be free from hunger". This right to food is even characterised as a "fundamental right" and is acknowledged as the primary economic right of a human being. This global concern heightened after the 1974 World Food Conference, when diminishing world food supplies and large-scale food shortages triggered responses in the international community that focused on increasing domestic agricultural production and creating international grain reserves. Food security was identified with commercial food prices and physical food availability, rather than with demand and consumption, especially by the poor and vulnerable (FEWS NET, 2009).

With the realisation that the problem of hunger has more to do with inequalities in distribution and that increased food production was only part of the solution, the concept of

food security has shifted from simply being a question of availability of food (at the national or even local level) to the more complex issue of access (at the household or individual level). The current definition, which incorporates issues of adequacy of food, supplies, stability of supplies and secure access to available supplies thus evolved. In 1986 the World Bank further added the dimension of activity level and defined food security as "secure access at all times to sufficient food for a healthy and active life" (World Bank 1986). At the household and individual level, the concept of adequate food is considered in both quantitative terms (i.e., caloric sufficiency) and, even more so, in qualitative terms (i.e., variety, safety and cultural acceptability). Similarly, household food security depends not only on the availability of an adequate and sustainable supply of food but also on the means employed by households to acquire the needed food.

1.1.2 Food Security and Urban Agriculture

The World Food Summit of 1996 defined food security as existing "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life". Commonly, the concept of food security is defined as including both physical and economic access to food that meets people's dietary needs as well as their food preferences. In many countries, health problems related to dietary excess are an ever increasing threat; In fact, malnutrition and food borne diarrhoea have become double burden.

Food security is built on three pillars:

a) Food availability: sufficient quantities of food available on a consistent basis.

b) Food access: having sufficient resources to obtain appropriate foods for a nutritious diet.

c) Food use: appropriate use based on knowledge of basic nutrition and care, as well as adequate water and sanitation.

Food security is a complex sustainable development issue, linked to health through

malnutrition, but also to sustainable economic development, environment, and trade For the poor urbanites in a cash intensive environment, low incomes, gender disparities, and lack of amenities are likely to propel them into food insecurity and poverty cycle (FEWS NET, 2009) One way to escape the cycle is for such households to engage in urban agriculture which has potential to address the three pillars of food security mentioned earlier. Regarding availability, urban agriculture has potential to ensure that supply to fresh food is consistently available to urban households. Urban farming households are able to produce their own food for household consumption and for sale. With income earned from the sale of urban agricultural produce; these households are able to mobilize resources to access appropriate foods for a nutritious diet. As regards food utilization, urban agriculture has the potential to ensure nutritional security through dietary diversity and intake of quality food, (Mitlin 2005).

1.2 PROBLEM STATEMENT

Mwiki is one of the two l ocations of Kasarani Division which is located in Kasarani District of Nairobi County. It's on the outskirts of Nairobi. The Division experiences chronic food and nutrition insecurity, due to low productivity associated with unreliable rainfall patterns, declining soil fertility, marketing problems and lack of capital for standardized farming. There is sound campaign from the Ministry of Agriculture, Livestock Development and other agencies through National Agriculture livestock extension programme (NALEP) to promote production and utilization of horticultural and underutilized crops such as sorghum, millet, cowpeas, cassava and sweet potatoes which are draught tolerant crops to help provide the population with proteins and micronutrients such as vitamins A, foliate, zinc and iron.

Majority of people practice subsistence agriculture and production has declined over the past years following recurrent droughts and declining of arable land to construction of commercial buildings and residential houses. Most of the population are poor and cannot afford food. There isn't a sustainable solution and households' food insecurity has therefore persisted in

the area. Information on the contribution of urban agriculture to food and nutritional security in the area is not known. Despite the relatively large number of studies on urban agriculture in Kenya, the information is largely qualitative. Principal studies that have been done on urban agriculture in the country include: Mbiba (1994). The main problem is that the contribution of urban agriculture in the study area is not known.

1.3 JUSTIFICATION OF THE STUDY

The area of study has been selected because it is one of the divisions that most benefited from the promotion of growing of drought tolerant food crops and keeping of small ruminants (rabbits) and poultry compared to other divisions in the District. The NALEP initiative has in the past received considerable funding but evidence of enhanced household food security is scanty.

There is therefore need to assess the contribution of the agricultural activities being promoted by NALEP and continued efforts by the government and other stakeholders in supporting and promoting the growing and consumption of vegetables food crops and livestock such as poultry and rabbits to improve households' livelihood, provide employment and provide food security and improved nutrition to the people. The results of the study will also be useful in helping in the evaluation of the project and at the same time help the government to develop programmes in urban agriculture. The results will be used by the government and other stakeholders to put more funds and other elements in improving urban agriculture so as to improve provision of food and nutrition to all city dwellers.

1.4 AIM OF THE STUDY

The aim of the study was to help establish the contribution of urban agriculture to low income households in a low rainfall peri-urban area.

1.5 PURPOSE OF THE STUDY

The purpose of the study was to contribute to information on the importance of urban agriculture in contribution to food and nutritional security, and livelihoods of urban and peri-urban dwellers.

1.6 GENERAL OBJECTIVE

The general objective was assessing the contribution of urban agriculture to food and nutritional security in low income families in peri-urban area of Mwiki Location of Kasarani Division Kasarani District.

1.7 SPECIFIC OBJECTIVES

1. To assess the socio-demographic and socio-economic characteristics of the study households.
2. To determine the extent of food production from urban agriculture.
3. To assess the household food sufficiency in the study area.
4. To determine the dietary intake of protein, energy and vitamin A in the households.
5. To establish the coping mechanisms employed during periods of scarcity.

1.8 HYPOTHESIS

Urban Agriculture among low-income households in Mwiki contributes significantly to their food and nutrition security.

CHAPTER TWO: LITERATURE REVIEW

2.1 URBAN AGRICULTURE

2.1.1 Definition of urban agriculture

The Food and Agriculture Organization of the United Nations (FAO), has defined urban agriculture as: An industry that produces, processes and markets food and fuel, largely in response to the daily demand of consumers within a town, city, or metropolis, on land and water dispersed throughout the urban and peri-urban area, applying intensive production methods, using and reusing natural resources and urban wastes to yield a diversity of crops and livestock (FAO, 2008).

Urban agriculture has also been defined as an industry that responds to the nutritional demands of a city, from within that city, with the use and reuse of that city's resources while acknowledging economic and resource use does not reconcile aspects of regional health, food security, and application of grassroots organizations. This definition is based on the work of Luc Mougeot of the International Development Research Centre and used in technical and training publications by UN-HABITAT's Urban Management Programme, FAO's Special Programme for Food Security, and international agricultural research centres, such as CIRAD (USAID, 1992).

Urban agriculture is the practice of cultivating, processing and distributing food in, or around (peri-urban), a village, town or city. Urban agriculture in addition can also involve animal husbandry, aquaculture, agro-forestry and horticulture. These activities occur in peri-urban areas as well. Urban farming is generally practiced for income-earning or food-producing purposes although in some communities the main impetus is recreation and relaxation Urban

agriculture contributes to food security and food safety in two ways: first, it increases the amount of food available to people living in cities, and, secondly, it allows fresh vegetables and fruits and meat products to be made available to urban consumers (Arimond and Ruel, 2004). A common and efficient form of urban agriculture is the bio-intensive method. Because urban agriculture promotes energy-saving local food production, urban and peri-urban agriculture are generally seen as sustainable practices to enhance food security (USAID, 1992).

The recognition of environmental degradation within cities through the relocation of resources to serve urban populations has inspired the implementation of different schemes of urban agriculture across the developed and developing world. From historic models such as Machu Picchu to designs for new productive urban farms, the idea of locating agriculture in or around the city takes on many characteristics (FAO, 2002).

2.1.2 History of Urban Agriculture

Community wastes were used in ancient Persia to feed urban farming (Arimond and Ruel). In Machu Picchu water was conserved and reused as part of the stepped architecture of the city and vegetable beds were designed to gather sun in order to prolong the growing season Allotment gardens came up in Germany in the early 19th century as a response to poverty and food insecurity. Victory gardens sprouted during WWI, WWII and were fruit, vegetable, and herb gardens in US, Canada, and UK. This effort was undertaken by citizens to reduce pressure on food production that was to support the war effort. Community gardening in most communities are open to the public and provide space for citizens to cultivate plants for food or recreation. (MOA/MOLD, 2004). A community gardening program that is well-established is Seattle's P-Patch. The grass roots Permaculture movement has been hugely

influential in the renaissance of urban agriculture throughout the world.

2.1.3 Status of Global Urban Agriculture

Fifty percent of the world's population lives in cities. 800 million people are involved in urban agriculture world-wide and contribute to feeding urban residents. Low income urban dwellers spend between 40% and 60% of their income on food each year. By 2015 about 26 cities in the world are expected to have a population of 10 million or more. To feed a city of this size, at least 6000 tonnes of food must be imported each day (MOA/MOLD, 2004).

The Council on Agriculture, Science and Technology, (CAST) is an international consortium of scientific and professional societies based in Ames Iowa that compiles and communicates credible science-based information to policy makers, media, private sector, and the public. CAST defines urban agriculture to include aspects of environmental health, remediation, and recreation. Urban agriculture is a complex system encompassing a spectrum of interests, from a traditional core of activities associated with the production, processing, marketing, distribution, and consumption, to a multiplicity of other benefits and services that are less widely acknowledged and documented. These include recreation and leisure; economic vitality and business entrepreneurship, individual health and well-being; community health and well being; landscape beautification; and environmental restoration and remediation (GOK/ UN, 2002).

Modern planning and design initiatives are more responsive to this model of urban agriculture because it fits within the current scope of sustainable design. The definition allows for a multitude of interpretations across cultures and time. Frequently it is tied to policy decisions to build sustainable cities (WHO/FAO, 1996).

2.1.4 Urban agriculture and food security

Access to nutritious food is another perspective in the effort to locate food and livestock production in cities. With the tremendous influx of world population to urban areas, the need for fresh and safe food is increased. Community Food Security Coalition (CFSC) defines food security as, all persons in a community having access to culturally acceptable, nutritionally adequate food through local, non-emergency sources at all times (USAID, 1992).

UPA (urban and peri-urban agriculture) expands the economic base of the city through production, processing, packaging, and marketing of consumable products. This results in an increase in entrepreneurial activities and the creation of job opportunities, as well as in food costs reduction and products of better quality (Hatloy et al.,1998). UPA represents an important opportunity for women to be part of the informal economy of a city. Farming and selling activities can be combined more easily with household tasks and child care.

UPA provides employment, income, and access to food for urban populations, which together contributes to relieve chronic and emergency food insecurity. Chronic food insecurity refers to less affordable food and growing urban poverty, while emergency food insecurity relates to breakdowns in the chain of food distribution. UPA plays an important role in making food more affordable and in providing emergency supplies of food (Arimond and Ruel, 2004). Research into market values for produce grown in urban gardens has attributed to a community garden plot a median yield value of between approximately $200 and $500 (US, adjusted for inflation In a community gardening program as well-established as Seattle's P-Patches, this can account for up to 1.25 million dollars of produce cultivated annually (Bonnard, 2001).

2.2 CONSTRAINTS IN URBAN AGRICULTURE

Space is at a premium in cities and is accordingly expensive and difficult to secure. The use of waste water for irrigation without careful treatment and monitoring can result in the spread of diseases among the population. Cultivation on contaminated land also represents a health hazard for the consumers. The practice of cultivating along roadsides facilitates the distribution of products to local markets, but it is also a risky practice since it exposes food to car fuel pollution (from lead fuels like petrol and diesel). Agriculture and urbanization are considered to be incompatible activities, competing for the access and use of limited land. In reality, in urban areas there is important available space for agriculture use such as public and private vacant lots, and areas not suited for built-up uses (steep slopes and flood plains). Legal restrictions and economic impediments to accessing land and resources and lack of security of tenure acts as impediments to urban farming. Urban agriculture has been criticized by those who believe that industrial farm production can produce food at larger volumes more efficiently (FAO, 1999).

A major argument is whether urban farming alone - farming very intensively on small land areas - could replace land extensive production in rural areas which produce the bulk of our food products. Yet hunger persists in both urban and rural areas despite a subsidized industrial agriculture (KARI, 1998). The degree to which urban agriculture can address these food needs systemically is undetermined, though there are indications in some communities that it is an important source of food.

Other opponents argue that localized food production and the introduction of common resources and common lands into the urban areas would produce a tragedy of the commons As referenced earlier, many urban farms and community gardens are managed privately or

through other civil society organizations.

Municipal greening policy goals can pose conflicts. For example, policies promoting urban tree canopy are not sympathetic to vegetable gardening because of the deep shade cast by trees. However, some municipalities like Portland, Oregon, and Davenport, Iowa are encouraging the implementation of fruit bearing trees (as street trees or as park orchards) to meet both greening and food production goals (MOA, 2005).

