ENHANCING FARMING PRACTICES FOR IMPROVED HOUSEHOLD FOOD AND NUTRITION SECURITY IN KAMAE, A PERI-URBAN AREA -NAIROBI, KENYA

BY

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DECLARATION

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

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To my father David Njogu, my mother Esther Wanjugu, my brothers and sisters and all my nephews and nieces for prayers, support and encouragement throughout my study period.
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LIST OF ABBREVIATIONS

AIDS- Acquired Immune Deficiency Syndrome
CBO-Community Based Organization
DGLVs-Dark Green Leafy Vegetables
FAO-Food and Agriculture Organization of the United Nations
HIV-Human Immunodeficiency Virus
IFAD- International Fund for Agricultural Development
IDRC-International Development Research Centre
IFPRI- International Food Policy Research Institute
ILSI-International Life Science Institute
KDHS- Kenya Demographic and Health Survey
NACC- National Aids Control Council
NALEP- National Livestock Extension Programme
NEMA- National Environmental Management Authority
NGOs- Non Governmental Organizations
PEM- Protein Energy Malnutrition
RDA- Recommended Dietary Allowance
RUAF- Resource Centre on Urban Agriculture and Food Security
TOL- Temporary Occupation Licence
UNDP- United Nations Development Programme
UPAL- Urban and Peri-urban Agriculture and Livestock
ABSTRACT

Urban food insecurity has risen to alarming levels. Urban agriculture is proposed as an effective strategy to reduce urban poverty and enhance urban food security. Kenyan urban poverty is high. This has pushed the urban poor to agricultural activities. Households in Kamae in the peri-urban area of Nairobi, produced crops but they lacked diversity. They needed intervention to diversify their farming activities by producing diversity of crops and rearing small livestock. It is in this light that this study was designed. The household food security and farming practices were determined from June to July 2005 in baseline survey covering 300 households obtained through cluster sampling. An intervention to diversify the household farming practices was designed and implemented from October 2005 to February 2006 to enhance household food security in 30 out of the 300 households. Another survey in 180 households (30 participating and 150 non-participating) households was done at the end of the research from March 2006 to April 2006 to determine the impact of the intervention. Data were collected using interview schedules, observation checklists and focus group discussion guides. The quantitative data were analysed using (SPSS) Programme. Nutrients were analysed using NutriSurvey, (2004) while nutrition status data were analysed using EpiInfo, (2000). Pearson product moment (r) established relationships and tested the hypothesis at 0.05 significant levels. Cross tabulation and t-test were used to determine the changes in the households after intervention. The qualitative data were organized into themes for interpretation. The results indicated improvement in social economic status, in farming practices and in food consumption. There were 13(43.3%) women without occupations before intervention, but they started farming, selling vegetables and did casual jobs after intervention. Participating households increased diversity of crops they produced from no crops to diversity of crops and they all started rearing small livestock. The mean caloric, vitamin A and iron intakes for all children in all age groups in the 300 households in baseline survey were below the RDAs. However, the mean protein intakes for the children in all age groups were above the RDAs. Consumption of calories, proteins, vitamin A and iron increased in all the 30 households. Those whose caloric intakes were below the RDAs decreased from 23(76.7%) before intervention to 20(66.7%) after intervention. Protein intake that was below RDAs decreased from 17(56.7%) to 12(40%), vitamin A intakes from 22(73.3%) to 18(60%) and iron intake from 29(96.7%) to 25(83.3%) before and after intervention, respectively. These improvements in consumption are attributed to the activities of the intervention of producing a diversity of crops and rearing of small livestock. The findings of the baseline survey showed that 62% of the children were stunted, 53.7% were underweight and 31% were wasted. T-test showed significant difference in iron intake before and after intervention t=2.715 and P= 0.009. There were positive relationships between nutrition knowledge and caloric r=0.040 p=0.494, protein r=0.055 p=0.341, vitamin A r=0.123 p=0.034 and iron r=0.052 p=0.372 intake. There was also a positive and significant relationship between crop diversity and dietary diversity r =0.123 and p =0.034. This shows that increase in food production and nutrition knowledge increased household food consumption. This project impacted positively on the community members by increasing access to more food. This improved their household food consumption by providing them with diversified diets that enhanced their household food and nutrition security. It is recommended that production of diversity of crops and rearing of small livestock be promoted in the available urban and peri-urban garden spaces. These gardens form a sustainable food based strategy to prevent malnutrition in the urban and peri-urban areas.
CHAPTER ONE
INTRODUCTION

1.1 Background

The United States National Research Council estimates that by 2030 more people will be living in urban areas (4.1 billion) than in rural areas (3.1 billion) in middle- and low-income countries (UN-HABITAT, 2004). In the African cities, many citizens are moving to the cities with the sole purpose of acquiring jobs. The present population in Kenya according to 1999 Population Census is at about 37 million (Government of Kenya, 1999). In Nairobi, the capital city of Kenya, the population has been growing at a very high rate between 1969 and 1999. In 1969 there were 509,286 persons, 827,773 persons in 1979, 1,134,570 persons in 1989 and 2,143,254 persons in 1999 (Government of Kenya, 1969; Government of Kenya, 1979; Government of Kenya, 1989; and Government of Kenya, 1999). The population has almost doubled within 10 years (1989-1999).

Overpopulation in the urban areas puts strain on the urban food and nutrition security (UN-HABITAT, 2004). In response, these urban dwellers turn to new livelihood sources including agriculture for survival (Urban harvest, 2007). Urban agriculture as a strategy of poverty alleviation has been overlooked, underestimated and under reported (Urban harvest, 2007). Therefore, more research is needed in order to understand the current practices and look for ways of improving these practices, including diversification in farming practices.

Diversification of farming practices increases dietary diversity, a concept that enhances household food and nutrition security. Attainment of household food security is the initial step towards poverty eradication (Government of Kenya, 2001). Kenyan urban poverty is estimated at 50% (Government of Kenya, 2003a). These poverty levels have made life
expensive for poor Kenyans who have turned to urban agriculture to make ends meet (Foeken and Mwangi, 2000). Majority of Nairobi farmers are left on their own, getting no assistance or advice necessary for the enhancement of food production skills such as diversification of farming practices (Foeken and Mwangi, 2000). Diversification of farming practices in the urban and peri-urban households would lead to dietary diversity. Dietary diversification increases consumption of micronutrient rich foods, hence, overcoming micronutrient deficiencies (FAO and ILSI, 1997). Production of small animals provides excellent food sources of micronutrients including bio-available iron and vitamin A (FAO and ILSI, 1997).

In Kenyan urban centres, urban farming is widely practised according to a survey by Mazingira Institute (1984/85) covering Nairobi, Mombasa, Kisumu, Kakamega, Isiolo and Kitui (Lee-Smith et al., 1987). In Nairobi, small-scale subsistence crop production is the most practised system. Another system that is also common is small-scale livestock production whereby poultry are the most reared animals. Farming activities are common phenomena in Kasarani Division in Nairobi. The baseline survey results in this study showed that farming activities had not been diversified in Kamae area.

This study targeted farmers who are landowners in Kamae area. However, according to the results of the baseline survey, these landholdings are small hence needed intensive use to reap maximum benefits. During the research these farmers were trained on how to diversify their household farming practices through production of a diversity of crops of their choice and rearing of small livestock. Diversification of crops and animals coupled with nutrition education led to dietary diversification in the households hence contributing to enhanced household food and nutrition security hence alleviating poverty.
1.2 Problem statement

Farmers in Kamae a peri-urban area of Nairobi own small landholdings measuring about 400m$^2$ in area. From the results of the baseline survey these farmers had not diversified their farming practices so as to produce a diversity of crops that would enhance household food security. Lack of diversity in food production leads to inadequate food supply leading to food insecurity. Food insecurity is indicated in malnutrition levels. Malnutrition trends in the years 2000-2003 in Nairobi and Kamae showed that stunting and underweight levels improved from 29.6% to 18.7% and 12.4% to 6.3% respectively, while wasting levels increased from 3.1% to 4.5% (Government of Kenya, 2003b). Results of baseline survey also showed that these farmers had no access to any sort of agricultural extension services. Therefore, they lacked the relevant agricultural knowledge and skills. Mireri, (2002) in a study in Nairobi found that lack of relevant agricultural knowledge and skills made it difficult for peri-urban farmers to develop agriculture to considerable levels. It is in this view that this project on diversification of household farming practices was designed and implemented. The farmers were trained on how to produce and consume diversity of food crops and to rear small livestock so as to give them a cheap source of animal protein. All this led to enhancement of household food and nutrition security, which is the initial step towards urban poverty eradication.

1.3 Purpose of the study

The purpose of this study was two fold. First, to determine the household food security, nutrition status of children and farming practices among the peri-urban farmers in Kamae area through a participatory baseline survey. Second, to design and implement an intervention project to diversify and intensify the farming practices in order to improve household food and nutrition security among the farmers.
1.4 Objectives

1. To determine the social economic characteristics of the households before and after intervention.
2. To determine knowledge and attitudes of the farmers towards peri-urban agriculture in the households before and after intervention.
3. To determine the farming practices among the farmers in the households before and after intervention.
4. To determine the household food security status in this area before and after intervention.
5. To assess the nutrition status of children below five years in households before and after the intervention.
6. To develop a model on diversification of household farming practices to enhance food and nutrition security in the households.
7. To establish the relationship between farming practices and the household food and nutrition security

1.5 Hypotheses

1. There is a positive relationship between the farming practices adopted by the peri-urban farmers of Kamae and improved household food security.
2. There is a significant improvement in household food and nutrition security of the households after the intervention.

1.6 Significance

The NGOs and the Community Based Organizations interested in agriculture have a basis for implementing intervention projects targeting the poor urban dwellers as a strategy for
poverty reduction. As a result of the study, NGOs and other interested individuals in Kamae became interested and assisted the community members in other aspects, such as provision of clean and safe water. The findings are important to the government for policy planning and development in that willing urban and peri-urban farmers will be offered agricultural services. This is because food production in both urban and peri-urban areas will probably be considered as an important element for managing poverty and the emerging food and nutrition insecurity in the urban and peri-urban areas of Nairobi, especially among vulnerable groups of the poor and hungry.

1.7 Operational definitions of variables

1. Household food security- a food secure household was one that had the ability to secure, either from its own production or through purchases adequate food (in terms of quantity and quality) for meeting the dietary needs of its members. The indicators of household food security in this study were:
   • Means used to meet household food needs- From its own production or through purchases
   • Crop diversity -Number of groups of crops produced by the households
   • Small livestock rearing- The type and number of small livestock reared
   • Caloric, protein, iron and vitamin A intake by the children
   • Consumption patterns -Frequency of intake of some selected food groups in a specified period of time
   • Dietary Diversity –Number of food groups consumed in the households in 24 hours preceding the study period
   • Number of times food is eaten -Number of times food is eaten in the households in 24 hours preceding the study period
• Nutrition status of children below five years - Nutrition and health position of an individual child as indicated by indirect (proxy) measurements of nutritional adequacy. It was achieved by interpretation of information obtained from anthropometric and dietary intake.

2. Peri-urban area - an area which is closer to an urban area or on borderline
1.8 Conceptual framework

This study was based on a model of diversification of household farming practices to improve household food production and consumption hence household food security. It is a modification of a household food security matrix developed by IFAD, (1994). This matrix has six components and was suitable for Kamae farmers who have small pieces of land that needed proper utilization. The six components are component activity, planning for household food production and consumption, preservation, outcome for household food security, risks and risk mitigation measures as indicated in Figure 1.1.

The activity component describes activities in the households, which are crop production and rearing of small livestock. The other component has planning for production and consumption in the households considering the small sizes of the plots. The production is divided into four: the staples, animal protein, micronutrients and others to include crops high in fats and sugars. The fats are important in the diets for enhancement of bioavailability of carotene in plant-based sources. For the sustainability of the farming activities, the farmers decided on the food crops and the small livestock to rear. The diversification of the crops produced and animals reared diversifies the diets and manages micronutrient deficiencies. The surplus dark green leafy vegetables were solar dried to preserve them for use in times of scarcity as indicated in the third component.

The positive household food security outcomes in the fourth component are: improved farming methods, nutrition adequacy and sustainable natural resource management. If these crop and animal production activities are well managed, the household would have enough food for the members and surplus to sell to acquire some income to meet other
basic needs such as shelter. The risks associated with this household food security matrix are that increased availability of diverse food crops may not translate into improved nutrition due to need to sell for income. Increased income may not translate into improved nutrition especially if it belongs to the men. Appropriate nutrition education and targeting 'lower status crops' such as root tubers, dark green leafy vegetables and fruits, which are of interest to women, counteracted the risks (Figure 1.1).
Component activity — Planning for Household production and consumption — Household Food Security outcome

- **Improved farming methods**
  - Diversified crop production
  - Decreased monocropping

- **Nutrition adequacy**
  - Diversified diets improving nutrition status
  - Consumption of DGLVs and Fruits
  - Consumption of protein rich foods.
  - Consumption of minerals salts.

- **Natural Resource Management**
  - Environmental conservation through use of biodegradable organic materials
  - Soil management

- **Increased incomes**
  - Sale of crops and animals.
  - Relieved income from purchasing of food.

- **Risk mitigation measures**
  - Culturally acceptable nutrition education to create awareness
  - Target lower ‘status crops’ that are of women interest.

- **PRESERVATION**
  - Solar drying of vegetables to avoid losses.

- **Risks**
  - Increased food crops may not translate to improved nutrition.
  - Low retention of food crops due to selling.
  - Increased income may not translate to improved nutrition.

**Figure 1.1**: Diversification of household farming practices for enhanced household food and nutrition security

**Source**: A modification of IFAD project on Household Food Security, a Programme in Zambia 1994.
CHAPTER TWO
LITERATURE REVIEW

This chapter explores the issue of urban agriculture under the following sub-topics: concept of urban agriculture, factors influencing household food security in the peri-urban area, benefits of urban agriculture, negative effects of urban agriculture, Kenyan policy on urban agriculture and agriculture in the city of Nairobi.

2.1 Concept of urban agriculture

Urban agriculture is a phenomenon that is as old as the town and cities themselves (Foeken and Mwangi, 1998a; Chivinge, Machakaire and Mudimu, 2001). The problem in African policy planning is that urban agriculture is a new concept. However, food production in and around urban areas is not new. For the past two decades, urban agriculture has been forgotten or largely ignored by the local policy makers (Rogerson, 2001). Food and Agriculture Organization (FAO) defines urban agriculture as food and non-food production dispersed throughout urban and peri-urban areas (FAO, 2001a). United Nations Development Programme (UNDP, 1996) states that urban agriculture implies any farming activity within the city boundaries including the cultivation of food and cash crops, animal husbandry, forestry, flower and garden plant production.

According to UNDP (2002) there are about 800 million urban farmers worldwide and most of them are poor and are found in the urban centres of the developing countries. In Britain, there are eight city farms in London of up to 2.5 ha in size, with horticultural farming and animal keeping (Garnett, 2000). Other countries are: Spain, evidence from
Madrid and Barcelona; Portugal, evidence from Lisbon, and in the Netherlands, where horticulture is practised (FAO, 2001a). Urban agriculture is also common in Africa and it has been tracked in several investigations. In Lesotho's capital city, Maseru, Mozambique's capital city, Maputo and in Mali's capital city, Bamako all types of crops are produced (Mbiba, 1994; Christie, 1996 and FAO, 2001a). Other cities where farming is done are Dakar in Senegal, Lome in Togo and Durban in South Africa (FAO, 2001a; May and Rogerson, 1995).

In Kenya, various studies have been carried out in the cities on urban farming: The Mazingira Institute did a study from October 1984 to January 1985 (Lee-Smith et al., 1987). This was a general survey to determine the extent and nature of farming activities in six Kenyan towns, Nairobi being one of these. The study showed that farming in Nairobi was not any different from other urban centres in Kenya (Lee-Smith et al., 1987). The other study was a general survey among 618 cultivators all over the city of Nairobi (Lee-Smith et al., 1988). The study determined the nature of farming activities in Nairobi where it concluded that poor households engage more in urban farming than those in middle and high classes due to the current economic crisis (Lee-Smith et al., 1988). The two studies did not address the issue of diversified farming practices. This project in Kamae addressed the issue of diversified farming practices to enhance household food security.

A study by Mwangi focused on poor households in Korogocho slum area (Mwangi and Foeken, 1996). The study determined the food and nutrition security of dwellers in
Korogocho slums. The farmers confessed that farming contributed to their household food and nutrition security. The study did not focus on empowering the farmers with farming knowledge and skills. The farmers in Kamae were trained to produce a diversity of crops of their choice and use of organic manure to improve and maintain soil fertility. They chose a type of small livestock that they preferred to rear to provide the household with a source of animal protein and manure for the crops.

An anthropological study among urban farmers in Kibera explored decision-making in crop production (Dennery, 1995). The results showed that both men and women are involved in decision-making regarding urban farming. A study was done in Nakuru by University of Nairobi in collaboration with the African Studies Centre of the Netherlands in 2000-2001 (RUAF, 2006). The purpose of the study was to determine the household food security, nutritional status of children and the environmental implications of urban farming (RUAF, 2006). According to the results, 72% of the farmers confessed that farming provided food for the household. However, there were no significant differences between the nutritional status of the children of the farmers and the non-farmers. It was found out that men used more input than women. The female heads practised a very ‘poor type’ of crop cultivation due to the diverse responsibilities that lay heavily on them (RUAF, 2006). The study did not focus on empowering both men and women with farming knowledge and skills. This project in Kamae area empowered both men and women with farming and nutrition knowledge and skills.
2.2 Factors influencing household food security in the urban and peri-urban areas

There are many factors that influence household food security in the urban and peri-urban areas. The factors considered in this study were: the ownership of plot, farmer's knowledge, skills and attitudes, household income and household size.

2.2.1 Ownership of plot

When an individual has legal and secure ownership of a plot, farming activities are sustainable because there is no fear of eviction. This ensures year round availability of affordable, clean and healthy crops. The residents of Kamae have legal and secure ownership of the plots, a factor that was important for sustainability of the activities of this project. Farmers on the roadside can be evicted anytime in case of any road construction and any other activities like tree planting.

2.2.2 Farmers' knowledge, skills and attitudes towards urban farming

Diversity of urban and peri-urban farming practices depends on factors such as the individual tastes and preferences, attitude towards urban and peri-urban farming, income available, individual level of agricultural knowledge and farming skills (Mougeot, 2000). The farmer's attitudes, knowledge and skills depend on the training that they may have received. Lack of knowledge in certain production techniques such as crop protection and rotation can cause considerable losses in production (Mougeot, 2000). Urban and peri-urban dwellers have different attitudes towards urban farming. Compared to other income generating activities in the urban and peri-urban areas, farming is often regarded as backward and 'rural' (Tinker, 1993). Urban and peri-urban agriculture is also condemned for its presumed negative health impact. There is evidence that some people believe that
there are some diseases associated with urban and peri-urban agriculture. For example it
is believed that maize grown in the urban areas provide breeding grounds for malarial
mosquitoes despite evidence to the contrary (Tinker, 1993).

2.2.3 Household income
The household income determines that household’s food security (Kennedy and Haddad,
1992). Ideally, those households with high incomes are able to produce more food
because they are in a position to buy productivity enhancing inputs while those relying on
the markets are able to purchase enough food. However, this depends on persons
controlling income either men or women (Kennedy and Haddad, 1992). Women have
high propensity to spend money on food than men (Hovorka, Zeeuw and Njenga, 2009).

2.2.4 Household size
The household size determines the household food needs. Larger ones require more food
while smaller ones require less food. Diversity in the food produced for family
consumption also affects food security. The families that plant a variety of staple crops
are more likely to have diversity in their diet than those producing primarily for sale
(FAO and ILSI, 1997).

2.3 Benefits of urban and peri-urban agriculture.
Urban agriculture, if well developed, plays an important role in the cities as it improves
nutrition status of household members; it generates income, and provides employment
and conserves the environment.
2.3.1 Urban agriculture improves nutrition status of the household members

Urban agriculture contributes to food security of the urban people. Farming activities provide the urban people with additional food, ideally resulting in a high level of food consumption (RUAF, 2006). In addition to increase in absolute amount of food, the dietary composition also improves (Foeken and Mwangi, 1998b). Diversified farming practices were promoted among residents of Kamae to improve their food and nutrition security in this research. Diversified farming practices increase dietary diversity, increase the percentage of households consuming minimum daily caloric requirements and the number of eating occasions per day (Swindale and Ohri-vachaspati, 2005). The improved consumption improves the nutrition status of the household members. The nutrition status of children below five years was assessed in this study at different times of the project to identify the food insecure and to assess the impact of the project.

2.3.2 Source of employment

If urban agriculture is well planned and developed, it can offer job opportunities. In times of economic crisis in most of the urban centres in developing countries, urban farming provides employment. Urban agriculture in Kenya creates jobs both for the farmers themselves and others. Since many people in the city of Nairobi are not able to find a regular job, farming would constitute an alternative way of employment for them. The jobs are in terms of production, processing and marketing of the farm products. This is only possible after careful investigations on the existing agricultural activities to know areas of intervention.
2.3.3 Source of income

Urban agriculture generates income for the households (FAO, 2001b). This is two fold. First more income will be available in the household because of less food that is purchased. Households will meet their dietary needs by their own food production without purchasing from the market. Secondly, cash income is realised by selling surplus after the households have had enough for the household members. The income generated may be used to buy other foods not produced by the farmers and non-food items like paraffin, as well as paying school fees (Foeken and Mwangi, 1998b).

2.3.4 Environmental conservation

The other contribution of urban agriculture is that it improves the urban environment (FAO, 2001a). First, urban farming provides an aesthetic quality as it beautifies the city by ‘greening’ it. Secondly, it helps in sustainable use of natural resources for example use of biodegradable organic wastes as compost manure, planting of trees and preventing soil erosion. The gardens in this project in Kamae have enhanced the environmental quality of this community.

One of the benefits is that the kitchen waste is recycled and used as compost manure. This waste would have been made into garbage dumps. All the thirty households planted a tree known as *Gravellier*, which was provided by the project team. They were encouraged to plant more trees. This is because this is one of the ways of environmental conservation because of nitrogen fixation and reduction of greenhouse gases from the atmosphere (Chivinge, Machakaire and Mudimu, 2001). Trees are also important in
formation of humus that is enhances soil fertility. There is need for more agricultural extension services to empower the farmers with environmental conservation knowledge so that they can practice sustainable agriculture.

2.4 Negative effects of urban agriculture

Urban farming if not closely monitored by those concerned such as the public health officers, the city council and those in the National Environmental Management Authority (NEMA), it may pose dangers to human health and the environment. The negative effects of urban agriculture are discussed as follows:

2.4.1 Effects on human health

Research has shown that crops produced in some parts of Nairobi are irrigated using sewage water (Esipisu, 2006). Sewage water leads to contamination of crops with pathogens such as Escherachia coli (E.coli). Consumption of crops contaminated with E.coli causes bloody diarrhoea in adults and kidney failure or death in infants (Esipisu, 2006). Those working with sewage water may experience headaches. Some of the pesticides used at the pre-harvest stage have hydrocarbons and when inhaled by humans they may cause cancer.

Livestock reared in urban and peri-urban areas feed on the dumpsites. As a result, their products such as the milk and the eggs may be contaminated with dioxin and lead minerals. Dioxin from burning plastics and lead minerals in the livestock products cause neurological impairments in young children. Dioxin has been found to cause cancer in humans (Esipisu, 2006). In Kamae the farmers were advised to rely on rainfall for
production of their crops. There is no use of sewage water for those 30 households in the intervention because majority of the residents use pit latrines. Organic farming was promoted because it does not require synthetic pesticides. The small livestock for those in the intervention are reared in enclosed shelters constructed for that purpose, hence they do not feed on any form of waste.

2.4.2 Effects on the environment

Urban and peri-urban farming can lead to environmental degradation. Agricultural inputs used at the pre-harvest stage such as pesticides are released to the atmosphere. While in the atmosphere they contribute to global warming, altered wind and rain patterns and rises in sea levels (Oza, 1999). Some farming methods especially along the rivers cause soil erosion. Rearing of livestock if not done hygienically can lead to bad smells, which pollute the air. To avoid environmental degradation, organic farming is practiced in Kamae because it does not require synthetic inputs, improves soil fertility, increases biodiversity and prevents soil erosion.

2.5 Kenyan policy on urban agriculture

The Local Government Act [Cap.265, section 154(c)] states that local authorities have the power to prohibit or permit cultivation of crops. Therefore, cultivation by unauthorized persons of any unenclosed and unoccupied private, government or land reserved for public road is prohibited (Government of Kenya, 1998). Cap. 265, section 162(b) empowers local authorities to prohibit or control livestock keeping (Government of Kenya, 1998). Therefore, large livestock may be kept and grazed on the outskirts of the city with written
permission a so-called Temporary Occupation Licence (TOL) while small livestock can be kept unless someone complains of a nuisance (Government of Kenya, 1998).