2.3 FOOD AND NUTRITIONAL SECURITY: CONTRIBUTION OF URBAN AGRICULTURE

The World Food Summit of 1996 defined food security as existing "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life". Commonly, the concept of food security is defined as including both physical and economic access to food that meets people's dietary needs as well as their food preferences. In many countries, health problems related to dietary excess are an ever increasing threat; In fact, malnutrition and food borne diarrhoea have become double burden.

Food security is built on three pillars:

Food availability: sufficient quantities of food available on a consistent basis.

Food access: having sufficient resources to obtain appropriate foods for a nutritious diet.

Food use: appropriate use based on knowledge of basic nutrition and care, as well as adequate water and sanitation.

Food security is a complex sustainable development issue, linked to health through malnutrition, but also to sustainable economic development, environment, and trade. There is a great deal of debate around food security with some arguing that:

There is enough food in the world to feed everyone adequately; the problem is distribution.

Future food needs can - or cannot - be met by current levels of production.

National food security is paramount - or no longer necessary because of global trade.

Globalization may - or may not - lead to the persistence of food insecurity and poverty in rural communities.

Issues such as whether households get enough food, how it is distributed within the household and whether that food fulfils the nutrition needs of all members of the household show that food security is clearly linked to health.

Agriculture remains the largest employment sector in most developing countries and international agriculture agreements are crucial to a country's food security. Some critics argue that trade liberalization may reduce a country's food security by reducing agricultural employment levels. Concern about this has led a group of World Trade Organization (WTO) member states to recommend that current negotiations on agricultural agreements allow developing countries to re-evaluate and raise tariffs on key products to protect national food security and employment. They argue that WTO agreements, by pushing for the liberalization of crucial markets, are threatening the food security of whole communities (WHO/ FAO/UNU, 1985).

2.4 THE STATUS OF URBAN AGRICULTURE IN KENYA

Kenya's leading development challenges today include alleviation of poverty and environmental management in the context of rapid population growth and urbanization. Kenya's population was 28.6 million people in 1999 and is expected to reach 43 million in the year 2020. According to the government statistics, the national level of absolute poverty increased from 44% in 1992 to 56% in 2002 (GoK 2002). Nairobi has registered the highest rate of urbanization (4.5%) with a population of 2.2m in 2000 projected to reach 3.2m in the year 2010. About 50% of people in Nairobi live below the absolute poverty line of Ksh. 2

648. As the urbanization trend continues, urban environments are deteriorating. Most of the urban poor are concentrated in the informal settlements where there are no infrastructure and services to address environmental problems and are engaged in urban agriculture. One of the biggest policy challenges today is the inclusion of environmental policy into urban policy. UPA can be an integral part of a set of policies for sustainable urban environmental management. Urban AF can play an especially vital role in waste management by transforming waste into food and fuel. Waste management approaches in place include waste collecting, sorting, treatment and recycling at the community level in corporation with local organizations. A national study of six Kenya towns including Nairobi revealed that 29 per cent of all urban households cultivated food crops while 17 per cent kept livestock (Lee-Smith *et al*, 1987). Urban agriculture is widespread and long established activity in Nairobi, however, it is still undervalued and resisted by public officials.

Urban and peri-urban agriculture encompasses the production of food and non-food plants and animal husbandry both within and in the peri-urban areas. The benefits of UA include: potential to provide cheap, fresh and nutritious food; less need for packaging, storage and transportation of food; reduced cost of waste collection, treatment and disposal as well as open public space maintenance and environmental protection; potential to create agricultural jobs and incomes and; non-market access to food for poor consumers. Environmental benefits of urban agriculture include improved hydrological functioning through soil and water conservation, micro-climate improvements, avoided costs of disposal of the recycled urban wastes (wastewater and solid waste), improved biodiversity, and greater recreational and aesthetic values of green space. Despite the benefits of UA, the risks of injury to health and environmental pollution are greater than those for rural agriculture for two reasons: the urban farming systems are more intensive, and their proximity to dense human population makes mistakes or failures more costly and risky: Thus UPA system must be designed more

carefully and monitored more stringently. However UA is illegal in most towns in Kenya. Where it exists, in spite of the law, it is unregulated and its safety therefore not assured (FAO, 1999).

The risks of urban agriculture includes, environmental and health risks from inappropriate agricultural practices. In urban areas the control needs to be more stringent because farming is in close proximity to dense human activities. However enforcement may be easier to carry out because the activities are not dispersed in remote areas and are more accessible to hygiene specialists.

CHAPTER 3: STUDY SETTING AND RESEARCH METHODOLOGY

3.1 STUDY AREA AND POPULATION

The area of study is Mwiki location, Kasarani District. The district has four Divisions namely, Kasarani Division, Githurai Division, Ruaraka Division and Roysambu Division. Kasarani Division has 3 locations; Mwiki location, Clay city location and Kasarani location Mwiki location which is the area of study has two sub-locations namely; Mwiki Sub location and Gitueko Sub-location. Mwiki Area per square km^2 is 18.8, Density 2,084. Population: male 28,637, Female 32,679, total 61,316 and Household 17,712.

3.1.1 Topography and Climatic Conditions of Mwiki Location

The location is generally low lying with two rivers boarding it on the North Kiuu River and on the South Gitatheru River. It rises from 780 to 2100 meters above sea level. The rainfall received is erratic and ranges from 900 to 1400 mm per year. The rainfall pattern is bimodal with the long season being in March to May and the short rain season from October to December. The temperature range is between 19^0C and 30^0C. Type of soils is mainly four namely clay soils, murram soils and red soils and sandy clay soils.

3.1.2 Farming systems

About ½ of the available land is used for Agricultural production. The average size of land is 50m x 50m and out of this ½ of the plot is used for cultivation of horticultural crops and for keeping of animals. Mainly dairy cattle's Rabbits and poultry and pigs. The main farming system is subsistence and its usually intensive farming. Food crops grown are mainly horticultural crops like kales, spinach, *amaranthus solaanum* spp, cat's whiskers and also coming up are underutilized crops like cassava, sweet potatoes and arrowroots. Maize and

beans are also grown but in very small quantities along the river banks. Multistorey gardens are used mainly to grow vegetables both for sale and home consumption.

3.1.3 Health Facilities and sanitation

Mwiki location has 12 established private health facilities. There is no public health facility in Mwiki but there is one in Kasarani location and this is what services the community. Common diseases in the area are malaria and typhoid HIV is also prevalent in the area The level of access to safe drinking water is high since there is access to piped city council water.

3.1.4 Education Facilities

Mwiki location has two public primary schools and five private day care centers with no public secondary school. There is no tertiary school in the region (GOK, 2008).

3.2 STUDY METHODOLOGIES

3.2.1 Study Population

The study population consisted of households who practice urban agriculture either fulltime or part time and not in salaried employment.

3.2.2 Study Design.

The researcher used a descriptive cross-sectional survey among 260 households between July and October 2011. The study consisted of a household survey which involved collecting socioeconomic demographic information as well as food frequency table and the coping mechanisms used during times of food scarcity and farming activities involved A pre-tested structured questionnaire and focused group discussion were used as the survey tools for the study.

3.2.3 Sampling Frame

The sampling frame consisted of all households which practiced urban agriculture.

3.2.4 Sample size determinations.

The sampling unit was the household. The fischer's formulae (Fischer, *et al.*, 1991) was used to calculate the sample size.

$n = Z^2 pq/d^2$, where:

n = the desired minimum sample size

z = statistically certainty chosen at 1.96 corresponding to 95% confidence interval

d = desired accuracy 6% (0.06)

p = estimated prevalence of food insecurity=32.9% for Nairobi province (CBS, *et al.*, 2004)

q = 1-p

$n = Z^2 pq/ d^2$

$n = 1.96^2*0.329*0.671 /0.06$

= 236

10% Attrition =24 households

Hence n = 236 households + 10% (236)

n = 260 households.

The sampling unit was the households.

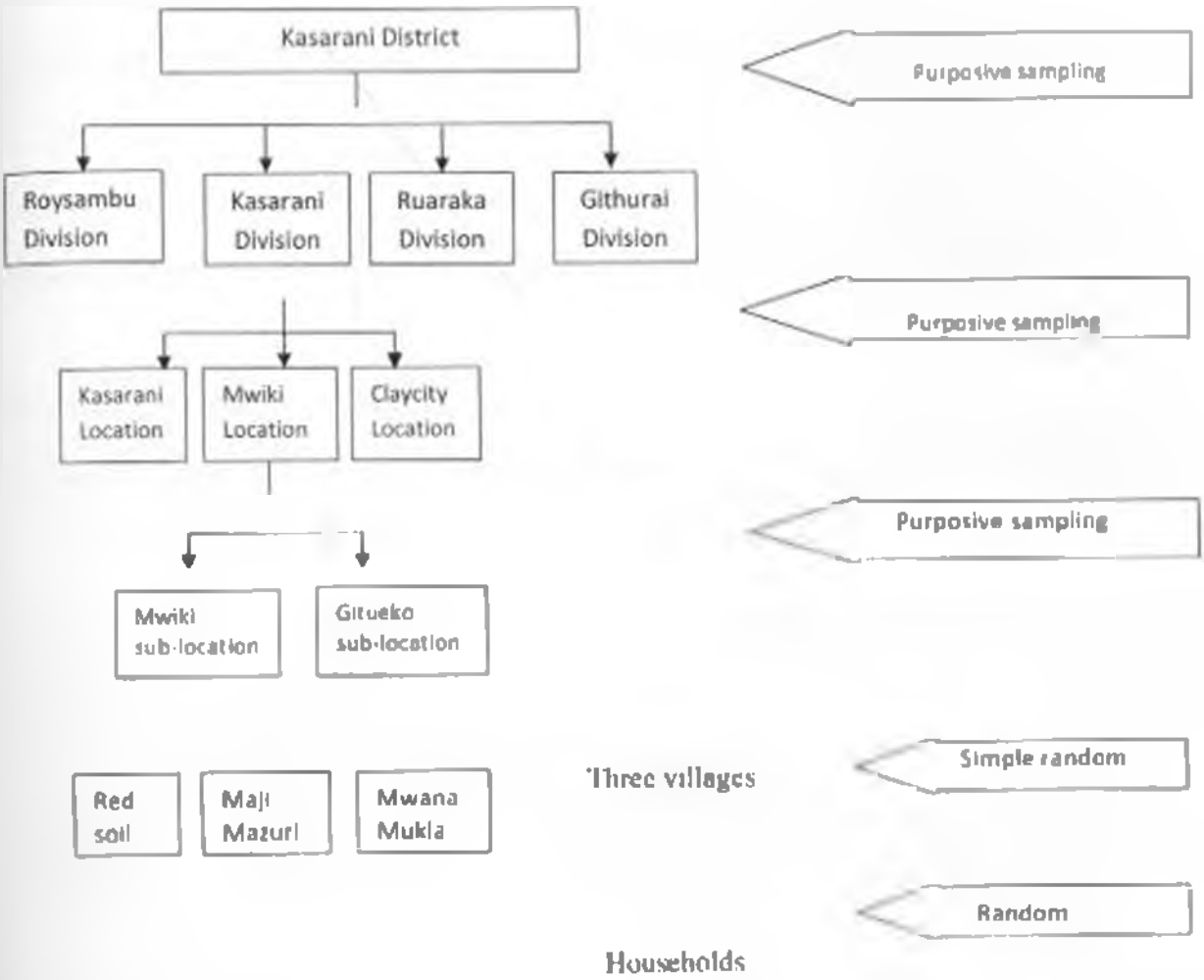

Figure 1.1 Sampling procedure

Mwiki location was purposively selected as its the location in the district which benefited most from National Agriculture and Livestock Project which was started by the government to promote urban and peri- urban agriculture. The sub-locations and villages were purposively selected as indicated in figure 1:1 above and an equal sample size was selected from each village.

3.3 DATA COLLECTION

3.3.1 Data Collection Tools.

i. Close (Structured) questionnaire

A pre-tested structured questionnaire was used to obtain information on the social demographic, social economic characteristics of the households, agricultural production, food consumption patterns and coping mechanisms employed during times of food scarcity.

ii. Focus group discussion question guide.

A question guide was developed that helped collect data on crop production, animals production, and challenges household face in coping with food and nutrition insecurity.

3.3.2 Data Collection Procedures.

Recruitment and training of field assistants.

With the help of the Assistant Chief and headmen in Mwiki location four field assistants were recruited, the field assistants were locals who came from different tribes so that there was a fair representation and were high school leavers so as to be able to understand easily how to conduct the excise.

A two day training session for the field assistants was conducted. The training was on questionnaire administration techniques, dietary diversity assessment, and general working ethics. This training ensured that there was similar understanding of the questionnaire and harmonized interviewing process.

Pre-testing of questionnaire

The questionnaire was pre-tested with a small sample size of about 15 households in one selected villages and necessary corrections were made before the main data collection period.