Cap.265, section 155(b), empowers local authorities to engage in agriculture and livestock production, provide extension services and take measures for the prevention of the spread of disease (Government of Kenya, 1998). However, extension service by the Ministry of Agriculture and livestock has been farmer driven for a long time. Therefore, only better off farmers seek crop and livestock extension services, but not the poor urban and peri-urban farmers. To solve the problem of extension services, the government is restructuring and partially privatizing the public extension system to improve extension service delivery to all farmers regardless of the social economic class (Government of Kenya, 2004). As a result, there is the introduction in Nairobi Province of the National Livestock Extension Programme (NALEP) (Ishani and Lamba, 2007).

The residents of Kamae were not aware of the Kasarani agricultural, livestock and fisheries development offices until the day of the awareness campaigns (on July 25\textsuperscript{th} 2005). From that time, cooperation between the residents of Kamae and the agricultural and livestock extension officers at the Divisional level has continued to be strong. This is a positive move towards pushing Urban and Peri-urban Agriculture and Livestock (UPAL) into the agriculture and livestock national policy agenda. This is because provision of technical support to willing farmers through extension services is necessary for the enhancement of household food production (FAO, 2003).
2.6 Agriculture in the city of Nairobi.

In Nairobi, Kenya’s capital city, farming is widely practised (Foeken and Mwangi, 1998a). In all kinds of open public spaces, crops are cultivated and animals like cattle, goats and sheep roam around. Farming is done in the backyard, notably in the residential areas (Foeken and Mwangi, 1998a). This means that, in Nairobi, people of all social economic classes grow food whenever and wherever possible. The Mazingira survey of 1984-85 presented a representative picture of urban farming in Nairobi.

Summary

Urban and peri-urban farming is practiced by people of all social economic classes. However, the poor urban and peri-urban dwellers are engaged more in farming because of the prevailing economic crisis. Urban and peri-urban farming is sustainable when people engaged have legal and secure ownership of their plots. Urban and peri-urban farming enhances household food and nutrition security and conserves the environment. Health risks and hazards of urban and peri-urban farming are due to contaminated food. Kenyan policy currently recognizes urban and peri-urban farming and this is seen in the introduction in Nairobi Province of the National Livestock Extension Programme (NALEP). Surveys done in Nairobi did not focus on diversified farming practices. This project was designed to determine the farming practices in Kamae and baseline results showed that there was no organized farming done there. Therefore diversification in farming practices was implemented as an intervention measure as discussed in Chapter Three.
CHAPTER THREE
METHODOLOGY

This chapter describes the procedures and strategies that were used in this study to determine the farming practices, household food security and the nutrition status of children below five years in the peri-urban area of Kamae in Nairobi, and the intervention measure taken. This includes research design, the study area, population, the sample size, the sampling procedures, data collection instruments, pre-testing of instruments, ethical considerations, data collection procedures, demonstrations and intervention and data analysis procedures.

3.1 Research design

This was an intervention study, semi-longitudinal in nature with an intervention period of one year. This research project adopted the Participatory Approach to Nutrition Security (PANS) using the Triple A cycle as shown in Figure 3.1:

Figure 3.1: The (PANS) TRIPLE A approach

Participatory Approach to Nutrition Security (PANS) facilitates the community members to look at themselves, map out their problems, design their solutions and take action to implement the solutions. A baseline survey was carried out to assess the food production and food security situation. Data were analysed to identify the food production and food and nutrition security problems. The problems given first priority in focus group discussions were lack of agricultural and nutrition knowledge and lack of clean and safe water. The action plan included offering of agricultural and nutrition education by the officers from the Ministry of Agriculture and Livestock and Fisheries Development and the researcher respectively. The project participants contributed each Ksh 3,500 for provision of water and the International Development Research Centre (IDRC) through the researcher provided fencing materials, seeds/seedlings and the small livestock worth about Ksh. 10,000 per household. An evaluation was done through a survey to ascertain the impact of the project.

3.2 Study area

Kamae area is in Kahawa Ward in Kasarani Division to the North of Nairobi City. It borders Kiambu District, which is in Central Province of Kenya (Appendix 7). Kamae has a total of 2,036 households and a population of 9,847 persons according to 1999 Population Census (Government of Kenya, 1999). Kamae, like Nairobi City has a bimodal rainfall pattern. The long rainy season is from April to August, while the short rainy season is from late October to early December.
3.3 Population

The target population were farmers in the peri-urban area of Kamae in Nairobi. The accessible population were the 300 sampled farmers in the selected households.

3.4 Sample size

To obtain a representative sample, Fisher’s formula was employed (Fisher et al., 1998).

That is,

\[ nf = \frac{n}{1 + (n + N)} \]

Where, \( nf \) is desired sample when the population is less than 10,000; \( n \) is sample when the total population is more than 10,000; and \( N \) is the estimated population of the households in Kamae area. Therefore, the sample consisted of about 300 households from the following calculation: (The actual figure from the calculation was 323 but was rounded off to the nearest hundreds).

\[ nf = \frac{384}{1 + (384 + 2036)} = 300 \]

The 300 households were covered in the baseline survey for situation assessment. The sample for intervention constituted thirty households. This is 10 percent of 300. There were three focus group discussions during the baseline survey consisting of 10 participants each. One group consisted of men, the other one of women and last one of youth. There was one focus group discussion during the evaluation consisting of those who were in the intervention project. Observations were on the 300 households during the baseline survey, on the 30 intervened households and then on the 180 households
during evaluation survey. Evaluation covered 180 households because about 120 respondents had either shifted, for others their children were already over five years, and there were those who refused to be interviewed because they were not selected for the intervention.

3.5 Sampling procedures

Cluster sampling was employed during baseline survey to obtain the 300 households. This is whereby every respondent in a household with a child below five years within the selected cluster was included in the study. Kamae area was divided into about 100 clusters according to the roads running across the area. The 2,036 total households in Kamae were divided by 100 to estimate the number of households in each cluster. There were about 20 households in each cluster. Out of the 20 households only about 5 households had children below five years. To get the number of clusters to be included in the baseline survey, 300 was divided by 5 leading to 60 clusters. The 60 clusters were selected purposively to include only those who had settled where they were allocated. The 5 respondents with children below five years within these 60 clusters were interviewed.

The 10 participants in the focus groups were selected purposively. The field assistant who was from the area helped to identify 10 men, 10 women and 10 youths who gave key information on food production and consumption. The participants were leaders of various social and religious groups in the community. The 30 households in the intervention were selected based on the nutrition status of their children (those that had high levels of wasting), nutrition knowledge (most of those in the intervention had scored zero) and had farming space available. The 180 households in the evaluation included the 30
households in the intervention and 150 who were in the baseline survey but not in the intervention.

3.6 Data collection instruments

Interview schedules, observation checklists and focus group discussion guides were used for collecting data on various variables.

3.6.1 Interview schedule

The interview schedule (Appendix 3) had questions on demographic information, social economic status, farming practices, intake of some nutrients, dietary diversity, anthropometric data to define the nutrition status of the under fives and household food consumption patterns. Interviews helped to question the farmers to elicit self-reports of their opinions, attitudes, values, beliefs or behaviour towards urban agriculture.

3.6.2 Observation checklist

The observation checklist (Appendix 4) was used to collect data on household farming practices, labour providers, crops produced and tools used for food production.

3.6.3 Focus group discussion guides

The focus group discussion guides (Appendix 5 and Appendix 6) solicited information on crop production and livestock rearing. The guides provided insights into opinions, perceptions, values and attitudes of the participants towards urban farming and household food consumption before and after intervention.
3.6.4 Pre-testing the instruments

A pre-test of the interview schedule, focus group discussion guide and observation checklist was done on 10 households from Kamae. Vague questions were refined and the instruments were checked so as to measure the content that they were supposed to measure. These households had the same characteristics as those in the sample but they were not included in the sample. The instruments were pre-tested on June 13th to June 17th 2005.

3.7 Ethical considerations

The Divisional Officer and the chief of this area were informed about the proposed research project in June 2005. A research permit was obtained from the Ministry of Education, Science and Technology on 5th July 2005. This ensured proper co-ordination of the project and reduced suspicion among the community members. The community members participated in the project voluntarily. They were assured of strict confidentiality of information that they provided.

3.8 Data collection procedures

A research assistant (not from Kamae) and two field assistants (from Kamae) were trained prior to data collection. There was a baseline survey at the beginning of the project (27th June 2005 to 31st July 2005), then monitoring throughout the project and lastly evaluation at the end of the project (March 2006 to April 2006). Data were collected through interview sessions, observation and through focus group discussions.
3.8.1 Training of research and field assistants

Research assistant and two field assistants were trained on data collection techniques. They were trained on interview techniques especially on how to translate the questions from English to Kiswahili. They were also trained on how to measure and record the volume of food cooked and eaten in the households and on how to take and record the anthropometric measurements.

3.8.2 Interview sessions

The interviews were carried out in a face-to-face situation using Kiswahili language. The researcher, research assistant and two field assistants from the community conducted the interviews. Interviews were done during the baseline survey (27th June to 31st July 2005) and at the end of the project (March 2006 and April 2006) for evaluation. The researcher, the research assistant and the field assistants introduced themselves to the household members. Then they explained the purpose of the project and asked for permission to conduct the interview. If the respondents consented, the interviews were conducted. The person interviewed was the head of the household, either male or female or the caregiver present in that household on the date of interview.

Nutrient intake of the children was assessed using 24-hour dietary recall. The intake was assessed by taking volumes of the dish cooked and volume taken by the child and the proportion calculated. The proportions were used to compute the amount of food consumed by the child. Dietary diversity was determined by recording the selected number of food groups consumed in the past 24 hours prior to the interview. To assess
nutrition status of children, age was given by the mother and verified using growth monitoring clinic card. Bathroom scale was used to take weight for both children below 2 years and children over 2 years. Height/ Length was taken using a length/height board. For children below 2 years their length was taken while children above 2 years, their height was taken. The weights and heights of the children were taken when the children had minimum clothing to minimize errors. The readings were taken twice and the average recorded to one decimal. These measurements were then analysed using EpiInfo, (2001) to show how far the child deviates from a well-nourished child used as the standard. Those children with -2 to < -1 SD were classified as mildly malnourished, those with -3 to < -2 SD were classified as moderately malnourished while those below -3 SD were classified as severely malnourished.

The nutrition knowledge focused specifically on carbohydrates and proteins as macronutrients, and on vitamin A and iron as micronutrients. The respondents were asked to give dietary sources of carbohydrates, proteins, vitamin A and iron. The total score was 15 marks. Those who scored 11-15 were regarded as having high knowledge, those who scored 6-10 to have middle knowledge, and those who scored 1-5 to have low knowledge, while those who scored zero as to have no idea. For attitudes, the respondents were given statements that represented attitudes and they were asked whether they agreed or disagreed with these statements. This showed whether they had positive or negative attitudes.
3.8.3 Observations

Observation was continuous throughout the project duration. The researcher, trained research assistant and two field assistants observed the farming systems, the crops produced, the livestock reared and the farmers' practices in farming. These were recorded on the observation checklist.

3.8.4 Focus group discussions

There were focus group discussions during the baseline survey (14\textsuperscript{th} September to 16\textsuperscript{th} September 2005) and during evaluation survey (16\textsuperscript{th} April 2006). The researcher and the research assistant guided the focus group sessions. The sessions identified the type of crops and livestock reared. Probing revealed the problems experienced in food production, consumption and livestock rearing and came up with community action plan. The focus group discussions in the evaluation survey identified the participants' opinions and attitudes towards the whole project. These sessions were tape-recorded.

3.8.5 Awareness campaigns

To sensitize the community members on the objectives and importance of this project, an awareness campaign was done (on July 25\textsuperscript{th} 2005) with collaboration with the staff of Ministry of Agriculture and Ministry of Livestock and Fisheries Development. The staff also promoted the use of locally made energy saving cooker popularly known as ‘fireless cooker’ and multi-storey gardens.
3.8.6 Demonstrations and intervention

The 30 households chosen for intervention were trained in two sessions. The first session was on agricultural training specifically on organic farming. Organic farming is one of the best methods for small-scale farmers because it does not require expensive inputs and can improve yields, improve soil fertility, prevent soil erosion and improve nutritional content of food (Ongwae, 2006). It is especially effective for the poor people because it increases their income security and improves their livelihood. The other session was on nutrition education, specifically on the macronutrients (carbohydrates and proteins) and vitamins and minerals, laying emphasis on Vitamin A and iron because of their deficiencies are very common. The participants were trained in two groups.