Demographic and socio-economic data

The data on household composition, education level, marital status, occupation and residence entail status was collected by using the close ended structured questionnaire. Household income was determined by asking how much money is spent on food, school fees, clothing, farm wages, animal treatment and Artificial insemination, wages, medical care on weekly, monthly or annual basis.

Agricultural data

By using structured questionnaire respondents provided both qualitative and quantitative data on crop and animal production in terms of type of farming conducted, yields, utilization of underutilized crops and no of animals and type kept yields of frequency of scales and amount. Secondary data was obtained from district and divisional Agriculture offices

Food consumption data

Tools /equipment that were used in collecting the data were structured questionnaire, weighing scales cylinders, cups, plates and spoons. A pre-marked survey was conducted in the study area to determine the type of food sold in the area and the local units of measurements after which a weight conversion table was developed to enable use of metric units. A 24 hour recall method was used in order to ask the respondent to recall all foods consumed by the household in the last 24 hours preceding the study in terms of quantity, and the characteristic of each food. This was used to assess the household energy and protein adequacy, iron, zinc and foliate intake.

The amounts of ingredients were estimated using household measures. The adequacy of the diet in terms of dietary energy and adequacy protein were calculated using consumer units in

reference to adult male of 20 -29 years whose requirement is estimated to be 2960 kcal and 50 grams of protein per day (WTTO/FAO/UNI, 1985).

A food frequency checklist, consisting of food commonly eaten in the study area was developed. The respondent were asked to indicate the typical frequency of consumption of each food item and frequency check list included crops that were grown by the farmer and are used frequently. The check list is used to determine the food preferred and whether they are produced by the respondent or purchased.

Household dietary diversity score was used to compute four food items that are consumed one day preceding the study. All foods consumed were grouped into 12 different food groups namely, fruits, vegetables, meat, poultry offal ,eggs fish, pulses .legumes ,milk/milk products, rice, wheat (millet, sorghum cassava, sweet potatoes arrow roots products. Each of the food groups from which at least one of the food items was consumed was given a sore of either "1" or a value "O". The dietary diversity score per household was obtained by summing the scores of the different food groups consumed .Household dietary diversity score range was 0 to12.

Focus group discussion

Two focus group discussions were conducted. One group consisted of 8 women and the other consists of three headmen from each village involved in Urban agriculture and also growing of underutilized crops. In each case there were people practicing intensive urban Agriculture and those less involved in urban agriculture.

The discussion was conducted with the help of a moderator and a question guide. The main issues of discussion included, major sources of income, crops grown, animals kept and source

of food consumed. Factors affecting agricultural production and coping strategies during food shortages were also discussed. The assistant recorded all the proceedings. The results of the focus group discussions are integrated in the relevant sections of this dissertation.

3.3.3 Ethical and human considerations

The researcher visited the administration office at the District Commissioner's and District Agricultural Office to seek for permission or research permit prior to carrying out the survey. The process included introducing the proposed study and explaining its purpose, objectives and activities that will be conducted. Verbal consent was sought from the respondent All the tools that were applied throughout the research such as questionnaire and food consumption household measures were non-invasive. At the same time, verbal informal consent was obtained from all the respondents before the commencement of the study. Adequate training of the field assistants was done in order to keep the interests of the respondents throughout the data collection period. All the data collected was treated with utmost confidentiality throughout the process and feedback to the community was factored in the study protocol.

3.4 DATA QUALITY CONTROL

1) **Minimizing biases**

   Standardization tests were done every morning prior to field work. The respondents were informed of the study objectives and its purpose in order to reduce the respondents bias.

2) **Reviewing of the questionnaires**

   The questionnaires completed each day were cross-checked for any anomalies. The principal investigator examined the questionnaires in the field to check for completeness, accuracy in recording the measurements, consistency of the answers as well as correct filling of the questionnaires. Any errors encountered during the cross checking of the

questionnaires were corrected immediately. If the questionnaires were incomplete or the data collected looked suspicious the households were revisited for clarification.

3) **Supervision**

All the activities during the study period were closely monitored and supervised. The presence of the principal investigator throughout the study; supervising and participating in some activities such as dietary frequency recall. These together with the availability of the supervisors from the University of Nairobi supervised the fieldwork and also provided technical assistance that ensured high quality data.

4) **Data Entry**

Before the data entry a data entry template was developed by the principal investigator in consultation with a biostastician. Data entry was then done using SPSS (12.0.1) by the principal investigator immediately after data collection.

3.5 DATA ANALYSIS

After completion of the study open ended questionnaires were coded. Data was then entered and cleaned using statistical packages for social sciences (SPSS).The data is on all foods grown and harvested, purchased and received as gifts and translate them into kilograms of edible portions and into calories and grams of protein per consumer unit using food composition tables for foods commonly eaten in Kenya.

Consumer units for each household was calculated and depressed as proportion of the daily requirement of 2960 kcal/cu/day and 50 gm/cu/day for calories and protein respectively based in WHO/FAD /UNU (1985) recommendations. A food group scored one (1) if one of the food item consumed had come from the farm. The highest DDS is 12.While the lowest is O. All variables were run and tabulated. The variables for each objective were defined and

coded for ease of analyzing the data. Frequencies mean, standard deviations, percentages were determined.

To determine significant association between variables chi-square and correlation coefficient tests are used after doing descriptive and correlation analysis of various variables that gave significant relationships. They were then analyzed to show the contribution and influence of the selected independent variables on the outcome variables.

CHAPTER FOUR: RESULTS

4.1 SOCIO-ECONOMIC STATUS

This section shows the socio-economic status of the respondents in the survey.

4.1.1 Type of roofing

Majority of the respondents (90%) indicated that they used iron sheet roofing for their housing while a small percentage 10% said that they used tiles for the roofing. And others used slab and concrete for their roofing .This is as exemplified by the table below.

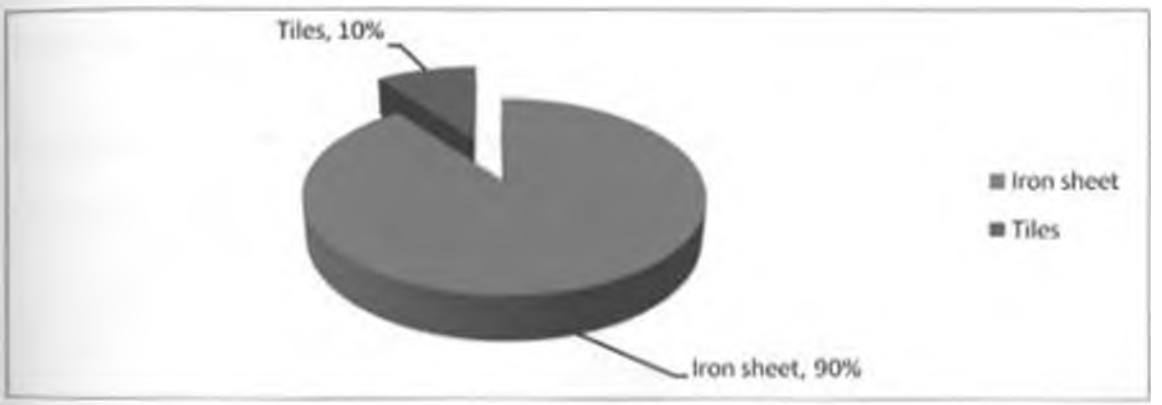

Figure 1.2 Type of Roofing

4.1.2 Type of wall

According to the findings, 83% indicated that their walls were of concrete while 13% said that their walls were wooden. Only 1% pointed out their walls were of mud. Three percent of the respondents indicated that their houses had other types of walls.

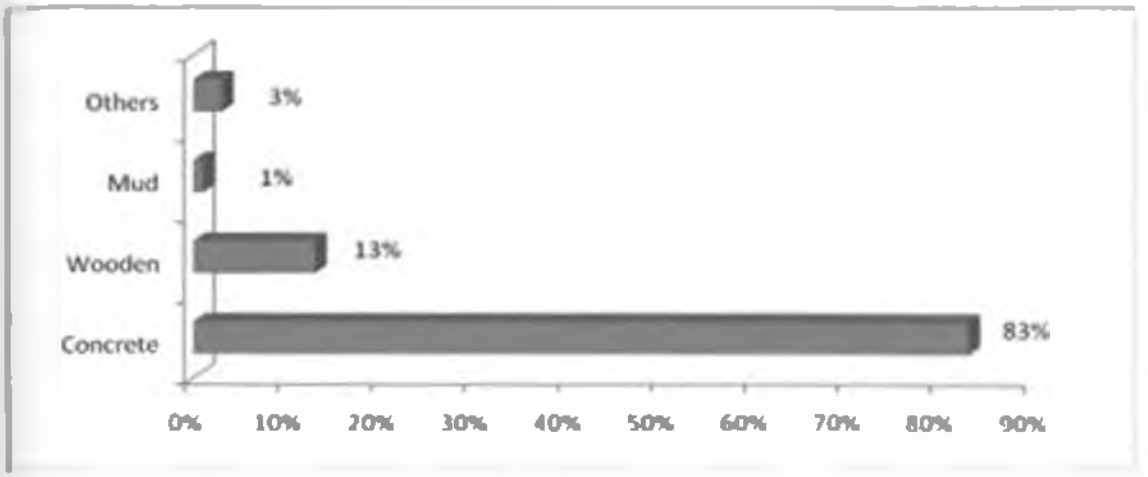

Figure 1.3 Type of Wall

4.1.3 Type of floor

The study established that majority (92%) indicated that their floors were made of concrete while 5% said that they were of mud. Only 3% indicated that they had other types of floors.

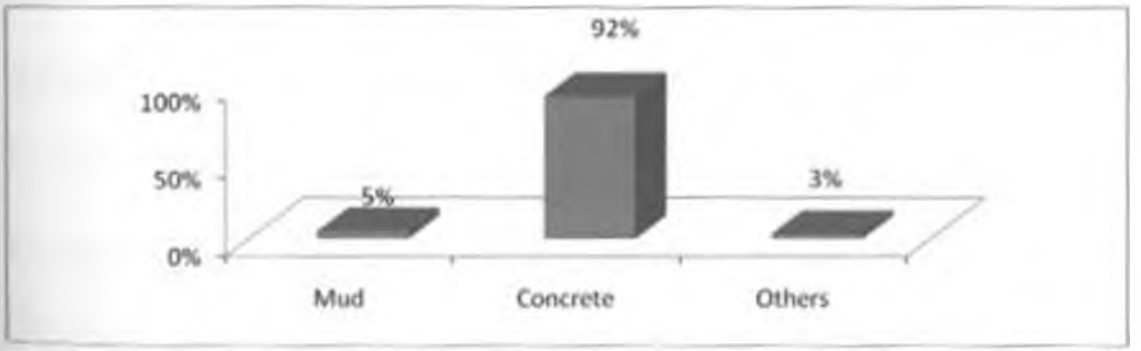

Figure 1.4 Type of Floor

According to the survey, 81.2% of the respondents indicated that they were parents while 2.7% represented the children. Notably 2.3% and 1.9% were relatives and brothers/sisters to the household owners respectively. Further, 11.9% indicated that they held other relations to the household.

4.1.4 Occupation of the respondents

The study established that majority (55%) were in business while 24% said that they were farmers. Further 9% indicated that they were housewives while 5% said that they were drivers. Only 3% pointed out that they were students/pupils. Four percent indicated that they held other occupations apart the one mentioned above.

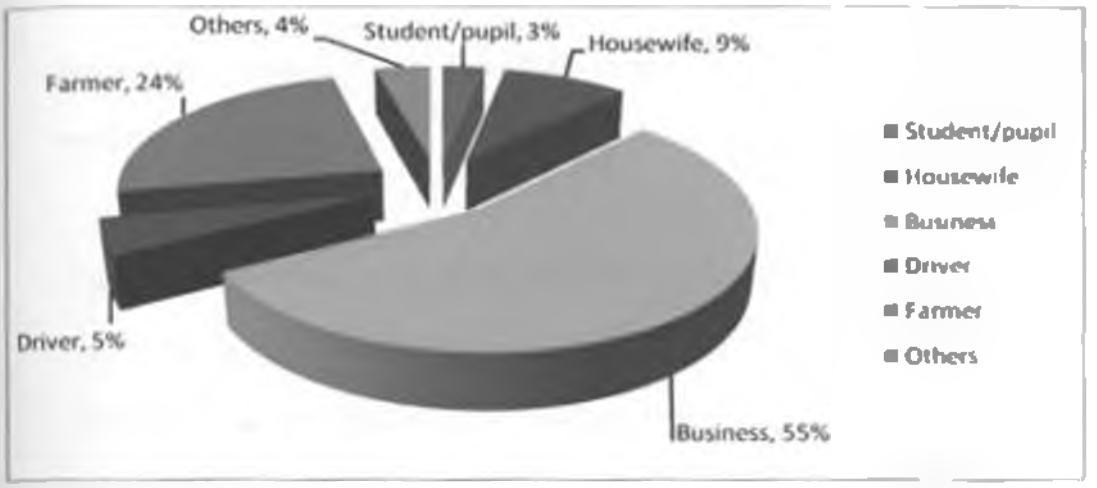

Figure 1.5 Occupation

The study shows that majority of the residents 99% were urban residents while 1% were in the rural residence.

4.1.5 Occupation

This section shows the occupation that the respondents held.

Land Owned

The study established that of the few who responded, majority indicated that they owned ½ acre while others indicated that they owned ¼ acre. Further some revealed that they owned 100 by 75 ft while others owned 75 by 75 ft. On the other hand the least indicated that they had 50 by 50 ft.

Farming

Majority of the respondents (78%) were fulltime farmers while 22% were farmers engaged in other activities.

Businesses

The respondents engaged in businesses such as hoteliers, fish mongers, and accountants, bar owners, casual workers and salonists. On the other hand some indicated working as laboratory technicians, masons, plumbers, software technicians, supermarket attendants and welders.

The study showed that most of the respondents (60%) main farming activity was poultry keeping while 56% indicated that they engaged in dairy farming. On the other hand 55% and 58% engaged in crop production and vegetable farming respectively. Those who were into livestock keeping and rabbit keeping were 42% and 44% respectively. Further 38% and 34% indicated that their main farming activities were cassava growing and multistorey gardens

4.1.6 MAIN FARMING ACTIVITIES

The table 1.1 shows all the farming activities that are carried out in the study area

Table 1.1: Main farming activities

	Yes	
	Frequency	**Percentage**
Poultry keeping	155	60
Dairy keeping	146	56
Crop production	143	55
Vegetable farming	152	58
Rabbit keeping	108	42
cassava growing	100	38
multi-storey garden	88	34
livestock keeping	114	44

N=260

The different kinds of food that are grown are for different reasons therefore the table 1.2 shows how the different kinds of foods are used in the community.

4. 1.7 Purpose of crop grown

Table 1.2: Purpose of the Crop Grown

	Sale		Food		Sale and food		not in production	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Kales	25	9.6	56	21.5	33	12.7	146	56.2
Spinach	18	6.9	35	13.5	12	4.6	195	75.0
Avocado	14	5.4	21	8.1	8	3.1	217	83.5
Onions	12	4.6	29	11.2	10	3.8	209	80.4
Maize	10	3.8	17	6.5	16	6.2	217	83.5
Tomatoes	11	4.2	31	11.9	8	3.1	210	80.8
Arrow roots	8	3.1	12	4.6	2	.8	238	91.5
Sweet potatoes	9	3.5	15	5.8	2	.8	234	90.0
Cabbages	9	3.5	11	4.2	3	1.2	237	91.2
Dania	5	1.9	14	5.4	2	.8	239	91.9
Potatoes	6	2.3	9	3.5	6	2.3	239	91.9
Green pepper	8	3.1	9	3.5	4	1.5	239	91.9
Carrots	2	.8	12	4.6	5	1.9	241	2.7
Cassava	10	3.8	11	4.2	7	2.7	232	89.2
Bush okra	2	.8	13	5.0	3	1.2	242	93.1
Beans	7	2.7	8	3.1	10	3.8	235	90.4
Pumpkins	3	1.2	12	4.6	3	1.2	242	93.1
Black nightshade	4	1.5	11	4.2	8	3.1	237	91.2
Amaranthus	5	1.9	10	3.8	6	2.3	239	91.9
Cow peas	5	1.9	12	4.6	4	1.5	239	91.9
Local vegetables	13	5.0	14	5.4	13	5.0	220	84.6
Irish potatoes	5	1.9	10	3.8	3	1.2	242	93.1
Sorget	3	1.2	8	3.1	4	1.5	245	94.2
Sorghum	5	1.9	5	1.9	6	2.3	244	93.8
Capsicum	8	3.1	5	1.9	4	1.5	243	93.5

The study showed that most of the respondents (9.6%) indicated that they grew kales for sale while 21.5% said that they grew kales for food, in addition 12.7% admitted that they grew kales for sales and food. Further 6.9% pointed out that they grew spinach for sale while 13.5% admitted that it was for food purposes. A few of the respondents 4.6% indicated that spinach was grown for both sale and food. The study found out that 5.4% said that avocado was grown for sale while 8.1% pointed out it was grown for food, meanwhile a marginal of 3.1% said that it was grown for both sale and food. In addition the least grown crops for sale were cowpeas, black night shade and sarget as indicated by 1.2% Further 4.6% said that cowpeas was grown for food while 1.2% pointed out it was grown for food and sale. Nevertheless 2.3% indicated that black night shade was grown for sale and both sale and food respectively. Moreover 3.1% agreed that sarget was grown for food while 1.5% said that it was grown for both sale and food.

Table 1.3: Order of Importance

	Consumed at hh level		Sold		Fed to livestock		Fed to children as weaning diet	
	Frequency	%	Frequency	%	Frequency	%	Frequency	Percentage
Cassava	130	50	62	24	28	11	40	15
Millets	106	40	65	25	43	17	46	18
Sorghum	114	44	63	24	39	15	44	17
Bulrush millets	70	27	74	28	28	11	80	34

N=260

Table 4.3 shows the order of importance of the crops produced. The survey showed that most of the respondents 50% admitted that cassava was consumed in the household while 41% agreed that millets was consumed in the household. Nevertheless 44% pointed out that sorghum was consumed in the household while 34% indicated that bulrush millets fed to children as weaning diet.

According to the findings, 82% disagreed that they preserved the food crops while only 18% admitted that they preserved the food crops that they grew.

4.2 SOCIO DEMOGRAPHIC CHARACTERISTICS

4.2.1 Relations of a respondent to the household

The relation to the household of the respondent is shown in figure 1.6.

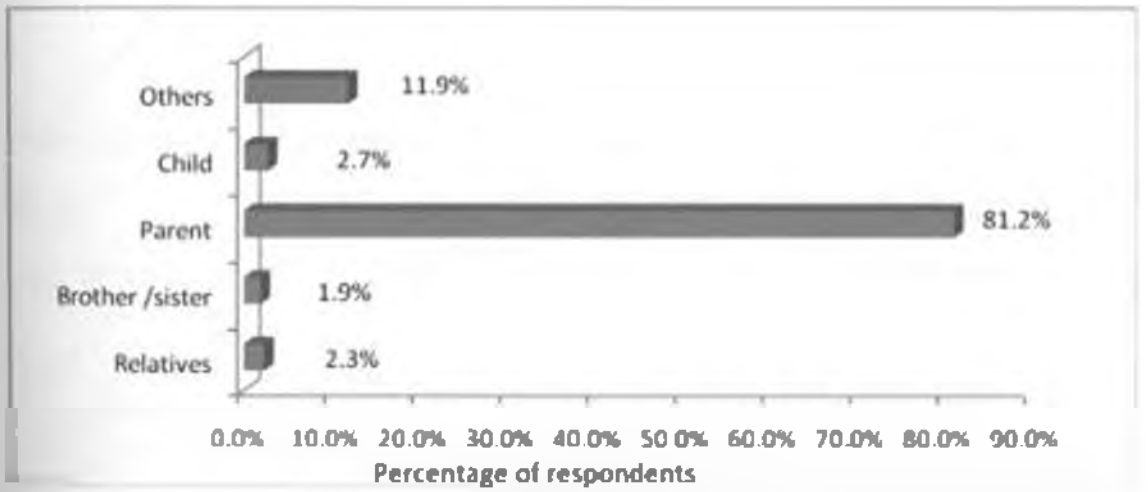

Figure 1.6 Relations to the Household

4.2.2 Gender of the respondents

The study shows that out of the 260 respondents , 62% were male while 38% were female as indicated in(figure 1:7).Gender equity was lacking in the survey.

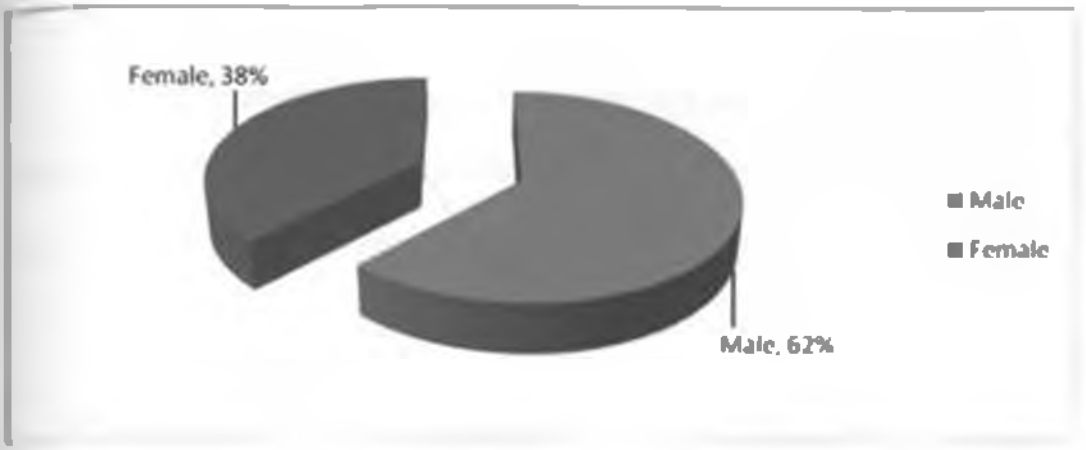

Figure 1.7 Genders of the Respondents

4.2.3 Age of the respondents

The survey established that most of the respondents 45% were in the age group 21-30 while 32% were between the ages of 31 and 40 years. Meanwhile 12% fell between the ages of 41-50 years while 4% were between the ages of 51.60 years. This shows most of the respondents were in their dynamic age

Table 1.4: Distribution Age of the Respondents

Years	Frequency	Percentage
0-20	5	2
21-30	118	45
31-40	82	32
41-50	31	12
51-60	13	5
61-70	11	4

(n=260) mean=43.3

4.2.4 Marital status of the respondents

Majority of the respondents (58%) indicated that they were married while a marginal of 29% stated that they were single. On the other hand 6% pointed out that they were separated while 4% were widowed. Further 3% stated that they were divorced.

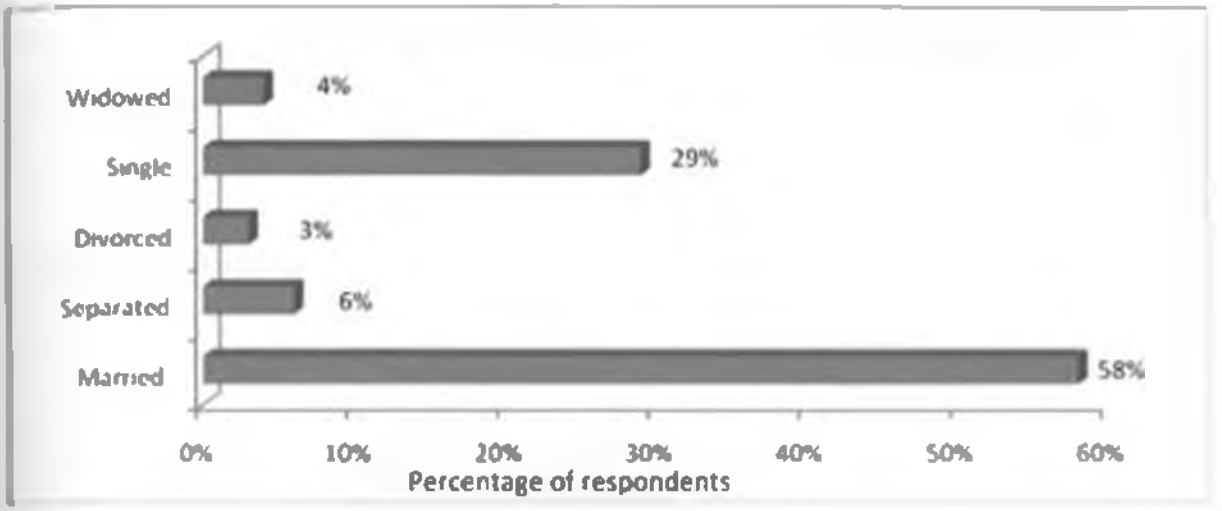

Figure 1.8 Marital Status

4.2.5 Education level of respondents

According to the findings, 62% of the respondents had attained university/college education, 27% were in their secondary level. On the other hand 6% said that they were in upper primary while 3% stated that they were in lower primary. Only 2% indicated that they were in their pre-unit level. These results are shown in figure 1.9.