The first group was trained by the researcher and an organic farming expert with collaboration with the staff of Ministry of Agriculture on 29th October 2005 and the demonstration was done on 2nd of November 2005. The second group was trained on 16th November by a chosen project participant who was in the first training session under the researcher’s guidance. The demonstration was done on the same plot on the same day. Small livestock were kept on the two demonstration plots. The two demonstrations plots were chosen by the project team with the help of the project participants. The demonstration plots were at strategic points, each corner of the area. The other 28 farmers in the intervention were guided on how to plant crops and rear small livestock on their plots. All 30 households were left to choose the crops they wanted to produce and the livestock they wanted to rear.
3.9 Data analysis

The quantitative data were analyzed using the Statistical Package for Social Sciences (SPSS) programme to generate frequencies, means and standard deviations. The farming practices were determined by assessing the food production system adopted by the households. The practices were in terms of crop and small livestock production. Anthropometric data were analyzed using the Nutrition Package (Epi Info, 2000). Weight, height and age were computed to generate Z-scores that were used to define the nutrition status. Those children with -2 to < -1 SD were classified as mildly malnourished, those with -3 to < -2 SD were classified as moderately malnourished while those below -3 SD were classified as severely malnourished. Anthropometric measurements were compared with the U.S. National Centre for Health Statistics/World Health Organization (NCHS/WHO) international reference standards (Epi Info, 2000).

The household food consumption was determined by assessing the intake of calories, protein, vitamin A and iron. The nutrient intake data were analyzed using computer software (Nutrisurvey, 2004). Dietary diversity was assessed by totaling the number of food groups consumed in the households for the past 24 hours. These groups are starchy (cereals), starchy (non-cereals), legumes and nuts (fresh), legumes and nuts (dry), vegetables, fruits, eggs, meat and fish. Those households consuming 1-3 groups were classified as having low diversity, those consuming 4-6 groups were classified as having middle diversity while those consuming 7-9 groups were classified as having high diversity (Hoddinolt and Yohannes, 2002). Frequency of intake of the same food groups in a specified period of time was assessed to determine food consumption patterns. The number of times food was eaten was counted to assess access to food in the households.
The level of agricultural and nutrition knowledge and the attitudes of the farmers were assessed by totaling the scores in each household.

The qualitative data on farming practices from the interviews were organized into categories then into themes for meaningful interpretation. Transcription was done on tape-recorded data to determine more information on the problems encountered in crop and small livestock production and the farmers' attitudes towards urban agriculture. Pearson product moment (r) established relationships between farming practices and household food security and tested the hypothesis at 0.05 significant levels. T-test was used to evaluate the intervention project by comparing mean intakes of calories, protein, vitamin A, iron and levels of nutrition knowledge before and after the intervention at 0.05 significant levels. Cross tabulation was used to determine the changes in occupations of respondents, crop diversity, nutrition knowledge and dietary diversity in the households after intervention. The results are presented in tables and photographs in Chapter Four.
CHAPTER FOUR
RESULTS AND DISCUSSIONS

The results of the intervention project are discussed under the following topics: demographic and social economic characteristics, knowledge and attitudes of the farmers towards peri-urban agriculture in the households before and after intervention, farming practices among the farmers in the households before and after intervention. Other results are on household food security status in this area before and after the intervention and nutrition status of children below five years in the households before and after the intervention. Lastly, on the model developed on diversification of farming practices to enhance household food and nutrition security, the relationships between farming practices and the household food and nutrition security and also dissemination of the project results to the community members.

4.1 DEMOGRAPHIC CHARACTERISTICS

The demographic information included gender of the respondents, ethnicity, size of the households, the number of children in the households, the number of children who were under five years, marital status and the education levels of the respondents.

4.1.1 Gender of the respondents

The study covered 300 households (Table 4.1) for the baseline survey, 30 households for intervention project and 180 households for evaluation (30 in intervention and 150 not in the intervention). In the baseline survey, out of 300 respondents 3% were males while 97% were females. All the respondents 100% in the evaluation survey were females.
Table 4.1: Demographic characteristics of households in baseline and evaluation surveys

<table>
<thead>
<tr>
<th>Variables</th>
<th>Baseline N/(%)</th>
<th>Evaluation N/(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender of respondents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9 (3.0%)</td>
<td>0</td>
</tr>
<tr>
<td>Female</td>
<td>291 (97.0%)</td>
<td>180 (100%)</td>
</tr>
<tr>
<td>Marital status of the respondents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>78 (26.0%)</td>
<td>42 (23.3%)</td>
</tr>
<tr>
<td>Married</td>
<td>218 (72.7%)</td>
<td>137 (76.1%)</td>
</tr>
<tr>
<td>Widow/er</td>
<td>3 (1.0%)</td>
<td>1 (0.6%)</td>
</tr>
<tr>
<td>Divorced</td>
<td>1 (0.3%)</td>
<td>0</td>
</tr>
<tr>
<td>Ethnicity of the respondents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kikuyu</td>
<td>287 (95.7%)</td>
<td>176 (97.7%)</td>
</tr>
<tr>
<td>Others</td>
<td>13 (4.3%)</td>
<td>4 (2.3%)</td>
</tr>
<tr>
<td>Highest level of education of respondents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No education</td>
<td>20 (6.7%)</td>
<td>3 (2.0%)</td>
</tr>
<tr>
<td>Primary</td>
<td>218 (72.7%)</td>
<td>124 (82.7%)</td>
</tr>
<tr>
<td>Secondary</td>
<td>58 (19.3%)</td>
<td>20 (13.3%)</td>
</tr>
<tr>
<td>Diploma</td>
<td>4 (1.3%)</td>
<td>3 (2.0%)</td>
</tr>
<tr>
<td>Total</td>
<td>300 (100%)</td>
<td>180 (100%)</td>
</tr>
</tbody>
</table>

The high numbers of females interviewed in this study is due to the fact that most of the women in Kamae are housewives hence they were easy to access than males.

4.1.2 Marital status of the respondents

Out of 300 respondents in the baseline survey 26% were single and 72.7% were married. In the evaluation survey out of 180 respondents 23.3% were single and 76.1% were married (Table 4.1). Poor female-headed households are usually vulnerable to food insecurity because of the diverse responsibilities laid heavily on the females who have to provide for the household members. Poor female heads were found to practise ‘poor type’ of crop cultivation in a study done in Nakuru town because they lacked money, knowledge and skills (RUAF, 2006). After intervention, the 30 households (only two
households were female headed) practised organized crop cultivation due to the agricultural training that they received.

4.1.3 Ethnicity of the respondents

Ethnicity plays an important role in the choice of the crops to be produced and the food to be consumed in the households (Kimiywe and Waudo, 2005). Out of 300 respondents most (95.7%) were Kikuyus, (2.7%) were Kambas and a few others were Merus, Luhyas and Embus in the baseline survey (Table 4.1). Out of 180 respondents in the evaluation survey most (97.7%) of the respondents were Kikuyus, while the others were Kambas, Embus and one was a Mdama from Uganda. From observation, it was notable that since Kikuyus were the majority they did not appreciate some traditional vegetables especially those that were not known to them though they have been found to be of high nutritional value. There is need therefore for extensive nutrition training especially where people have negative attitudes towards certain foods or are not exposed to those foods.

4.1.4 Educational levels of the respondents

Educational levels determine the social economic status and the overall well being of the households. This is because educated people most of the times obtain better paying jobs and are able to invest in nutrition and health for the well-being of the households. Out of 300 households in the baseline survey, 6.7% had not gone to school at all, majority, (72.7%), had primary school education, while only 1.3% had post secondary training attaining a diploma (Table 4.1). The results of evaluation survey similar to the baseline survey revealed that majority, 82.7%, of the respondents had attained education up to
primary school level. Those who had not attended school at all and those who had post secondary training were (2%) each (Table 4.1).

4.1.5 Household demographics

The household demographics included the household size, number of children in the household and the number of children that were below five years. Table 4.2 represents the household demographics for the baseline and the evaluation surveys:

Table 4.2: Household demographics

<table>
<thead>
<tr>
<th></th>
<th>Baseline survey</th>
<th>Evaluation survey</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=300</td>
<td>N=180</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>Household size</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>Total No of children</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>No of under fives</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

The household sizes ranged between 2 and 12 with a mean size of 5 household members in the baseline survey. This mean household size differs slightly from that of Nairobi (3.3) according to the Kenyan Demographic and Health Survey (Government of Kenya, 2003b). The number of children ranged between 1 and 10 with a mean of 3 children in the baseline survey. The minimum number of children below five years was 1 while the maximum was 4 and a mean of 1 child. In the evaluation survey the household size ranged between 2 and 10 household members with a mean of 5 members. The minimum number of children in the households was 1 while the maximum and mean was 8 and 2 respectively. The minimum number of children below five years was 1 while the maximum was 3 and the mean was 1 child. The size of the household determines the
amount of food required for that household. The number of children below five years in a household determines the amount of time a mother or caretaker will invest in childcare. The respondents’ and household demographic characteristics would have an effect on the household social economic status.

4.2 SOCIAL ECONOMIC STATUS OF THE RESPONDENTS

The social economic status of a household depends on the occupation and the assets owned by the individual providing for the household needs and the income he/she earns. In this study most of the respondents were housewives and casual labourers. This could be attributed to their educational levels because most (72.7%) of them had attained up to primary level education.

4.2.1 Ownership of the plots

Kamae is a resettlement scheme whereby these former slum dwellers were resettled in the year 2001 by the Government of Kenya on plots measuring about 30 by 60 ft (information obtained from resettlement certificates). They have permanent ownership of these plots because each of them has a resettlement certificate. There are a few others who have rented or are taking care of the plots for other people. All the 30 households included in the intervention project have permanent ownership of the plots for the purpose of sustainability of the project.

4.2.2 Occupations of the respondents

The occupations of household members determine the levels of income at their disposal. If the income at the household disposal is well managed, household food security can be
enhanced. The respondents were asked to state the occupations that they were involved in at the time of the study. The results of the baseline and evaluation surveys and changes in occupations of respondents in the 30 households were as indicated in Table 4.3.

Table 4.3: Occupations of the respondents before and after intervention

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Baseline 300 assessed</th>
<th>30 vulnerable</th>
<th>Evaluation 150 evaluated</th>
<th>30 intervened</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Casual labourers</td>
<td>80</td>
<td>26.7</td>
<td>11</td>
<td>36.7</td>
</tr>
<tr>
<td>Housewives</td>
<td>101</td>
<td>33.7</td>
<td>13</td>
<td>43.3</td>
</tr>
<tr>
<td>Business</td>
<td>43</td>
<td>14.3</td>
<td>4</td>
<td>13.3</td>
</tr>
<tr>
<td>Farmers</td>
<td>3</td>
<td>1.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Private sector</td>
<td>1</td>
<td>0.3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unemployed</td>
<td>72</td>
<td>24.0</td>
<td>2</td>
<td>6.7</td>
</tr>
<tr>
<td>Farmer and casual labourer</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Farmer and business</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>100</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

Out of 300 respondents in the baseline survey, 26.7% were casual labourers doing jobs such as masonry for men while women were washing clothes for the neighbouring middle level residential area. About 33.7% were housewives and 24% were unemployed.

The focus group discussions revealed that the residents also acquired income from coffee estates, which are in the neighbourhood. Out of those 150 respondents in the evaluation survey, most of them 32.6% were housewives and 24% were unemployed.

Results in Table 4.3 show that those 30 respondents in the intervention changed their occupations completely after intervention. Those 13(43.3%) who were housewives (no other occupations) before intervention changed their occupations after intervention. Out of 13, it was found out that 7 became farmers and sold surplus especially vegetables hence became farmers and business people. Results showed that 3 of them became farmers and lastly 3 of them farmed and went for casual jobs. Half of them 15(50%) were
able to farm and sell the surplus especially of vegetables hence becoming farmers and business people. Others 11 (36.7%) were casual labourers before intervention but after intervention they farmed and also went for casual jobs especially in the coffee plantations, which are in the neighbourhood. By the time of the evaluation, only 4 (13.3%) were involved in farming only. Diversification of economic activities is a way of broadening the households’ financial base or capacity. As a result, the access component of household food security is enhanced.