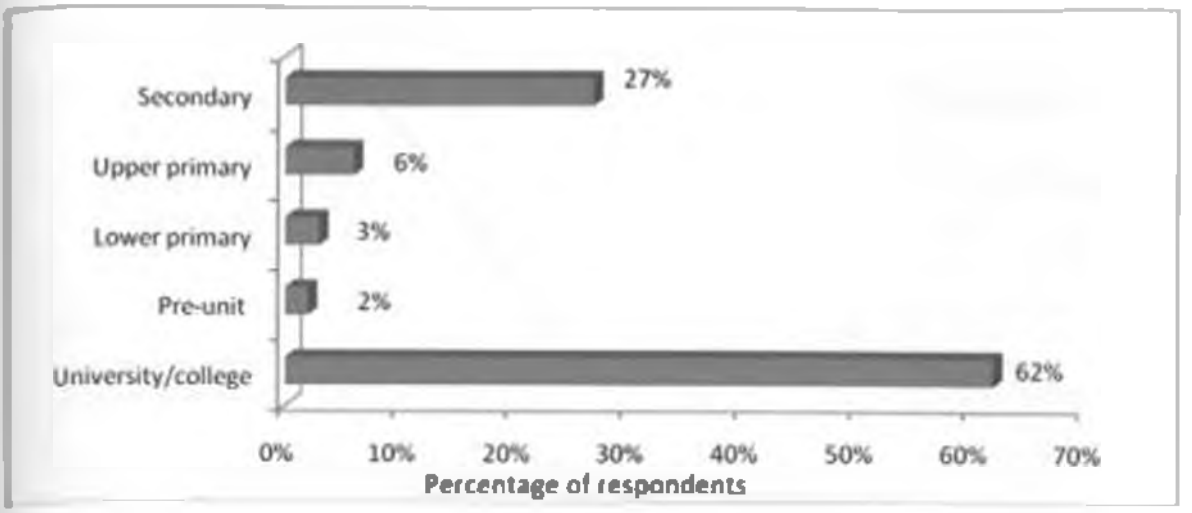

Figure 1.9 Educational Level

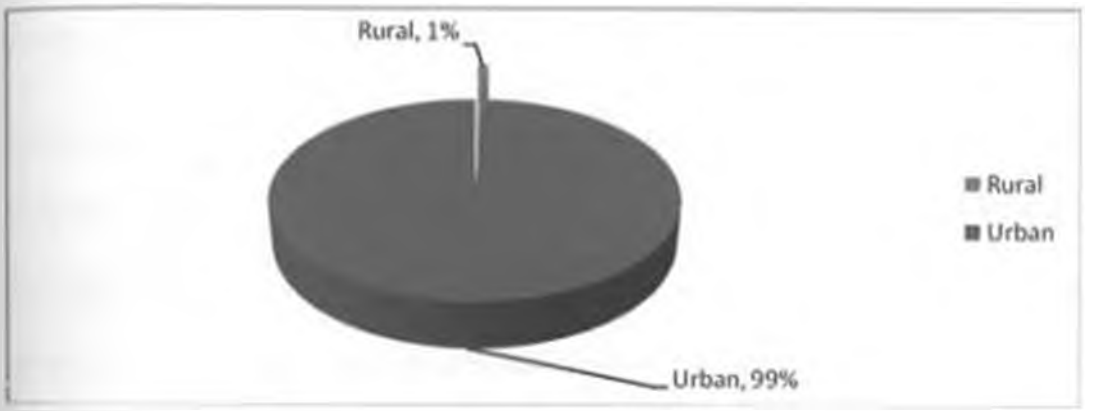

Figure 1.10 Residence

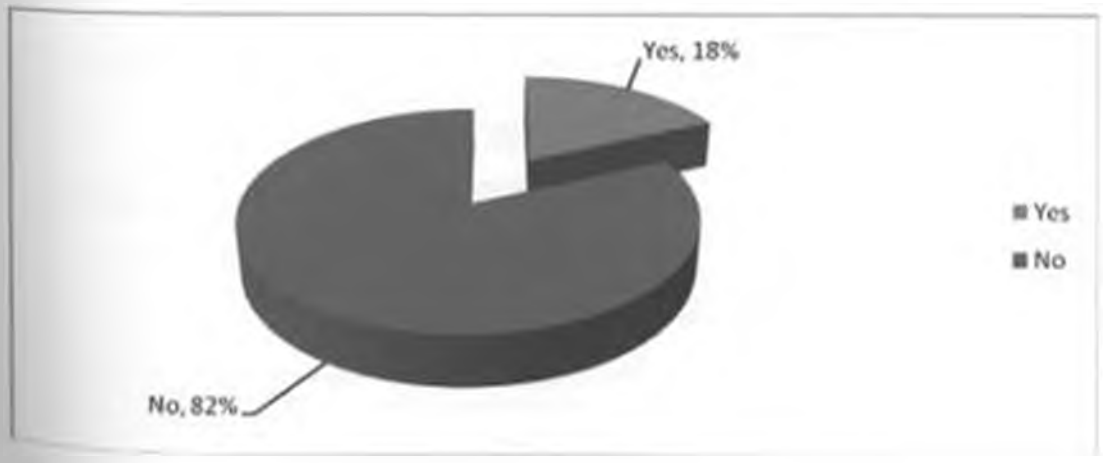

Figure 1.11 Preservation of food

Table 1.5 Preservation of the food

	Smoking		Pesticides		Drying		Processed and stored in other forms	
	F	%	F	%	F	%	F	%
Legumes and cereals	71	27	117	45	72	28	-	-
Root crops	47	18	46	18	70	27	97	37

The survey shows that most of the respondents 45% indicated that legumes and cereals were preserved by pesticides while 27% admitted that root crops were preserved by drying as shown on (Table 1.5).

Thirty five percent of the respondents indicated that their main source of income was business while 16% said that their source was sale of labor (Figure 1.12). In addition 16% pointed out that their source of income was sale of animals. Further 10% said that their main source of income was sale of drought tolerant food crops. Nevertheless 25% of the respondents indicated that they had other sources of income apart from the ones mentioned. Moreover some indicated that they reared piglets, others were employed while some grew crops. In addition some sold crops, milk and fish while others sold welding items.

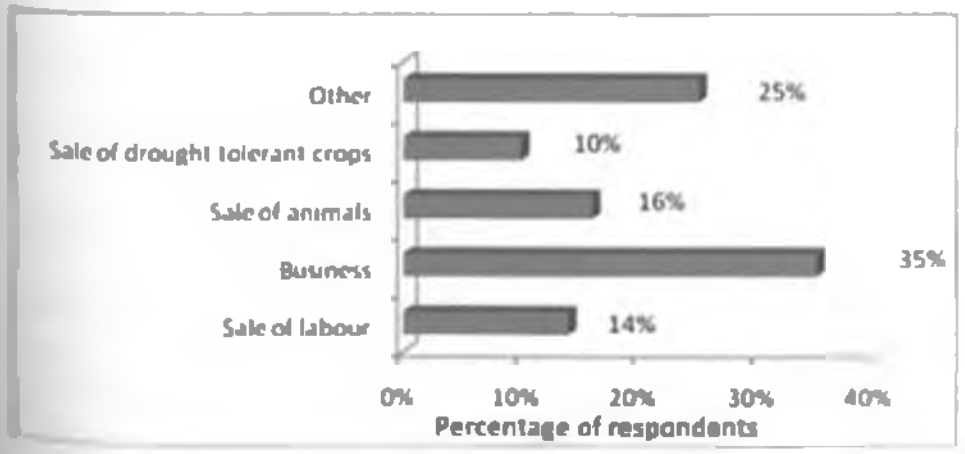

Figure 1.12 Main source of Income

4.3. FOOD SECURITY STATUS

Results show the majority of the respondents, 97% of the households were getting sufficient food either from own production or from purchases (Figure1.13). Only 3% of the respondent; households indicated that they depend most of the time on unreachable food aid. It is indicated that 17% of the families attained their food solely from own production. However, even among these who are indicated as getting their food from purchases there are those who get food from own production in kitchen gardens. Then there are 17% of them who indicated that they get their food from own production.

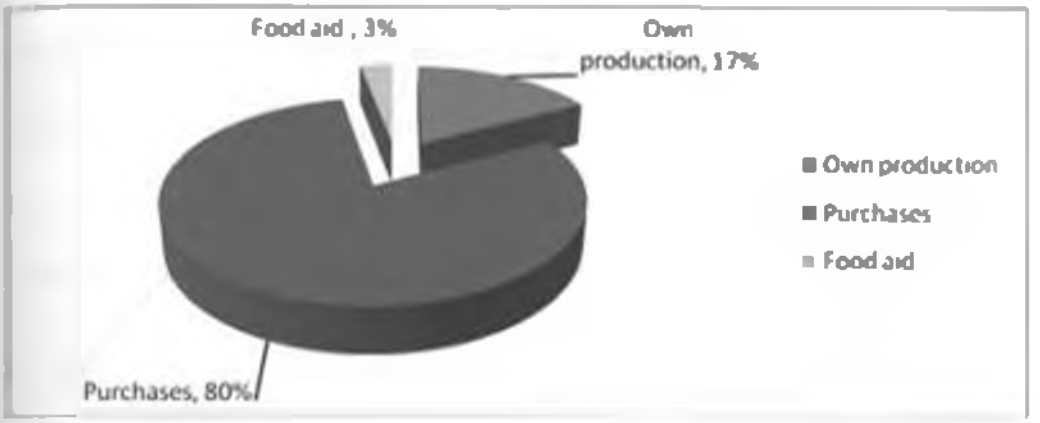

Figure 1.13 Main Source of Food

Table 1.6: Correlation between number of meals per day and Uptake of various types of Foods

Variables	Correlation coefficients with number of meals/day
Cereals	0.002**
Roots and Tubers	0.182
Plants Proteins	0.136
Animal Proteins	0.024*
Vegetables and Fruits	0.018*

**. Correlation is significant at the 0.01 level

*. Correlation is significant at the 0.05 level

The survey shows that there was a significant correlation between number of meals per day and cereals as shown by a co-efficient (0.002). On the other hand, the survey shows there was a significant relationship between animal proteins, vegetables and fruits with number of meals per day as shown by correlation co-efficient (0.024 and 0.018) respectively. However, there was a insignificant relationship between roots and tubers with number of meals per day as shown by a coefficient of 0.182.

This implies that in a day's meal, majority of the respondents consumed cereals (Maize products, millet products, sorghum products, wheat products); plant proteins (beans, cowpeas, pigeon peas, green grams, black beans); animal Proteins (beef, eggs, milk, fish) and vegetables and fruits (Kales, cowpeas leaves, cabbage, Spinach, tomatoes, pawpaw, oranges, ripe bananas among others). However, roots and tubers (cassava, sweet potatoes and arrowroots) rarely formed part of a day's meal.

Majority of the respondents (56%) indicated that they took three meals in a day while 23% said that they took two meals in a day. On the other hand only 1% pointed out they took one meal in a day.

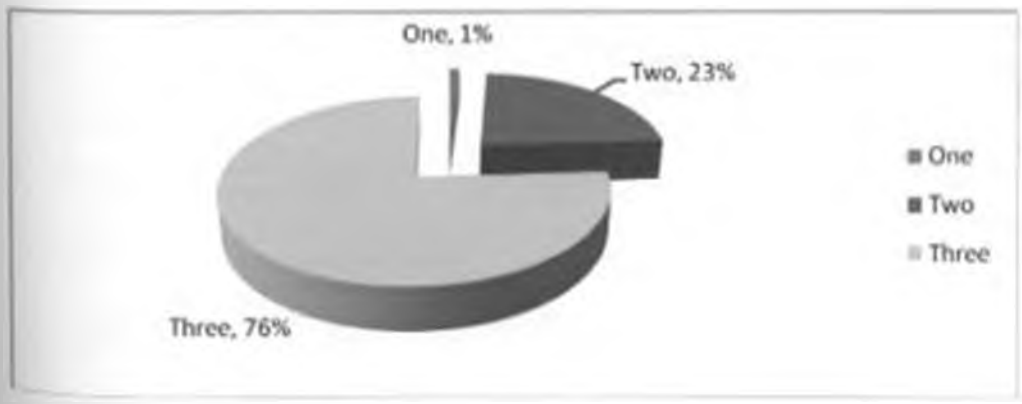

Figure 1.14 Meals Consumed per day

The study shows that 72% of the respondents agreed that they always had enough food for all the members in the household while a few 28% disagreed that there was enough food for members in the household.

Coping mechanisms

Table 1.7: Correlation between Coping Measures and Food Sufficiency

Coping Measures	Food Sufficiency
Sale of assets	0.387
Reduce the meal size	0.042*
Reduce the frequency of meals	0.008**

The study shows that there was a positive and significant relationship between reducing the frequency of meals and food sufficiency as shown by p= 0.008; and between Reduce the meal size and food sufficiency as shown by p = 0.042. The study further showed a positive but insignificant relationship between sale of assets and food sufficiency as shown by p =0.387. This implies that reduction of the frequency of meals served best as a coping measure to ensure food sufficiency in the household

Table 1.8: Measures taken to cope with Food Shortage

	Frequency	Percent	P-value
Sale of assets	75	28.8	0.387
Reduce the meal size	111	42.7	0.042*
Reduce the frequency of meals	74	28.5	0.008**

Forty two percent of the respondents admitted that they had reduced the meal size as a measure to cope with the food shortage. Further 28.8% indicated that they engaged in sale of

assets as a measure to cope with food shortage. In addition 28.5% said that they reduced the frequency of meals as a measure to cope with the food shortage.

Table 1.9: Correlation between demographic characteristics and dietary intake of protein, energy, vitamin A

Variables	dietary intake of protein, energy, vitamin A
Type of Floor	0.126
Occupation	0.012**
Age	0.028*
Type of Wall	0.385
Type of Roofing	0.425

The study shows that there is positive and significant relationship between occupation of the respondents and the dietary intake of protein, energy, vitamin A. There is also a positive correlation and significant relationship between dietary intake of protein, energy, vitamin A and Age of the respondents. However, the study shows a positive but insignificant relationship between dietary intake and type of roofing, type of wall and type of floor. This means that, occupation and age determined a lot about the dietary intake of protein, energy, vitamin A.

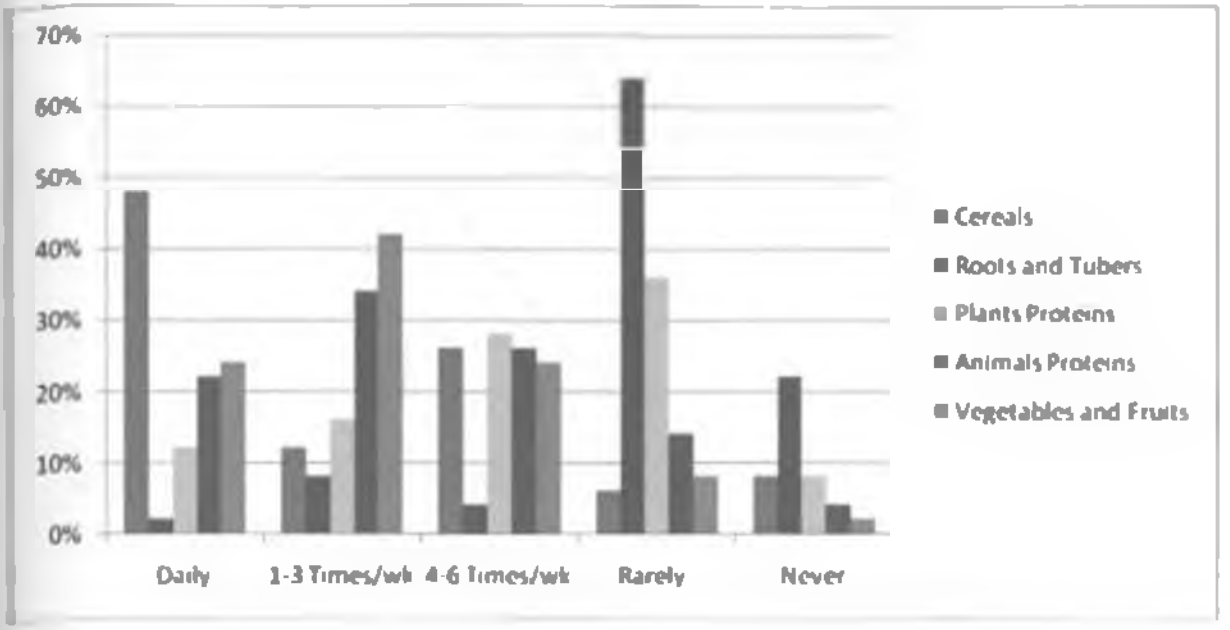

Figure 1.15: Frequency of Consumption

In summary, 48% of the respondents revealed that they consumed cereals (Maize products, millet products, sorghum products, wheat products) daily while 64% revealed that they consumed roots and tubers (cassava, sweet potatoes and arrowroots) rarely. The survey also found out that 36% of the respondents consumed plants proteins rarely while 34% indicated that they consumed animal proteins 1-3 times a week. On the consumption of vegetables and fruits, 42% revealed that they consumed 1-3 times a week while 24% consumed daily

Nutrient adequacy

For both Nutrient adequacy ratio and Mean adequacy ratio, a value of 100% is the ideal since it means that the intake is the same as the requirement. Table 1.10 shows Mean adequacy ratio (iron, zinc and vitamin A) and Nutrient adequacy ratio for iron, zinc, vitamin A, energy and proteins for the study group. Protein and iron had an average Nutrient adequacy ratio of at least 100 percent. Vitamin A, zinc and energy had the lowest Nutrient adequacy ratio's less than 50 percent.

Table 1.10: Nutrient Adequacy ratios of selected nutrients

Variable*(%)	Mean	SD
NAR Vitamin A	35.71	35.44
NAR Iron	117.6	64.8
NAR Zinc	24.1	33.8
NAR (Vitamin A, Iron, Zinc)	59.16	31.0
NAR Protein	138.57	71.3
NAR Energy	31.2	18.7

*NAR= Nutrient adequacy ratio

NAR percentage was significantly at ($p>0.05$) between the male and female respondents.

Association between Individual Dietary Diversity Scores and Nutrient Adequacy

The mean nutrient intakes for all the people as expressed by NAR correlated positively with their individual dietary diversity scores for all the nutrients considered. The correlation coefficients for Energy, Proteins, Vitamin A, Iron and Zinc were, 0.198, 0.081, 0.102, 0.076 and 0.065 respectively. Only the correlation between energy adequacy and IDDS was significant ($p<0.05$).

Table 1.11: Relationship between Individual Dietary Diversity Scores and Nutrient Adequacy Ratios for energy, protein, vitamin A, iron and zinc and Mean Adequacy Ratio

	Individual Dietary Diversification Scores	
Variable*(%)	**Correlation coefficients**	**P-Value**
NAR Vitamin A	0.102	0.131
NAR Iron	0.076	0.261
NAR Zinc	0.065	0.331
NAR (Vitamin A, Iron, Zinc)	0.081	0.227
NAR Protein	0.198	0.003**
NAR Energy	0.126	0.061

** Statistically significant at $p<0.05$.

4.4 FOCUSED GROUP DISCUSION

The discussion was held at Mwiki using a group that consisted of 12 male farmers and 12 female farmers. The results were that many people in Mwiki practiced urban farming and are experiencing the problem of lack of rainfall and poor quality seeds and unstreamlined marketing channels. They also came up with the issue of farm land diminishing due to commercial building which have come up. The two rivers which are there Maji Mazuri and Kiuu river are polluted by the people up stream so the water cannot be used for irrigating the crops.

They also cited the problem of the youth who are not taking up urban farming which should help them improve their standard of living and occupy them to reduce incidences of drug and substance abuse.

Coping strategies in case of drought come up as use of drought tolerant crops like cassava and sorghum and bulrush millet and also cow peas. Casual labour was another coping strategy and also sale of livestock. Discussions from the focus groups revealed that casual labour was not readily available in the area

On what can be done to improve food security in the area it came out that the government should enact new by laws allowing farmers to utilize open government land and also to provide high quality seeds cheaply and provide irrigation water to horticultural farmers

The challenges facing utilization of vegetables and other crops grown is lack technical knowhow on value addition techniques to improve the prices and nutritive quality of the grown crops.

CHAPTER FIVE: DISCUSSION

5.1 INTRODUCTION

The main objective of the study was to determine the contribution of urban agriculture to food and nutrition security to the low income households of Mwiki location of Kasarani district of Nairobi county. The study also assessed the socio-demographic and socio economic characteristics of the study households and was seeking to determine the extent of food production from urban agriculture and also determine the dietary intake of protein, energy, vitamin A, zinc and iron in the households. These were generated as a measure of dietary diversity for each adult according to a methodology recommended by FAO(2007). This chapter discusses the results in chapter 4 in view of the objectives and hypothesis that were advanced for this study.

5.2 SOCIO DEMOGRAPHIC AND SOCIOECONOMIC CHARACTERISTICS.

The higher proportion of the respondents in the study population were males as compared to females. This is contrary to the general trend of most urban populations where females are more than males. These results are however in line with the findings of the district's second report of poverty that reported 51.8% males (GOK, 2002b). Majority of the household heads are married while a few are single, widowed or divorced. This is expected in the study population since most of those who participated were young couples.

High levels of education in the study population is indicative of the fact that the study population is able to easily comprehend the importance of quality and nutritious food and access to family planning services which help in getting a small family size thus reducing chances of having a large family size which poses a challenge in getting enough of expensive protein foods according to KDHS 2003 (CBS,et al,2004).

About 60% of the households derive their income from casual labour from construction sites and also from horticultural farms and these are seasonal due to rainfall pattern experienced These findings are similar to those of studies done in Nairobi Kariobugi area (Mwangi,2008) where engement in casual labour was found to be an indicator of food and income insufficiency(GOK,2003b).

The mean monthly income per household is Ksh. 920 which is relatively low as compared to the findings of Welfare Monitoring Survey 111 in 1997 that was Ksh 1239 per adult per month (GOK,2002).

5.2.1 AGRICULTURAL PRODUCTION

5.2.1.1 Agricultural land size

While the main source of food for the study household is from purchases, the mean land under cultivation is small. The land size is much less than that required to produce calories adequate for average household size of 6.3 in the area. As a result, households are not able to produce adequate food for their members throughout the year. At least five acres are required to produce the required calories (F.A.O 1986).Land size poses a challenge not only to crop production but also to livestock rearing. More than half of the study population keep small livestock such as poultry, rabbits, dairy goats and some keep dairy cows. This is probably due to small land size and lack of sufficient pasture. Most of the land is a plot size of 75 by 75 feet which results to very small land holdings. The results are however in line with the findings of the districts' second report on poverty that reported 51.8% males (GOK,2002b).The proportion of female headed households in the study is only one third(10.6% compared to 35.8%)of that reported in Nairobi county (CBS, et al, 2004) and about half of that reported in the districts second report on poverty (GOK, 2002).Majority of the households heads are married followed by single, separated and widowed and the least

population were divorced. This is expected in the study population since most of the study population are young people who have settled in the area.

The higher proportion of respondents in the study population have acquired university education and this is followed by those who acquired secondary education and others have reached upper primary, lower primary, and pre-unit. This shows that the population can understand better issues of food and nutrition security.

The results on housing conditions indicate that most houses are made using modern materials such as concrete and tiles as roofing materials. These results are similar to those in other urban areas in Kenya (CBS, 2002).However few have mud floors and wooden walls which indicates that the household heads have low sources of income.

5.3. AGRICULTURAL PRODUCTION

5.3.1 Agricultural Land Size

The main source of food for the study household is from purchases and only 17% are able to get food from own production. The mean acreage land under cultivation is small. The land size is much less than that required to produce calories adequate for average household size of 5.3 in the area. As a result, households are not able to produce adequate food for their members throughout the year. At least five acres are required to produce the required calories (FAO, 1986).Land size poses a challenge not only to crop production but also to livestock rearing. More than half of the study households do not rear big livestock but keeps rabbits, poultry and daily goats this mainly due to the small land size.

5.3.2 Preservation of Food

Majority of the respondents admitted that they did not preserve food crops the reason being that they did not produce enough for immediate consumption and storage this due to the fact that they rely on rain fed farming and their farm size is small. The fact that majority of the households do not preserve food is a clear indication that there is no food stored in the study household leading to food insufficiency.

5.3.3 Main Source of Food

According to the results the main source of food was purchases while others got food from their own production. In addition only few people had their main source of food from aid from the government and Catholic Church. The situation is however like this because the mean yield of the most common crops in the study area is lower than the average production in the district (MOA, 2003a). The low yields are attributed to low and unreliable rainfall in the study area. Another reason is that people get poor quality seeds. Also high cost of inputs leads to lack affordability by the study population who are not well off financially. Another reason is could be that crops are intercropped in small pieces of land with limited use of inputs resulting to low production. This is similar to the findings in studies in Colombia (Cock, 1985) where intercropping was found to reduce yields drastically.

5.3.4 Coping Mechanisms

Most of the respondents indicated that in the months of food scarcity they reduced the meal size as a measure to cope with the food shortage. They also said that they engaged in sale of assets as a measure to cope with food shortage. They also indicated that they reduce the frequency of meals as a measure to cope with the food shortage.

Discussions from focused groups revealed that erratic rainfall, lack of space and poor quality seeds were some of the challenges that led to lack of enough food. On the other hand they cited economic pressure/hardships and lack of casual labor.

5.4 DIETARY DIVERSITY

Studies have shown that food diversity defined as the number of different individual food items or food groups, provides an inexpensive and reliable indicator of food accessibility at the household level(FANTA, 2003).As the results show the households have access to a variety of foodstuff. This is due to the fact that the study population gets their food stuff, fruits and vegetables from Nairobi county markets which receive their food from all over Kenya. This means that the households are meeting their recommended dietary needs for both protein and energy.