4.2.3 Respondents’ income per month

The incomes at the households’ disposal depend on the occupations of the household members. In this study the respondents were asked to estimate the total household income per month. According to the results of the baseline survey, the income of the respondents ranged between as low as 1,000 Kenyan shillings to 25,000 Kenyan shillings per month. During the baseline survey, the highest percentage, 71%, out of 300 respondents earned between 1,001 and 5,000 Kenyan shillings per month and the least, 0.3%, earned above 25,000 Kenyan shillings per month. In the evaluation survey covering 150 non-participating households, most of the respondents 58.7% were earning between 1,001 and 5,000 Kenyan shillings per month. Those who earned below 1,000 Kenyan shillings per month were 39.3% while just a few 2% earned between 5,001 and 10,000 Kenyan shillings per month. Table 4.4 shows the ranges of income of the respondents per month during the baseline and evaluation surveys:
Table 4.4: Range of incomes in the households per month

| Ranges of incomes in Kenya shillings per month | Baseline | | | | | | Evaluation | | | |
|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | N | % |
| 1,000 and below | 51 | 17.0 | 2 | 6.7 | 59 | 39.3 | 3 | 10.0 |
| 1,001 - 5,000 | 213 | 71.0 | 23 | 76.7 | 88 | 58.7 | 25 | 83.4 |
| 5,001 - 10,000 | 32 | 10.7 | 4 | 13.3 | 3 | 2.0 | 0 | 0 |
| 10,001 - 15,000 | 1 | 0.3 | 1 | 3.3 | 0 | 0 | 1 | 3.3 |
| 15,001 - 20,000 | 2 | 0.7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20,001 - 25,000 | 1 | 0.3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Above 25,000 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3.3 |
| Total | 300 | 100 | 30 | 100 | 150 | 100 | 30 | 100 |

Among the 30 respondents found vulnerable, 23(76.7%) of them earned between 1,001 and 5,000 Kenyan shillings. After intervention, those who earned between 1,001 and 5,000 Kenyan shillings increased to 25(83.4%) and one respondent was earning above 25,000 Kenyan shillings. This respondent was a male who worked as a train driver and had been interdicted at the time of assessment after killing a person, but during evaluation he had been reinstated. The one household that dropped to the income of 1,000 Kenya shillings after intervention was for a single female casual labourer at Kenyatta University and during intervention was not on hire. Urban farmers in Nakuru confessed that they fetched 32% of their income from livestock and 15% from crops (Klaver, 2006). Income generation increases food consumption and improves the quality of diets for poorer households (Bonnard, 2001). Due to the increased income the households’ food purchases become more diverse shifting to higher quality foods implying that the diets
become more diversified and overall nutrient composition of the diet improves (Bonnard, 2001).

4.2.4 Respondents' assets

Materials property owned by the individuals indicate the income levels or the purchasing power of those individuals. Nine common assets (TV, radio, gas cooker, lantern lamp, gas lamp, sofa set, bicycle, motor cycle and motor vehicle) in this community were listed. They were then classified into four categories 1-3 assets indicating low, 4-6 assets indicating middle index and 7-9 assets indicating high index as follows in Table 4.5.

Table 4.5: Assets owned by respondents in the baseline and evaluation surveys.

<table>
<thead>
<tr>
<th>Asset index</th>
<th>Baseline</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>300 assessed</td>
<td>30 vulnerable</td>
</tr>
<tr>
<td>None</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>1-3 low</td>
<td>179</td>
<td>59.7</td>
</tr>
<tr>
<td>4-6 middle</td>
<td>65</td>
<td>21.7</td>
</tr>
<tr>
<td>7-9 high</td>
<td>4</td>
<td>1.3</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>100</td>
</tr>
</tbody>
</table>

In the baseline survey, the highest percentage 59.7% owned between 1 and 3 of the selected assets, while the least percentage 1.3% out of 300 respondents owned between 7 and 9 of the chosen assets. In the evaluation the highest number 72% owned between 1 and 3 of the selected assets, while none had the highest index of 7 to 9 selected assets. The reason why none had the high index among the non-participants in the evaluation survey is because those who were well to do refused to be interviewed the second time.

Out of 30 households before the intervention, 4(1.3%) owned between 4-6 assets and
they increased to 10(33.3%) after intervention. Those who owned none of the assets decreased from 5(16.5%) to 3(10%). A study in Korogocho Nairobi revealed higher material welfare level among the farmers than the non-farmers due to the fact that the farmers spent less money on purchasing food hence could purchase other assets (Foeken and Mwangi, 2000).

The social economic status of Kamae residents are not stable because most of them are casual labourers hence their incomes are not regular. Introduction of gardening by this project contributed to stabilising of the social economic status of those practising it. This project provided employment in form of informal jobs. The project participants usually work on their gardens and some offer part time employment to others especially during land preparation and planting. This has led to diversification of income generation sources because Kamae residents are casual labourers and sometimes they are not hired. Sale of the vegetables from the gardens provide alternative source of income when casual jobs are not forthcoming hence decreasing their vulnerability to deterioration of their livelihood.

4.3 KNOWLEDGE AND ATTITUDES OF THE FARMERS ON URBAN FARMING

The farmers’ attitudes, knowledge and skills depend on the training that they may have received. Knowledge in certain production techniques such as crop protection and rotation leads to high level of production (Mougeot, 2000). The aspects considered were agricultural and post harvest-handling knowledge, nutrition knowledge and the attitudes of the farmers towards farming.
4.3.1 Agricultural knowledge

The results in the baseline survey revealed that none of the 300 respondents had received any kind of organized agricultural training. Due to this lack of organized agricultural knowledge a training programme on organic farming was developed covering soil preparation, crop management, harvesting techniques and post harvest handling. The following photograph represents an organic farming expert training the residents on how to prepare their pieces of land, how to plant and manage the crops and on post harvest handling.

Plate 4.1: Project participants in an agricultural training session.

Out of those 300 households in the baseline survey, 67.3% had not heard about farming at all. Those 8.4% who had any form of agricultural knowledge or information (that is, on either of these: soil preparation, compost manure making, planting dates, plant spacing, crop protection, crop rotation, weeding dates, harvesting dates harvesting techniques and preserving the surplus) had received from school where they received their formal schooling and from the media especially the radio (Table 4.6)
Table 4.6: Sources of agricultural information

<table>
<thead>
<tr>
<th>Sources of information</th>
<th>Baseline</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>300 assessed</td>
<td>30 vulnerable</td>
</tr>
<tr>
<td>Not heard</td>
<td>201 67.3</td>
<td>23 76.7</td>
</tr>
<tr>
<td>Parents</td>
<td>73 24.3</td>
<td>5 16.7</td>
</tr>
<tr>
<td>Class and farm training</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>Others (e.g. media)</td>
<td>26 8.4</td>
<td>2 6.6</td>
</tr>
</tbody>
</table>

Out of the 150 households in the intervention, most of them (76%) had not got any agricultural information from any source. After intervention all the 30 households reported that they gained information from training sessions and from on-farm training. Probing in the focus group discussions revealed that they learnt something that they had never learnt before. One of the project participant said in Kiswahili, ‘Hatukuwa tunajua yakwamba tunaweza kulima kwa plots hizi zetu. Tulikuwa tunaziona zikiwa ndogo sana. Lakini saa hii wengine wetu tunapata mboga ya kutosha na hata tunauza’. In English “We did not know that we could farm on these plots. We were seeing them very small. But right now some of us are getting enough of vegetables and surplus for selling”.

(Focus group discussion April 2006)

4.3.2 Post harvest handling

There is a risk of low retention of food crops due to selling. The risk mitigation measure in this project was to initiate and promote solar drying as a low cost preservation technology. Preservation of agricultural produce is important so as to avoid post harvest losses caused by spoilage. In this project locally made solar driers were constructed by a carpenter from the community in conjunction with the project participants. They were
constructed in a way that the vegetables are protected from dust, rain, wind, insects, birds, rodents and domestic animals while drying. The following photographs show two locally made solar driers during a demonstration on how they work:

Plate 4.2: Two locally made solar driers during a demonstration on how they work

The participants were trained on how to prepare the vegetables before drying them. The vegetables were washed, shredded and put in the solar drier to dry. They were advised to observe high levels of hygiene to avoid contamination during drying. The surplus crops can be processed and stored for later resale. The producer can sell in small quantities over a longer period of time achieving a steadier flow of income and capturing a higher price later in the marketing season (Bonnard, 2001).

4.3.3 Nutrition knowledge

Nutrition impact of agricultural interventions is improved by incorporating well-designed nutrition training. Nutrition knowledge improves the food selection choices made by the individuals and utilization of the selected food. The results of the baseline survey showed
that out of the 300 respondents 49.7% had no idea at all about macronutrients (carbohydrates and proteins) and micronutrients (vitamin A and iron). About 30% knew very well what carbohydrates, proteins, vitamin A and iron are, and could give their sources (Table 4.7).

Table 4.7: Levels of nutrition knowledge before and after intervention

<table>
<thead>
<tr>
<th>Levels of nutrition knowledge</th>
<th>Baseline 300 assessed</th>
<th>30 vulnerable</th>
<th>Evaluation 150 evaluated</th>
<th>30 intervened</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Zero or no idea</td>
<td>149</td>
<td>49.7</td>
<td>15</td>
<td>50.0</td>
</tr>
<tr>
<td>1-5 low</td>
<td>28</td>
<td>9.3</td>
<td>3</td>
<td>10.0</td>
</tr>
<tr>
<td>6-10 middle</td>
<td>33</td>
<td>11.0</td>
<td>6</td>
<td>20.0</td>
</tr>
<tr>
<td>11-15 high</td>
<td>90</td>
<td>30.0</td>
<td>6</td>
<td>20.0</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>100</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

\(t\)-value = 2.843, mean difference = 0.967 and \(p = 0.060\)

Out of those 30 respondents selected for intervention 15(50%) had no idea about carbohydrates, proteins vitamin A and iron. After training the 30 respondents on carbohydrates, proteins, vitamin A and iron and their sources those who still did not have any idea were 9(20%). After reconsidering their educational levels, it was realized that they had not gone to school at all hence they had limited ability to recall what they had been trained on. The mean difference between nutrition knowledge before and after the intervention was 0.967 but was not significant (\(p = 0.060\)).

4.3.4 Attitudes of the respondents towards urban farming

The attitude of an individual depends on the level of knowledge one may have acquired from various sources of information. The respondents were given statements that represented attitudes and they were asked whether they agreed or disagreed with these
statements. Table 4.8 shows that most of the respondents above 97%, in the baseline survey had positive attitudes towards farming in the baseline survey.

Table 4.8: Attitudes of the respondents towards urban farming

<table>
<thead>
<tr>
<th>Attitude</th>
<th>Baseline</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>300 assessed</td>
<td>30 vulnerable</td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>Disagree</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Is a good thing</td>
<td>98.3</td>
<td>1.7</td>
</tr>
<tr>
<td>Is good to neighbours</td>
<td>97.3</td>
<td>2.7</td>
</tr>
<tr>
<td>Should be accepted</td>
<td>98.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Important in food supply</td>
<td>98.7</td>
<td>1.3</td>
</tr>
<tr>
<td>Supported by government</td>
<td>98.7</td>
<td>1.3</td>
</tr>
</tbody>
</table>

All the 30 households before and after intervention had positive attitudes towards urban farming. They all thought that urban farming was a good thing and recommended that neighbours should consider it as it enhanced household food supply hence the government should support it. This was the case too, in the 150 households that were not included in intervention. Why the respondents in the 150 households had positive attitudes is probably because they could see how those in the intervention were benefiting from farming. Farmers in Nakuru town were positive about urban farming and they had a general conviction that farming in town is important to urban food supply (Nyandwaro, 2006). The stakeholders in the area of Urban and Peri-urban Agriculture and Livestock (UPAL) should collaborate with the urban and peri-urban residents to push UPAL into the national policy agenda.
Majority of Kamae residents had not received any form of agricultural training by the time of the baseline survey. After offering knowledge on how to utilize their small plots to 30 respondents, crop production is now widely spread in this area even among those that were not trained. This is because these residents are positive about farming. About half of them did not know the dietary sources of carbohydrates, proteins, vitamin A and iron. After training 30 respondents on the same, it still seemed difficult for them to recall. The challenge was their low educational levels hence need to offer nutrition knowledge using visual aids to enhance understanding.

4.4 FARMING PRACTICES IN THE HOUSEHOLDS

The farming practices considered were household food production systems, acquisition of seedlings, types and diversity of crops produced and harvested and the problems associated with urban farming.

4.4.1 Household food production systems

The systems of farming adopted by the household members determine the benefits reaped from their land. Diversification of farming systems is important because it also diversifies the end product. According to the results of the baseline survey, there was either no farming, little or disorganised farming being done. In focus group discussions a participant revealed the reason why they did not farm. She said in Kiswahili, “Hatuwezi kulima kwa plot hizi zetu kwa sababu mifugo ya jirani huharibu mimea yetu”. Translated in English, “We can not farm on our plots because neighbours’ livestock destroy our crops”. Asked what the possible solution would be, another one said, “Kuweka ua
lizunguke ploti yote”. Translated in English, “Fencing all round the plot”. Probing why they had not done it, one of the resident said, “Unajua hatuna uwezo wa kifedha” in English, “We have no economic power to fence all around our plots”. (Focus group discussion held in September 2005).

Fencing was then done all round the 30 households that were found to be the most vulnerable. All the fencing materials (posts, barbed wire, chain link, nails, cement, sand and ballast) were all provided by IDRC project and given free of charge to farmers, the participants only provided labour for fencing. At least 10,000 Kenyan shillings was spent on each household to set up a garden. The following photographs represent one of the households before and after intervention:

Plate 4.3: (Left) a plot before intervention (right) and same plot when fencing started

Plate 4.4: The same plot during demonstration and after intervention
All the 30 households chosen for intervention either had no crops and small livestock or for those that had crops, they had no distinct farming system. After intervention the farming systems in those households were three distinct ones with diversification of the crops that were produced. Therefore it is important to build upon and improve on traditional mixed cropping systems. Mixed cropping systems reduce risk and total crop failure (IFPRI, 2001). The three identified systems were as follows: small-scale subsistence farming system, small-scale market oriented crop production and small-scale livestock production.

4.4.1.1 Small-scale subsistence farming system

This is production of crops entirely for household food consumption. The crops produced by the 30 households were: starchy (cereals) such as maize, starchy (non-cereals) such as potatoes and legumes harvested when dry including all types of beans. The vegetables included kales, spinach, amaranth, pumpkin leaves, cowpea leaves, cabbages, green pepper, eggplants, courgettes, coriander, tomatoes and other traditional vegetables (\textit{managu-solanum nigrum} and \textit{saget-cleome gynandia}) and fruits such as melon and pawpaw.

4.4.1.2 Small-scale market oriented crop production

This is a system whereby the farmers have produced enough and have surplus for sale to earn some income. This system changes the economic and social status and roles of community members, especially the women. Out of the 30 households, 46.7% managed
to produce enough vegetables to meet the household needs and had surplus for sale. They sold kales, spinach, courgettes, amaranth and coriander.

4.4.1.3 Small-scale livestock production

The residents of Kamae reared large and small livestock. The large livestock commonly reared in this area is cattle. The small livestock reared included goat, sheep, pig, rabbits, chicken, duck, turkey and doves. Plate 4.5 shows the chicken given to project participants.

Plate 4.5: Chicken given to project participants.

The small livestock chosen by the 30 households were chicken and ducks. The 30 households in the intervention were provided with a male and female chicken or duck. Small livestock was chosen because they do not require a lot of inputs in terms of space and feeding. The participants were asked to construct a shelter for the small livestock using the materials provided. By the time of evaluation, the poultry given to the 30 project participants were already laying eggs.
4.4.2 How respondents acquired seeds and seedlings

According to the results of the baseline and evaluation surveys, all the households bought their own seeds and seedlings. Those in the intervention were given seed and seedlings that they required at the beginning of the project (October 2005-March 2006). In the season that followed those in the intervention were not given seeds and seedlings by the project team. It was observed that 7(23.3%) bought their own seeds and seedlings. Others 23(76.7%) established their own seedbeds for vegetable seedlings. This has enhanced the sustainability of the project. In the real sense, many more who were not in the intervention have set up their gardens and they buy seedlings from those in the intervention.

4.4.3 Types and diversity of crops produced and harvested in the households

Out of the 300 households covered in the baseline survey 206(68.7%) did not produce any crops. The crops were grouped into six (6) groups namely: starchy (cereals) such as maize and starchy (non-cereals) such as potatoes. Then legumes and nuts harvested when still green such as frenchbeans and green peas and legumes and nuts harvested when dry including all types of beans. The last group included the fruits and vegetables. The diversity of crops produced in the 30 households increased as indicated by the results in Table 4.9:
Table 4.9: Crop diversity in the households before and after intervention

<table>
<thead>
<tr>
<th>Crop diversity</th>
<th>Baseline</th>
<th></th>
<th></th>
<th>Evaluation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>300 assessed</td>
<td>30 vulnerable</td>
<td>150 evaluated</td>
<td>30 intervened</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>No crops</td>
<td>206</td>
<td>68.7</td>
<td>24</td>
<td>80.0</td>
<td>114</td>
</tr>
<tr>
<td>1-2 low</td>
<td>65</td>
<td>21.6</td>
<td>1</td>
<td>3.3</td>
<td>31</td>
</tr>
<tr>
<td>3-4 middle</td>
<td>23</td>
<td>7.7</td>
<td>3</td>
<td>10.0</td>
<td>4</td>
</tr>
<tr>
<td>5-6 high</td>
<td>6</td>
<td>2.0</td>
<td>2</td>
<td>6.7</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>100</td>
<td>30</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

\[t\text{-value}=12.78 \text{ mean}=2.90 \text{ and } p=0.00\]

In the 30 households chosen for intervention, 24 of them (80%) did not produce any crops before the intervention. After intervention, cross tabulation test showed that 4 households moved to 1-2 groups (low diversity), 18 households moved to 3-4 groups (middle diversity) and 2 households moved to 5-6 groups (high diversity). The one household that was producing 1-2 groups (low diversity) before the intervention moved to 3-4 groups (middle diversity) as indicated in Table 4.9. T-test results showed significant difference in crop diversity before and after intervention \((t=12.78 \text{ mean}=2.90 \text{ and } p=0.00)\). All of them gave a priority to different types of vegetables such as kales, spinach, Amaranth, cowpea leaves, cabbages, green pepper, eggplant, courgettes, coriander, tomatoes and other traditional vegetables \((\text{managu- solanum nigrum and saget- cleome gynandia-})\). The reason being that they are short season crops and they are marketable.

The project participants also produced fruits such as melons and pawpaws. They also produced maize, beans, potatoes, sweet potatoes and bananas. Different households
utilized the crops in different ways. There were 16(53.3%) households producing basically for home consumption while 14(46.7%) consumed at home and sold the surplus especially the vegetables. The following photographs show some of the different types of crops that were produced in the households indicating crop diversity:

Plate 4.6: Crops produced by participants: Spinach, kales, pawpaw, sweet potatoes, onions, banana, mango tree, green pepper and eggplants

4.4.4 Problems associated with urban farming

The problems encountered in livestock production were that they lacked fodder especially for those who had large ones such as the cows. The underlying problem is that their plots are small hence they cannot plant fodder such as napier grass. They also complained of lack of space for rearing large livestock and that the animals were affected by diseases which caused many deaths of chicken. Asked whether they received extension services from the Ministry of Livestock and Fisheries Development; one of the focus group participant said, “Huwa tunasikia tu kwa radio, lakini wengine hawana hio radio kwa hivyo mifugo yao inaangamia”. In English: ‘We hear from the radios, but there are those without the radios therefore their livestock die from diseases’. It was
noted that those who reared cows, sought artificial insemination and vaccination services from private service providers. This is because extension service in Nairobi by the Ministry of Agriculture and Ministry of Livestock and Fisheries Development is farmer driven.

There are many benefits associated with urban farming. It has a critical role in providing food for the household members and alleviating urban poverty by providing job opportunities and by generating income. However there are people who believe that there are problems that are caused by this kind of farming. There are people who claim that urban farms are unsightly and promote pollution and illness (Tinker, 1993). Table 4.10 represents the problems that the respondents in the assessment and evaluation surveys reported to have been caused by urban farming.

Table 4.10: Problems caused by urban farming before and after intervention

<table>
<thead>
<tr>
<th>Problems</th>
<th>Baseline</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>300 assessed</td>
<td>30 vulnerable</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Pollution</td>
<td>13</td>
<td>4.3</td>
</tr>
<tr>
<td>Noise</td>
<td>4</td>
<td>1.3</td>
</tr>
<tr>
<td>Diseases</td>
<td>3</td>
<td>1.0</td>
</tr>
<tr>
<td>None</td>
<td>280</td>
<td>93.3</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>100</td>
</tr>
</tbody>
</table>

In the baseline survey, 4.3% argued that urban farming causes pollution, while there were 21.4% in evaluation that argued the same. Those who said that farming specifically
livestock causes noise were 1.3% in the baseline survey and 5.3% in the evaluation survey. They said noise from the livestock cause disturbance to neighbours. The droppings of the livestock cause pollution and this causes bad smell. In the focus group discussions the youth complained that the pigs were the worst livestock to rear because they are dirty. They wandered in the community consuming all sorts of rubbish and the worst thing is that they mated with the dogs.

The results of this project on farming practices show that agricultural activities can only be developed to considerable levels if the people involved are empowered with the relevant knowledge and skills. For those who are extremely poor, the donor community in collaboration with the governments, NGOs, CBOs and other relevant organizations should provide financial support to them so that they can implement the knowledge and skills acquired.

By the time of the baseline survey, there were no organized farming practices identifiable at Kamae. Fencing all around the 30 households enhanced production of a wide variety of crops including banana and pawpaw trees that could not mature because of livestock, which destroyed them. Setting up these 30 gardens has seen many more such gardens set up by others in this area. The fencing was an eye opener to many in this area.

4.5 HOUSEHOLD FOOD SECURITY
Agricultural interventions if well designed and implemented contribute significantly to household food availability, access and utilization. This is so when the farmers choose a better mixture of crops and improve their farming systems and practices. The result of
this is enhanced food and nutrition security. This study focused on the means of food procurement in the households, proportion of income spent on food purchases, intakes of calories, proteins, vitamin A and iron, dietary diversity and consumption patterns of selected foods.

4.5.1 Means of food procurement

The means through which a household acquires food to meet the dietary needs of its members determines the household food security status of that particular household. A household can obtain food mainly via home production, purchasing from the market, or through own production and purchasing. Sustainable own production depends on availability of resources such as land that must be fertile, rainfall, knowledge and skills of farmers.

Enough purchases from the market depend on the purchasing power of the household that is, whether they have enough money to buy enough food for all the household members. A youth in the focus group discussion said, “Inawezekana wamama wanajua ile chakula watoto wanakosa lakini hawana kazi ya kuwapa mapato”. In English, “It may be possible that the mothers know the kind of food that their children are lacking but these mothers have no source of income” (Focus group discussion in September 2005). According to the findings of this study, majority (76.7%), of the respondents in the baseline survey acquired food through purchasing, while the least (1.7%) acquired food through urban production (Table 4.11). A study in Nakuru showed similar results whereby, 64% acquired food through purchasing and 1% acquired through urban production (Klaver, 2006).
Table 4.11: Acquisition of food by the households

<table>
<thead>
<tr>
<th>Source of food</th>
<th>Baseline 300 assessed</th>
<th>Baseline 30 vulnerable</th>
<th>Evaluation 150 evaluated</th>
<th>Evaluation 30 intervened</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Own urban production</td>
<td>5</td>
<td>1.7</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>Purchase</td>
<td>230</td>
<td>76.7</td>
<td>25</td>
<td>83.3</td>
</tr>
<tr>
<td>Urban production &amp; purchase</td>
<td>57</td>
<td>19.0</td>
<td>3</td>
<td>10.0</td>
</tr>
<tr>
<td>Rural production &amp; purchase</td>
<td>8</td>
<td>2.7</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>100</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

Out of those 30 households found to be vulnerable, most 25(83.3%) of them acquired food through purchasing. After intervention, those who acquired food through own urban production and purchasing increased from 3(10%) to 28(93.4%). According to Klaver (2006), 64% urban farmers purchased food compared to 90% non-farmers who purchased food for their household food needs. Out of the 150 households in the evaluation majority, 85.3%, of them acquired food through purchasing while only 8.7% acquired through own urban production and purchase. The food that is at the household’s disposal should be adequate to meet all the needs of the household members.

4.5.2 Amount of money (in Ksh) spent on food per month in the households

The proportion of income spent per month by a household on food purchases determines the food security of that household. According to results, before the intervention, the 30 households spent between 500 and 6,000 Kenya shillings on food per month. After the intervention the amount of money spent on food was between 500 and 4,500 Kenya shillings per month. There were 15 out of 30 households that reduced the money they spent on food after intervention. Kenyan Economic Survey (GOK, 2007) indicates that on
average a Nairobi household spends around 3,010 Kenya shillings per month on food (Government of Kenya, 2007). This intervention played a major role in reducing the participants' monthly expenditure on food. This is because they got food from their own production and sold the surplus to fetch income. The greater the share of resources devoted to acquisition of food and health services, the higher the vulnerability of the household to food insecurity (Bonnard, 2001).

4.5.3 Number of meals per day in the households

The number of times food is consumed in the households determines the members' access to food. Three meals per day (breakfast, lunch and supper) are what most people describe as adequate. When people have access to a lot of food, the number of times they consume food increase. Some would consume a snack between meals. The results of the study in the baseline survey, intervention and among the 150 non-participating households were as shown in Table 4.12.

<table>
<thead>
<tr>
<th>No. of times</th>
<th>Baseline</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>300 assessed</td>
<td>30 vulnerable</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>No meal</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>5.0</td>
</tr>
<tr>
<td>3</td>
<td>244</td>
<td>81.3</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>6.7</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>4.0</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>2.3</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>100</td>
</tr>
</tbody>
</table>
The results in the baseline survey showed that majority, 81.3%, of the households took food three times in a day. There was one that is, 0.3% household whereby they had not taken any food a whole day. Majority 84%, of the 150 non-participating households had taken three meals per day while none of them had gone without food for a whole day. Most (80%) of those 30 vulnerable households took three meals per day. When they were included in the intervention those 80% that were taking three meals per day, increased to 86.7% indicating the positive impact of the intervention.