5.4.1 Dietary Intake of Energy and Protein

In the study population, maize, beans and cowpeas are the main sources of protein and energy. This is so because these are the crops grown and most preferred. This implies that diversity of foods consumed, a factor often considered as an indicator of dietary adequacy (FANTA, 2003), is low. The results however, indicate that most households met their energy and protein requirements during the study period. This could be attributed to the fact that the households purchase their food crops from the county markets which receive food from all over Kenya in the 24hours preceding the study, some of which were still available for consumption. In addition, data collection was done between August and October a period indicated by households not to experience food shortage as severe food shortage is experienced between January and February.

The negative effect of household size on nutrient adequacy especially for protein could be attributed to low production of legumes hence low amounts available and especially for the larger families. Low purchasing power among the study households also means that there is higher probability to purchase cereals that are cheaper as compared to the protein sources.

Drought tolerant food crops are found to contribute little in terms of dietary intake, especially for energy. This is because the production and subsequent utilization of these crops, especially of drought tolerant, cereals and root tubers, is less preferred and low.

5.4.2 Determinants of Nutrient Adequacy

Significant factors predicting energy adequacy are expenditure on food, coping mechanisms and the number of meals per day. The coefficient estimation of expenditure on food indicates a positive effect on energy adequacy. This implies that, increased expenditure on food increases calorie intake. More purchases are done for energy sources that are cheap than protein sources in urban low-income households.

Coping mechanism adopted during food shortage have a negative effect on the energy adequacy. This could be due to the fact that some of the mechanisms result in either reduction of the meal size consumed or reduction of the number of meals and hence households may not be able to meet their requirements. Sale of assets as a coping mechanism promotes energy adequacy unlike other strategies in the study population.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The study general objective was to determine the contribution of urban agriculture to food and nutrition security to the low income households of Mwiki location of Kasarani districts of Nairobi County.

Different conclusions can be drawn from the study findings.

The residents in Mwiki location engage in urban agriculture to a very large extent which amounts to 78% being farmers yet they are not able to obtain food for own consumption from their farms they rely on purchases to a large extent Fast growing vegetables were planted these are consumed by the residents themselves and at times commercially traded at a very small scale in the local markets mainly in the low income. Therefore, helping the families of Mwiki location to practice urban agriculture is a viable option to increase the availability of food in the households. Urban agriculture could serve as an income generation activity for the residents of Mwiki Location and an important source of food and nutrition security and livelihood.

In terms of food requirements, there is insufficiency of roots and tubers such as cassava, sweet potatoes and arrowroots in the day's meals as compared to cereals such as maize products, millet products, sorghum products and plants proteins (beans, cowpeas, pigeon peas, green grams, *dolicoslablab* (black beans) which were consumed regularly in the households. Insufficiency of roots and tubers which also fall under the drought tolerant foods may also be as result of low farming of these crops as compared to vegetables and livestock farming. This implies that during drought season, food shortage increases due to low rate of farming of drought tolerant foods.

Given the circumstances, the residents at Mwiki location own small pieces of land that hinder them from engaging in large cultivation of crops. Those who are currently planting on public land in Mwiki could at any time be deprived of the patches of land on which they grow vegetables and other crops for their daily consumption. It would be ideal if the government backed by community leaders would legalize such agricultural practices and help these growers with schemes that promote the management and maintenance of community led urban agriculture. In addition to increasing food security, being involved in the production of one's own fresh food gives people a sense of ownership and increases their self-esteem.

Food shortage was experienced in the months of January, February and October due to erratic rainfall, poor methods of farming and lack of enough land for cultivation. However, the study established that the respondents employed coping mechanisms during periods of scarcity such as sale of assets, reduce the meal size, reduce the frequency of meals.

The results showed that there is an increase in nutrient adequacy with an increase in dietary diversity of food intake. Although a simple count of food groups cannot give a full picture of the adequacy of the nutrient intake, the results from the study show that the food scores can give a fairly good assessment of the specific nutrient adequacy of the diet, particularly energy and protein. Residence of Mwiki location should be encouraged to keep more of livestock since it earns them more money which can be used to buy food stuff leading to food and nutrition security and more so because these occupy less space.

6.2 RECOMMENDATIONS

For future research and monitoring of programs this study recommends the following:

There is need to help the families of Mwiki location to practice urban agriculture since it is a viable option to increase the availability of fruits and vegetables in the city. Urban agriculture

could serve as an income generation activity for the residents of Mwiki Location and an important source of food security and livelihood.

The government backed by community leaders should legalize agricultural practices on public land and help these growers with schemes that promote the management and maintenance of community led urban agriculture. In addition to increasing food security, being involved in the production of one's own fresh food gives people a sense of ownership and increases their self-esteem.

City authorities need to start allocating plots of manageable size to the residents at Mwiki location, and provide support in the form of tools and water. Irrigation schemes and harvesting of water should be encouraged among the community members to curb the vice during periods of dry weather. The nearby rivers should be properly managed so that safe irrigation of agricultural land is possible.

More extension officer should be employed to assist farmers by giving them quality technical packages on urban farming which should include wet gardens, multistory gardens, hanging gardens which can increase food production leading to food sufficiency thus food security.

There is also need for people to be trained on value addition skills where they can learn vegetable preservation, cake baking, peanut butter making, jam making, juice making and other trades which can help fetch more money from their food produce.

REFERENCES

ACC/SCN (2004). Nutrition and millennium development goals. A periodic review of development in international 28:7-33.

Amani, H.K.R. and S. Kapunda (1990). "Agricultural Market Reform in Kenya: The Restriction of Private Traders and its Impact on Food Security," in M. Rukuni, G. Mudimu and T. Jayne (eds.), Food Security Policies in the SADCC Region. Nairobi:

Bagachwa, M.S.D. (1992). "Choice of Technology in Small and Large Firms: Grain Milling In Kenya, "World Development, 20, 1: 97-107.

Beall J, Fox S 2007. Urban Poverty and Development in the 21st Century: Towards an Inclusive and Sustainable World. Oxfam Paper, United Kingdom: Oxfam GB. P. 5

Crush J, Frayne B, Grant M 2006. Linking Migration, HIV/AIDS and Urban Food Security in Southern and Eastern Africa. From <http://www.ifpri.org/renewal/pdf/UrbanRural.pdf>

D M Nyariki: June 2007, Kenya position paper on The Horn of Africa Initiative on Tackling Food Insecurity,

FAO (2000). Roots and tubers, plantains and bananas in human nutrition. Rome: Food and Agriculture Organisation

FAO (2006). The state of food insecurity in the world. Food insecurity: when people must live with hunger and fear starvation.(Rome: FAO. National food and nutrition policy Draft, February 2009).

FAO/WHO (1998). Major issues for Nutrition Strategies. International Conference on Nutrition. Theme paper No. 3. Rome: FAO and WHO.

FEWS NET 2009. Zimbabwe Food Security Outlook: October, Urban Agriculture in Low Income Houscholds of Harare 95 2007-March 2008.

Food and Agricultural Organization of the United Nations (FAO) 2008. FAO's Initiative on Soaring Food Prices Guide for Immediate Country Level Action. Rome: FAO, P.5

G.O.K (2001). Population and Housing Census.Government of Kenya, Central Bureau of Statistics, Nairobi.

G.O.K (2002). National Development Plan for the period 2002-2008.Government of Kenya, Ministry of Finance and Planning, Nairobi.

G.O.K (2003). Economic Survey 2003. Government of Kenya Central Bureau of Statistics, Nairobi.

Hongo, A T (2003) Micronutrient malnutrition in Kenya. *African journal of food, agriculture, nutrition and development:13:2*

IOM. (2002). Dietary reference intakes: recommended intakes for individuals, food and nutrition board, institute of medicine, national academics, Washington DC USA

KARI (1998). Annual Report. Nairobi, Kenya.

Kodhek-Argwings, Gem, Mulinge Mukumbu and Eric Monke (1993). "The Impacts of Maize Market Liberalization in Kenya," Food Research Institute Studies, 12, 3: 331-348.

Mbiba B., 1994. Institutional responses to uncontrolled urban cultivation in Harare: Prohibitive or Accommodative? Environment and Urbanization 6: 188-202.

Mitlin D., 2005. Chronic Poverty in Urban Areas. Environment and Urbanization, 17: 3-10.

MOA/MOLFD (2004). Strategy for Revitalizing Agriculture2004-2014. MOA ana MOLFD Nairobi: GOK Printer.

mith DW, 1998. Urban food systems and the poor in developing countries. The Institute of British Geographers. Trans Inst British Geographers, 23: 207-219.

N-HABITAT, 2006. The State of the World's Cities: Urbanization: A Turning Point in History. Nairobi: United Nations Centre for Human Settlements.

APPENDICES

Appendix 1: Questionnaire

Role of urban agriculture in food and nutrition security status in low income households of Mwiki Location

Circle or fill as appropriate.

Interviewer_____ Interviewer Date_____ Household No_____

1. Name of County_____
2. Name of District_____
3. Name of Division_____
4. Name of Location_____
5. Name of Sub-location_____
6. Name of Village_____

A. Household composition.

List the household members indicating their marital status, gender, and relation to hh head, education level, residence and occupation. Use the codes provided below the table

Serial No.	Name	1.Relation to head of hh	2. Sex	3. Age months	4. Yrs	5. Marital status	6. Education	7. occupation	8. Residence
1.									
2.									
3.									
4.									
5.									
6.									

Codes

Relationship to hh head	Sex	Marital status	Education	Occupation	Residence
1. Child	1.Male	1.Married	1.Lower Primary	1.Farmer	1.Rural
2. Parent.	2. Female	2.Separated	2.Upper Primary	2.Driver	2.Urban
3. Brother/sister		3.Divorced	3.Secondary	3.Business	3.Others,Specify
4. Relatives		4.Single	4.University/College	4.House wife	
5. Others, Specify		5.Widow(ed)	5.Pre-Unit	5.Student/pupil	
			6.Others, specify	6.Others, specify	

B. Occupation

1. Are you a fulltime farmer? (a)Yes (b)No

2. If No, what other business do you do?

3. Which 5 main farming activities are you involved in?

1.
2.
3.
4.
5.

4. Which crops do you grow for food and which ones do you grow for sale?

Crop Grown	Sale (cash)	Food
1.		
2.		
3		
4.		

5. of the four crops which is profitable? 1 2 3 4 (circle as appropriate)

C. SOCIO-ECONOMIC STATUS.

(I)HOUSING

9.Type of roofing (Verify by observation)

Code:1-Iron sheet 2-Tiles 3-Others,specify_____

10.Type of wall(verify by observation)

1-Mud 2-wooden 3-concrete 4-Others,specify_____

11.Type of floor(Verify by observation)

1.Mud 2-Concrete 3-Others,specify_____

(ii)LAND OWNERSHIP AND CROP PRODUCTION

12. How much land do you own?_____(acreage)

13. Do you rent any land for cultivation?_____(acreage)

14. (If the answer is No go to question 15,if yes ask)

15. How much is under cultivation?_____(acreage)

16. What food crops do you grow in this household? How much was produced per crop in the last year both in the long and short rain season?

16. Food crops	17.Amount produced			18.Area under cultivation(acreage)	
	Long rain season	Short rain season	Units of measure	Long rain Season/units of measure	Short rain season'units of measure
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

Measures

1. 90 Kgs Sacks
2. 50 Kgs Sacks
3. 18 Kgs-Debe
4. 2Kg Kasuku
5. Kgs
6. Others,specify

19 (a)Do you know of any drought tolerant food crops? 1.Yes 2 No

19(b)**(If the answer Yes Ask)** Which ones? (List them)_____

19.(c)For what reasons are they grown? (Please rank)

Use less inputs They are drought tolerant, home consumption others, specify

_____

20.Indicate in order of importance what you do with each of the crops. Use the codes provided below the table.(use the codes provided below the table)

CROP	IMPORTANCE (RANK)				
RANKING	1.	2	3	4	5
1.Cassava					
2.Millets					
3.Sorghum					
4.Bulrush Millets					
5.					
6.					
7.					

Code:

1.Consumed at the hh 2.Sold 3.Fed to livestock 4.Fed to children as weaning diet.

5.Others specify_____

21.How much was used in each category of utilization (in question 21)?

(Use the codes below or enter the quantity in kilograms. Note indicate the unit of measure in brackets)

19.Drought Tolerant crops	(a)Amount produced	(b)Amount consumed	(c)Amount sold	(d)Other uses Specify……
1.				
2.				
3.				
4.				
5.				
6.				

Codes: Measurements

1.Sacks-90kg 2.Sacks-50kgs 3.Debe-18kgs 4.2kg Kasuku 5.Others,specify_____

22(a)Do you preserve the above food crops that you grow? 1.yes 2.No.

22(b)**If the answer is Yes,Ask)** How they are preserved?

(A)Legumes and cereals_____ (B)Root crops_____ (use code below)

1.Smoking 2.Pesticides 3.Drying 4.Processed and stored in other forms

5.Others specify

(iv)LIVESTOCK OWNERSHIP

What types of livestock do you own?

(Use the codes below)

23.Type of livestock	24.Number owned	25.Type of product	26.Uses (Please rank in order of importances)
1.Cow		(a).....	1.....2.....3.....
		(b).....	1.....2.....3.....
2.Bull		(a).....	1.....2.....3.....
		(b).....	1.....2.....3.....
3.Goat		(a).....	1.....2.....3.....
		(b).....	1.....2.....3.....
4.Sheep		(a).....	1.....2.....3.....
		(b).....	1.....2.....3.....
5.Poultry		(a).....	1.....2.....3.....
		(b).....	1.....2.....3.....
6.Others,specify		(a).....	1.....2.....3.....
		(b).....	1.....2.....3.....

Codes: uses

1. Home consumption 2.Sell. 3.Others,specify_____

(v)HOUSEHOLD INCOME

27. In order of importance indicate the main source of income in this household.(Please rank)

Sale of drought tolerant food crops sale of animals Business

Sale of labour other, specify

28 How much do you spent on the following items in your household?

	Item	Per day (Ksh)	Per week (Ksh)	Per month (Ksh)	Per year (Ksh)
1	Food				
2	Clothing				
3	Farm inputs				
4	Wages				
5	Medical care				
6	School fees				
7	Others, specify				

FOOD SECURITY STATUS.

29. What are the main sources of food in order of importance in this house?(please rank)

Own production Purchases Food aid Others, specify _____

30. How many meals do you usually consume per day?

Code: 1-one 2-Two 3-Three

31. Are there foods that you do not eat in this household? 1.Yes 2.No.

32. **(If the answer to No.31 is Yes, Ask)** What are the reasons?

FOOD	REASONS
(a)	
(b)	
(c)	

Code: 1.Medical reasons 2.Food avoidance 3.Social economic reasons

4.Religious/cultural reasons 5.Taboo. 6.Others,specify

33.Do you always have enough food for all the members of your household?

Code:1.Yes 2.No.

34.**(If the answer in No.33 is No, ask)**how many months do you usually have scarcity of food in a year?

35.What specific months of food scarcity?_____

36.What measures do you do you take to cope with the food shortage?**(Indicate in order of importance)**

Sale of assets Reduce the meal size Reduce the frequency of meals

Migrate to seek employment others, Specify

37.What do you think contributes to your having/not having enough food?

FOOD CONSUMPTION

3-24 HOUR RECALL METHOD

38. indicated what kind of food and amounts have been consumed in the hh in the last 3 days.

Type of food	Type of food	Ingredients	Amounts (use HH Measures)	
(a)Breakfast				
(b)snacks				
(c) lunch				
(d)snacks				
(e) supper				

FOOD FREQUENCY CHECKLIST

Below is a list food, please indicate how many times the food is consumed

42. Type of food	43. Frequency of consumption per week	44. Freq. of consumption per month	45. Frequency of consumption per 2 month	46.Rarely consumed	47. Never consumed
CEREALS					
Maize products					
Millets products					
Sorghum					
Products					
Wheat products					
Rice					
Others, specify					
ROOTS AND TUBERS					
Cassava					
Sweet potatoes					
Arrowroots					
Other, specify					
PLANTS PROTEINS					
Beans					
Cow peas					
Pigeon peas					
Green grams					
"Njahi"					
Others, specify					

ANIMALS PROTEINS					
Beef					
Eggs					
Milk					
Fish					
VEGETABLES & FRUITS					
Kales					
Cowpeas leaves					
Cabbage					
Spinach					
Tomatoes					
Pawpaw					
Oranges					
Ripe bananas					
Other, specify					

Appendix 2: Focus Group Discussion Question Guide

1. What are the main sources of income in your community?
2. What are the factors that affect the crop production in your area?
3. How do you cope with food insecurity?
4. What foods are used in times of scarcity?
5. What can be done to improve food security in your area?
6. What are some of the challenges you face in the growing and how are they utilized?
7. What are some of the challenges you face in the growing and utilization of these drought tolerant food crops?

Appendix 3: Food Conversion Table

TYPE OF FOOD	SELLING PRICE KSH	WEIGHT (EDIBLE PORTION)
Loaf of bread	45	
1kg Tin of maize	90	
1kg Tin of Beans	135	
1kg Tin of pigeon peas	140	
1 sack of sweet potatoes	1900	
1 sack of cassava	1600	
1 sack of pumpkins	1200	
Kales kg	60	
Spinach kg	80	
Terere amaranthus kg	80	
Black nightshade kg	70	
Tomatoes kg	190	
Tomatoes kg	120	
Irish potatoes kg	60	
sweet potatoes kg	90	
Cowpeas kg	50	
Red cabbage kg	70	
Cabbage	60	
Cowry flower kg	100	
Cassava (medium)- 1 piece	30	
Pawpaw (medium)	70	
Ripe bananas kg	130	
Pumpkin (medium)	70	
Pumpkin (large)	120	
Fat 0.5 kg	120	
Fat kg	240	
1 Egg	10	

Appendix 4: Consumer Unit

Energy and protein requirements of the various age and sex group expressed in terms of consumer units. One consumer unit is the consumption equivalent in terms of energy and protein respectively of a nominal adult man. Energy requirement of 2960 Kcal of adult man (20 -29 years) and protein requirement of 5ograms was used (WHO/FAO/UHU, 1985)

	Energy requirements –Kcal/cu/day		Protein requirements –grams/cu/day	
Age (years)	**Male**	**Female**	**Male**	**Female**
<1	0.3	0.3	0.3	0.3
1	0.4	0.4	0.3	0.3
1-2	0.4	0.4	0.3	0.3
3-5	0.5	0.5	0.4	0.4
5-7	0.6	0.6	0.4	0.4
7-10	0.7	0.6	0.6	0.6
10-11	0.8	0.7	0.7	0.7
12-14	0.8	0.7	0.9	0.9
14-16	0.9	0.7	1.1	0.9
16-18	0.9	0.7	1.1	0.9
18-30	1.0	0.7	1.0	0.8
30-60	0.7	0.7	1.0	0.8
>60	0.7	0.7	1.0	0.8

Appendix 5: Training Field Assistants Programme

DAY ONE				
Time	**Activity (and content or subject matter)**	**Teaching methods**	**Teaching Aids**	**Facilitator**
8:30-9:00	Opening remarks and introduction	Lecture	Written speech	Principal investigator
9:00-9:30	Logistics	Brainstorming	Flip chart, markers	Principal investigator
9:30-10:00	Study title, aim, purpose, objective of the study	Lecture	LCD Projector, laptop slides	Principal investigator
10:00-10:30	**Tea Break**			**30 minutes**
10:30-12:00	Discussing questionnaire	Discussion	Questionnaire (copies)	Principal investigator
10:00-10:30	**Lunch**			**1:30 hr**
1:30-3:30	Discussing questionnaire and interviewing techniques	Role play Demonstration	Questionnaire (copies)	Principal investigator
3:30-4:00	**Tea Break**			**30 minutes**
4:00-4:30	Focus group discussion guide questions coding and recording	Discussion Question and Answer lecture	Copies of FGD guide LCD Projector Laptop slides	Principal investigator

Appendix 6: Food Frequency Table

Maize products	Consumption per week		Consumption per month		Consumption per 2 month	
	F	%	F	%	F	%
1	-	-	-	-	-	-
2	16	8	64	8	32	8
3	36	18	144	18	72	18
4	52	26	208	26	104	26
5	28	14	112	14	56	14
6	-	-	-	-	-	
7	68	34	272	34	136	34
Millet products						
1	-	-	-	-		
2	32	16	128	16	64	16
3	40	20	160	20	80	20
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	96	48	384	48	192	48
Rarely consumed	16	8	64	8	32	8
Never consumed	16	8	64	8	32	8
Sorghum						
1	44	22	176	22	88	22
2	16	8	64	8	32	8
3	16	8	64	8	32	8
4	12	6	48	6	48	6
5	-	-	-	-	-	-
6	24	12	96	12	48	12
7	12	6	48	6	24	6
Rarely consumed	28	14	112	14	56	14
Never consumed	48	24	192	24	96	24
Wheat						
1	4	2	16	2	8	2
2	16	8	64	8	32	8
3	24	12	96	12	48	12
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	4	2	16	12	8	2
7	124	62	496	62	248	62
Rarely consumed	20	10	80	10	40	10
Never consumed	-	-	-	-	-	-
Rice						
1	-	-	-	-		
2	44	22	176	22	88	22
3	36	18	144	18	72	18
4	36	18	144	18	72	18

5	56	28	224	28	112	28
6	4	2	16	2	8	2
7	16	8	64	8	32	8
Rarely consumed	4	2	16	2	8	2
Never consumed	-	-	-	-	-	-
Cassava						
1	12	6	48	6	24	6
2	24	12	96	12	48	12
3	32	16	128	16	64	16
4	4	2	16	2	8	2
Rarely consumed	120	60	480	60	240	60
Never consumed	8	4	32	4	16	4
Sweet potatoes						
1	16	8	64	8	32	8
2	24	12	96	12	48	12
3	100	50	400	50	200	50
Rarely consumed	40	20	160	40	80	20
Never consumed	20	10	80	10	40	10
Arrow roots						
1	12	6	48	6	24	6
2	76	38	304	38	152	38
3	40	20	160	20	80	20
4	36	18	144	18	72	18
Rarely consumed	16	8	64	8	32	8
Never consumed	20	10	80	10	80	10
Beans						
1	48	24	192	24	96	24
2	12	6	48	6	24	6
3	32	16	128	16	64	16
4	36	18	144	18	72	18
5	60	30	240	30	120	30
6	12	6	48	6	24	6
Cow peas						
1	20	10	80	10	40	10
2	20	10	80	10	40	10
Rarely Consumed	60	30	240	30	120	30
Never consumed	100	50	400	50	200	50
Pigeon peas						
Rarely consumed	50	25	200	25	100	25
Never consumed	150	75	600	75	300	75
Green grams						
1	20	10	80	10	40	10
2	30	15	120	15	60	15
3	50	25	200	25	100	25
4	60	30	240	30	120	30

Rarely consumed	40	20	160	20	80	20
Njahi						
1	50	25	200	25	100	25
2	60	30	240	30	120	30
3	40	20	160	20	80	20
4	20	10	80	10	40	10
5	15	8	60	8	30	8
Rarely consumed	10	5	40	5	20	5
Never consumed	5	3	20	3	10	3
Beef						
1	35	18	140	18	70	18
2	40	20	160	20	80	20
3	25	13	100	13	50	13
4	75	38	300	38	150	38
5	5	3	20	3	10	3
6	20	10	80	10	40	10
Eggs						
1	40	20	160	20	80	20
2	60	30	240	30	120	30
3	100	50	400	50	200	50
Milk						
1	5	3	20	3	10	3
2	10	5	40	5	20	5
3	20	10	80	10	40	10
4	30	15	120	15	60	15
-	-	-	-	-	-	-
6	65	33	260	33	130	33
7	70	35	280	35	140	35
Fish						
1	10	5	40	5	20	5
2	40	20	160	20	80	20
3	50	25	200	25	100	25
Rarely consumed	100	50	400	50	200	50
Kales						
1	-	-	-	-	-	
2	-	-	-	-	-	
3	12	6	48	6	24	6
4	35	18	140	18	70	18
5	40	20	160	20	80	20
6	88	44	352	44	176	44
7	25	13	100	13	50	13
Cow peas leaves						
Rarely consumed	82	41	328	41	164	41
Never consumed	118	59	472	59	236	59

Cabbage						
1	-	-	-	-	-	
2	-	-	-	-	-	
3	-	-	-	-	-	
4	30	15	120	15	60	15
5	40	20	160	20	80	20
6	50	25	200	25	100	25
7	65	33	260	33	130	33
Rarely consumed	15	8	60	8	30	8
Spinach						
1	5	3	20	3	10	3
2	15	8	60	8	30	8
3	20	10	80	10	40	10
4	25	13	100	13	50	13
5	30	15	120	15	60	15
6	60	30	240	30	120	30
7	45	23	180	23	90	23
Tomatoes						
1	-	-	-	-	-	
2	-	-	-	-	-	
3	-	-	-	-	-	
4	20	10	80	10	40	10
5	50	25	200	25	100	25
6	70	35	280	35	140	35
7	60	30	240	30	120	30
Pawpaw						
1	25	13	100	13	50	13
2	50	25	200	25	100	25
3	75	37	300	37	150	37
Rarely consumed	50	25	200	25	100	25
Mangoes						
1	-	-	-	-	-	-
2	1	1	4	1	2	1
3	34	17	136	17	68	17
4	40	20	160	20	80	20
5	50	25	200	25	100	25
6	60	30	240	30	120	30
Rarely consumed	15	8	60	8	30	8
Ripe bananas						
1	2	1	8	1	4	1
2	8	4	32	4	16	4
3	15	8	60	8	30	8
4	25	13	100	13	50	13
5	40	20	160	20	80	20
6	50	25	200	25	100	25
7	60	30	240	30	120	30

Appendix 7: Map of Kasarani District showing Mwiki Location