There was one household in the intervention that had taken only one meal in a day. When this household was studied further, it was found that both spouses were unemployed and they had six children three of who were below five years. The meal that they had taken was vegetables that they produced on their plot. This household size (8 members) and none of them employed increased their vulnerability to food and nutrition insecurity. There was another household whereby they had consumed food 5 times a day during assessment and reduced to 4 times during the evaluation. The reason is that this household receives food donation from the Catholic Church and this coincided with the day of interview. A female participant in the focus group discussion said, “Nikienda kibarua na nipate shillingi mia, haweze kununua chakula ya siku yote. Vile tunafanya sana ni kukaa bila kula lunch”. In English: “When I go out for a casual job and I am given 100 Kenya shillings, it is not enough to purchase food for the whole day. What we do is to skip lunch”. This is the reason why there were cases of missed meals in the households.
Nairobi has a bimodal rainfall pattern that is long rain season (April-August) and short rain season (October –December). Therefore, in the months of January to March and then September there may not be a lot of agricultural activities being carried out. However, in this project low cost agro processing technique specifically solar drying was introduced so that vegetables (kales and cowpea leaves) are dried to ensure availability when not in season.

4.5.4 Intakes of selected nutrients in the households

This study focused on the intake of calories, proteins, iron and vitamin A. The intake was assessed using the 24-hour dietary recall of children below five years. The adequacy was determined by calculating the mean intake for three age groups 6-12, 13-48 and 49-60 months and compared to the Recommended Dietary Allowance (RDAs) of a child of the same age (Nutrisurvey, 2004).

4.5.4.1 Calories and protein intake in the 300 households

Children who are below five years require enough calories because at this stage they are very active. Proteins on the other hand are essential in the building and repair of the body tissues. Children below five years therefore require enough proteins and calories because they are in a stage of rapid growth and development. The results in the 300 households showed that children in all the households consumed inadequate calories because the mean intakes in all the age groups were below the RDAs. However, the mean protein intakes in all age groups were above the RDAs as indicated in Table 4.13. The reason is that many households in this area rear cows for milk. Milk therefore is cheap and readily
available. It was therefore found out that all households consumed a lot of milk and it being a complete protein the mean protein intakes were high.

Table 4.13: Nutrient intake of the 300 children in the baseline survey

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>RDA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>52 Children 6-12 months</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calories (Kcal)</td>
<td>16.7</td>
<td>1388.1</td>
<td>589.7</td>
<td>342.6</td>
<td>700.0</td>
</tr>
<tr>
<td>Proteins (grams)</td>
<td>0.6</td>
<td>31.5</td>
<td>11.7</td>
<td>7.5</td>
<td>10.0</td>
</tr>
<tr>
<td>Vitamin A (µg)</td>
<td>20.2</td>
<td>1120.2</td>
<td>258.6</td>
<td>261.8</td>
<td>600.0</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>0.3</td>
<td>16.1</td>
<td>4.6</td>
<td>2.9</td>
<td>8.0</td>
</tr>
<tr>
<td><strong>203 Children between 13-48 months</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calories (Kcal)</td>
<td>137.3</td>
<td>3329.5</td>
<td>974.0</td>
<td>475.3</td>
<td>1050.0</td>
</tr>
<tr>
<td>Proteins (grams)</td>
<td>1.3</td>
<td>59.9</td>
<td>17.1</td>
<td>11.3</td>
<td>13.5</td>
</tr>
<tr>
<td>Vitamin A (µg)</td>
<td>0.3</td>
<td>2493.9</td>
<td>418.5</td>
<td>441.7</td>
<td>600.0</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>0.2</td>
<td>43.2</td>
<td>4.9</td>
<td>4.1</td>
<td>8.0</td>
</tr>
<tr>
<td><strong>45 Children between 49-60 months</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calories (Kcal)</td>
<td>161.3</td>
<td>4216.8</td>
<td>1340.7</td>
<td>811.5</td>
<td>1450.0</td>
</tr>
<tr>
<td>Proteins (grams)</td>
<td>1.5</td>
<td>50.8</td>
<td>17.9</td>
<td>12.4</td>
<td>16.0</td>
</tr>
<tr>
<td>Vitamin A (µg)</td>
<td>33.1</td>
<td>4403.2</td>
<td>505.2</td>
<td>723.3</td>
<td>700.0</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>1.7</td>
<td>26.2</td>
<td>5.7</td>
<td>5.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

RDA standards from (Nutrisurvey, 2004)

4.5.4.2 Vitamin A and iron intake

Diets that are composed of vegetables and fruits contain carotene, which provides the pre-cursors for the body's production of Vitamin A. If the individuals are advised to consume these carotene-containing foods together with fat, then they achieve good vitamin A status. Iron on the other hand is very essential in the body because it makes haemoglobin for transporting oxygen and carbon dioxide in the body. Iron intake improves when the households increase the consumption of the dark green vegetables. The study results showed inadequacy in the intakes of both vitamin A and iron among all age groups. The mean intakes were all below the RDAs. In this project the households in
the intervention increased the production of the dark green vegetables with a view to increasing vitamin A and iron intakes.

4.5.5 *Nutrient intakes of children in the 30 households before and after intervention*

The intake of calories, proteins, iron and vitamin A of the children in the 30 households before and after intervention were assessed using the 24-hour dietary recall. The adequacy was determined by use of a nutrient analysis computer programme (Nutrisurvey, 2004). The adequacy was assessed by determining the children whose intake was below and above the Recommended Dietary Allowance (RDA). The mean intake per age group could not be used to compare the intake before and after intervention because during evaluation (seven months later), some children moved to other age groups.

4.5.5.1 *Caloric and protein intake*

There was improvement in both caloric and protein intake of the children. Those whose intakes were below the RDAs for calories and proteins decreased from 23(76.7%) to 20(66.7%) and 17(56.7%) to 12(40%), respectively. Those whose intake was above the RDA for calories and proteins increased from 7(23.3%) to 10(33.3%) and from 13(43.3%) to 18(60%), respectively (Table 4.15) (calories $t=1.636$, mean difference=0.567 and $p=0.107$) and (proteins $t=1.504$, mean difference=0.267 and $p=0.138$). The mean difference in calories and protein intake before and after the intervention was not statistically significant. These improvements could be associated to the impact of the project because of the increased availability of crops and increased income from sale of the surplus. This concurs with results among Korogocho farmers.
whereby their energy and protein intake was higher than for the non-fanners (Foeken and Mwangi, 2000).

### Table 4.14: Nutrient intake of children in 30 households before and after intervention

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Before (t-value=1.636, mean=0.567 and p=0.107)</th>
<th>After (t-value=1.504, mean=0.267 and p=0.138)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>Below RDA: 23(76.7%)</td>
<td>20(66.7%)</td>
</tr>
<tr>
<td></td>
<td>Above RDA: 7(23.3%)</td>
<td>10(33.3%)</td>
</tr>
<tr>
<td>Proteins</td>
<td>Below RDA: 17(56.7%)</td>
<td>12(40.0%)</td>
</tr>
<tr>
<td></td>
<td>Above RDA: 13(43.3%)</td>
<td>18(60.0%)</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>Below RDA: 22(73.3%)</td>
<td>18(60.0%)</td>
</tr>
<tr>
<td></td>
<td>Above RDA: 8(26.7%)</td>
<td>12(40.0%)</td>
</tr>
<tr>
<td>Iron</td>
<td>Below RDA: 29(96.7%)</td>
<td>25(83.3%)</td>
</tr>
<tr>
<td></td>
<td>Above RDA: 1(3.3%)</td>
<td>5(16.7%)</td>
</tr>
</tbody>
</table>

#### 4.5.5.2 Vitamin A and iron intake

There was improvement in both vitamin A and iron intake. Those whose intakes were above RDA for vitamin A and iron increased from 8(26.7%) to 12(40%) and 1(3.3%) to 5(16.7%), respectively after intervention as shown in Table 4.14. The only mean difference that was significant was in iron intake before and after intervention. The significant value was 0.009, which was less than 0.05. These results can be associated with the impact of the project because production of fruits, vegetables and rearing of small livestock has been found to increase the vitamin A and iron intakes of those involved in such activities. The dietary diversity also increases with increase in the number of food groups accessible to households.
4.5.6 Dietary diversity

Dietary diversity refers to the number of different groups of food consumed by the household members per day. High levels of dietary diversity ensures adequate intake of essential nutrients such as the vitamins and minerals and increases nutrient density (Swindale and Ohri-vachaspati, 2005). Out of the 300 households that were in the baseline survey, 57% had middle diversity that is, 4-6 groups of different foods in the past 24 hours prior to the interview. Out of those 150 households in the evaluation survey, 54.7% also had middle diversity that is, 4-6 groups of different foods in the past 24 hours prior to the interview (Table 4.15):

Table 4.15: Dietary diversity before and after intervention

<table>
<thead>
<tr>
<th>Dietary diversity</th>
<th>Baseline</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>300 assessed N</td>
<td>30 vulnerable N</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>1-3 low</td>
<td>122</td>
<td>40.7</td>
</tr>
<tr>
<td>4-6 middle</td>
<td>171</td>
<td>57.0</td>
</tr>
<tr>
<td>7-9 high</td>
<td>7</td>
<td>2.3</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>100</td>
</tr>
</tbody>
</table>

|                   | 150 evaluated N | 30 intervened N |
|                   | %              | %               |
| 1-3 low           | 67             | 44.6            |
| 4-6 middle        | 82             | 54.7            |
| 7-9 high          | 1              | 0.7             |
| Total             | 150            | 100             |

T-value=3.69 mean=1.03 and p=0.00

Among the 30 households in the intervention, there were 9(30%) who had low dietary diversity of 1-3 groups before intervention, but after intervention cross tabulation showed that all the 9 households moved to the middle diversity of 4-6 food groups. The 21(70%) with middle diversity before intervention increased to 26(86.7%) after intervention. After intervention 3(10%) households moved from middle diversity to high diversity of 7-9 groups. T-test showed significant difference in dietary diversity before and after intervention (t=3.69 mean=1.03 and p=0.00). These results are associated to the impact of the project because increased crop diversity increases dietary diversity.
4.5.7 Food consumption patterns of selected food groups before and after intervention

The consumption patterns were assessed by determining the frequency of intake of selected foods groups in a specified period of time. The specified periods of time were: everyday, 3-6 times per week, once or twice per week, once per month and after a long time or never. This assessment gives food habits and can be associated with occurrence of certain diseases (Food Security Analysis Unit- FSAU, 2003).

The foods were classified into starchy cereals such as maize, rice, millet, wheat and sorghum. Then starchy non-cereals such as potatoes, sweet potatoes, cassava yams, green and bananas. The other group included legumes and nuts (fresh) such as frenchbeans, green peas and all types of fresh beans. Another group included legumes and nuts consumed when dry to include all beans, peas, green grams and groundnuts. Then the vegetables including all green leafy vegetables and then fruits such as oranges, pawpaws, avocados, tomatoes and passion fruits. The eggs were also considered to include chicken eggs and duck eggs and then meat and fish to include beef, chicken, fish, rabbit, pork and goat meat. The last group included milk. Table 4.16 and Table 4.17 show consumption patterns in the 300 households in the baseline survey and in the 30 households in the intervention respectively.

4.5.7.1 Starchy cereals

These foods included foods such as maize, rice, millet, wheat and sorghum. The maize included the food items made from it such as *ugali* (stiff porridge) and *githeri* (mixture of maize and beans). The results in Table 4.16 show that starchy cereals were often consumed because 42.7% of those in the baseline survey consumed these cereals
everyday and 54.7% consumed them 3-6 times per week. None of them consumed after along time and a few people consumed once per month and once or twice per week 0.3% and 2.3%, respectively. In the evaluation among the 150 households most of them 62.7% consumed cereals 3-6 times per week. The reason is because cereals are the Kenyan staple food. Those in the intervention as shown in Table 4.17 improved in the consumption of cereals because those who consumed cereals everyday decreased from 43.3% to 13.3% probably because they increased the diversity of their diets.

Table 4.16: Consumption patterns of selected food groups in 300 households in baseline survey

<table>
<thead>
<tr>
<th>Food groups</th>
<th>Frequency of consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Everyday</td>
</tr>
<tr>
<td>Starchy cereals</td>
<td>42.7</td>
</tr>
<tr>
<td>Starchy (non-cereals)</td>
<td>16.0</td>
</tr>
<tr>
<td>Legumes and nuts (fresh)</td>
<td>0.7</td>
</tr>
<tr>
<td>Legumes and nuts (dry)</td>
<td>3.0</td>
</tr>
<tr>
<td>Vegetables</td>
<td>29.7</td>
</tr>
<tr>
<td>Fruits</td>
<td>52.3</td>
</tr>
<tr>
<td>Eggs</td>
<td>2.3</td>
</tr>
<tr>
<td>Meat and fish</td>
<td>3.3</td>
</tr>
<tr>
<td>Milk</td>
<td>99.7</td>
</tr>
</tbody>
</table>

4.5.7.2 Starchy non-cereals

They included foods such as potatoes, sweet potatoes, cassava yams and green bananas.

The results of the baseline survey in Table 4.16 show that 41.7% of the households
consumed starchy non-cereals 3-6 times per week while very few, 0.7% consumed starchy non-cereals once per month. The most consumed starchy non-cereals were potatoes and green bananas. Those in the intervention as shown in Table 4.18 showed mixed results because those who consumed these non-cereals after along time increased from zero to 10% and those who consumed these starchy non-cereals every day decreased from 16.6% to zero. Those who increased are those who consumed these starchy non-cereals once or twice per week from 36.7% to 56.6%. This decrease could be attributed to increase in diversity of the diets of those in the intervention reducing monotony of their diets.

4.5.7.3 Legumes and nuts (fresh)

Legumes and nuts (fresh) included frenchbeans, green peas and all types of fresh beans. The consumption of legumes when they were fresh was very rare in the households in all the phases of the project. During the baseline survey, majority, 78%, of the households and 73.6% of those in the intervention consumed fresh legumes after a long time or never. However, those in the intervention who consumed fresh legumes once per month increased from 6.7% to 23.3% as indicated in Table 4.17. This is probably because they started producing their own beans enhancing the access component of household food security.
### Table 4.17: Consumption patterns of selected food groups in the 30 households before and after intervention

<table>
<thead>
<tr>
<th>Food groups</th>
<th>Frequency of consumption</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BFI</td>
<td>AFI</td>
<td>BFI</td>
<td>AFI</td>
<td>BFI</td>
<td>AFI</td>
<td>BFI</td>
<td>AFI</td>
<td>BFI</td>
<td>AFI</td>
</tr>
<tr>
<td>Starchy cereals</td>
<td>43.3</td>
<td>13.3</td>
<td>56.7</td>
<td>86.7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Starchy (non-cereals)</td>
<td>16.6</td>
<td>0</td>
<td>46.7</td>
<td>26.7</td>
<td>36.7</td>
<td>56.6</td>
<td>0</td>
<td>6.7</td>
<td>0</td>
<td>10.0</td>
</tr>
<tr>
<td>Legumes and nuts (fresh)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>13.3</td>
<td>3.3</td>
<td>6.7</td>
<td>23.3</td>
<td>80.0</td>
<td>73.6</td>
</tr>
<tr>
<td>Legumes and nuts (dry)</td>
<td>0</td>
<td>0</td>
<td>23.3</td>
<td>40.0</td>
<td>30.0</td>
<td>26.7</td>
<td>10.0</td>
<td>13.3</td>
<td>36.7</td>
<td>20.0</td>
</tr>
<tr>
<td>Vegetables</td>
<td>36.7</td>
<td>20.0</td>
<td>50.0</td>
<td>76.7</td>
<td>10.0</td>
<td>3.3</td>
<td>0</td>
<td>0</td>
<td>3.3</td>
<td>0</td>
</tr>
<tr>
<td>Fruits</td>
<td>53.3</td>
<td>16.7</td>
<td>23.3</td>
<td>40.0</td>
<td>10.0</td>
<td>20.0</td>
<td>0</td>
<td>16.7</td>
<td>13.3</td>
<td>6.7</td>
</tr>
<tr>
<td>Eggs</td>
<td>0</td>
<td>0</td>
<td>6.7</td>
<td>3.3</td>
<td>23.3</td>
<td>40.0</td>
<td>13.3</td>
<td>33.3</td>
<td>56.7</td>
<td>23.3</td>
</tr>
<tr>
<td>Meat and fish</td>
<td>3.3</td>
<td>0</td>
<td>10.0</td>
<td>0</td>
<td>10.0</td>
<td>26.7</td>
<td>26.7</td>
<td>50.0</td>
<td>50.0</td>
<td>23.3</td>
</tr>
<tr>
<td>Milk</td>
<td>96.7</td>
<td>96.7</td>
<td>3.3</td>
<td>3.3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Key: BFI- Before intervention
AFI- After intervention

#### 4.5.7.4 Legumes and nuts (dry)

The dry legumes and nuts included all beans, peas, green grams and groundnuts. The most consumed legumes were beans. According to the results of the baseline survey (Table 4.16), 43.7% of the households consumed dry legumes once or twice per week. From the results it is clear that very few households in all the phases of the project consumed legumes everyday. The only improvement that was notable after intervention was that those consuming dry legumes 3-6 times per week increased from 23.3% to 40%.
4.5.7.5 Vegetables

About half of the households in the baseline survey consumed vegetables 3-6 times per week that is, 52% (Table 4.16). Consumption of vegetables among those who were in the intervention improved because those who consumed vegetables 3-6 times per week increased from 50% to 76.7% (Table 4.17). This was due to the fact that these are the crops that were mostly produced by the households in the intervention.

4.5.7.6 Fruits

Consumption of fruits according to the results of the surveys shows that the households had good access to fruits. This is because 52.3% in the baseline survey and 53.3% of the 30 vulnerable households consumed fruits everyday. Consumption of fruits among those in the intervention improved because those who consumed fruits after along time or never decreased from 13.3% to 6.7% while those who consumed 3-6 times per week increased from 23.3% to 40% (Table 4.17). These results are associated with positive impact of the project because some of the project participants harvested tomatoes, pawpaws and others melons.

4.5.7.7 Eggs

According to the results, 60.7% out of the 300 households in the baseline survey consumed eggs rarely (Table 4.16). This could be attributed to the problem of livestock diseases whereby the residents reported that most of their chicken had died. Consumption of eggs among the 30 households in the intervention improved because those who consumed after along time or never decreased from 56.7% to 23.3%, while those who
consumed once or twice per week increased from 23.3% to 40% (Table 4.17). These results are attributed to the availability of eggs because of poultry rearing and the nutrition knowledge offered during the project duration. The project participants sold vegetables to earn income and there was also income relieved from the purchase of the food.

4.5.7.8 Meat and fish

The meat considered included beef, chicken, fish, rabbit, pork, and goat meat. The results of the baseline survey (Table 4.16) showed that most 47.3% consumed meat after a long time or never. This was the case too to those 150 households in evaluation survey whereby 55.3% consumed meat after a long time or never. There were 50% of those in the intervention who consumed meat after a long time or never before intervention, but after intervention they decreased to 23.3%. Those who consumed meat once or twice per week increased from 10% to 26.7% indicating that access to meat improved (Table 4.17). This could be attributed to the project activities due to the increased income from sale of the surplus and the relieved income from purchase of food because they now produce some for themselves.

4.5.7.9 Milk

A finding that was notable was that most of the households in this area have stable access to milk. In the baseline survey (Table 4.16), it was found out that 99.7% of the households consumed milk at least everyday whether as pure milk or when in tea. Out of the 150 households in the evaluation, 98.6% consumed milk everyday. Results of those in
the intervention both before and after, (Table 4.17) shows that out of the 30 households 96.7% consumed milk everyday. Milk is readily available because there are some households that rear cows that produce milk for sale. This may be the reason why the mean protein intakes of children in the baseline survey were all above the RDAs.

According to the results of the baseline survey Kamae residents were at risk of food and nutrition insecurity. The reason being that they spent a large proportion of their income on food purchases. The mean caloric, vitamin A and iron intakes of the under fives were below the RDAs. The household diets lacked diversity hence they were monotonous. However, production of a diversity of crops and rearing of poultry enhanced household food security by increasing food availability in the 30 households in the intervention. The proportion of income spent on food purchases decreased and caloric, protein, vitamin A and iron intakes of the under fives increased. The dietary diversity of the 30 households increased and their consumption patterns improved. This reduced their vulnerability to food and nutrition security.

4.6 NUTRITION STATUS OF CHILDREN

The nutrition status of children in a household reflects the well being of that household. Nutritional status of young children is a sensitive indicator of changes in food availability. Adequate availability of food at the household level is necessary to achieve nutrition security but it is not sufficient. Other key contributors to good nutrition are adequate health, adequate childcare, access to clean water, and sanitation (FSAU, 2003). The indicators used in this study to assess nutrition status of children were height-for-age,
weight-for-height, weight-for-age, morbidity, immunization and general sanitation of the household compound.

The nutrition status of children among other factors in this study was used for selecting households to be included in the intervention. The photograph in Plate 4.7 shows enumerators ready to take weights and heights of the children below five years:

Plate 4.7: Enumerators ready for nutrition status assessment

The focus group participants were asked to give the nutrition problems in this area. One of them said, "Watoto wengine hawana afya bora". Meaning, "Some children do not have good health". When probed to give reasons why the children were in poor health, she said, "Wanakosa chakula cha kutosha". Meaning, "They lack adequate food". She was asked to explain more and she said, "Unajua hatuna kazi nzuri zenye zinaweza kutupatia pesa kwa hivyo hatuwezi kulisha watoto vizuri". Meaning, "We do not have good jobs to give us money so we cannot feed our children well".
Out of 300 children in the baseline survey a total of 62% were stunted, 53.7% were underweight and 31% were wasted. Malnutrition levels in Nairobi in 2003 were 18.7% stunting, 6.3% underweight and 4.5% wasting (Government of Kenya, 2003b). Thirty children with high levels of wasting (-3SD and -2SD and those whose parents had farming space) were included in the intervention. The nutrition status of children in the 30 households before and after intervention showed mixed results. The nutrition status of the children in the baseline survey was assessed in June and July 2005 and in evaluation survey in March and April 2006. The time lapse was seven months, which may not have been long enough to cause significant changes in nutrition status of children especially in terms of stunting

4.6.1 Stunting

It is a measure of chronic malnutrition. It is associated with long-term poverty and illness. Children are termed as stunted when they are too short for their age (FSAU, 2003). Before the intervention there were 23.3% mildly stunted children and they increased to 36.7% after intervention. There were 23.3% moderately stunted children before the intervention and they decreased to 10% after the intervention. There were 10% severely stunted children before the intervention and they decreased to 6.7% after the intervention (Table 4.18).
### Table 4.18: Nutrition status of children in baseline and evaluation surveys

#### Nutrition status of the 300 children in the baseline survey

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Stunting</th>
<th>Underweight</th>
<th>Wasting</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Mild</td>
<td>71</td>
<td>23.6</td>
<td>81</td>
</tr>
<tr>
<td>Moderate</td>
<td>65</td>
<td>21.7</td>
<td>70</td>
</tr>
<tr>
<td>Severe</td>
<td>50</td>
<td>16.7</td>
<td>10</td>
</tr>
<tr>
<td>Normal</td>
<td>114</td>
<td>38.0</td>
<td>139</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>300</td>
<td>100</td>
<td>300</td>
</tr>
</tbody>
</table>

#### Nutrition status of the 150 children in the evaluation survey

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Stunting</th>
<th>Underweight</th>
<th>Wasting</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Mild</td>
<td>51</td>
<td>34.0</td>
<td>48</td>
</tr>
<tr>
<td>Moderate</td>
<td>32</td>
<td>14.7</td>
<td>38</td>
</tr>
<tr>
<td>Severe</td>
<td>20</td>
<td>13.3</td>
<td>13</td>
</tr>
<tr>
<td>Normal</td>
<td>57</td>
<td>38.0</td>
<td>51</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>150</td>
<td>100</td>
<td>150</td>
</tr>
</tbody>
</table>

#### Nutrition status of children in the 30 households before and after intervention

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Before intervention</th>
<th>After intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stunting</td>
<td>Underweight</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Mild</td>
<td>23.3</td>
<td>20.0</td>
</tr>
<tr>
<td>Moderate</td>
<td>23.3</td>
<td>23.3</td>
</tr>
<tr>
<td>Severe</td>
<td>10.0</td>
<td>0</td>
</tr>
<tr>
<td>Normal</td>
<td>43.4</td>
<td>56.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
4.6.2 Underweight

Underweight is indicated by weight-for-age and conveys the weight of a child in relation to the child’s age. This index is useful for monitoring growth and development of children (FSAU, 2003). Before the intervention there were 20% children who had mild underweight and they increased to 23.3% after the intervention. Those who had moderate underweight were 23.3% before and they increased to 33.3% after the intervention.

4.6.3 Wasting

Wasting indicates thinness and it identifies acute malnutrition due to rapid changes in food supply or disease. It is a useful index to target the vulnerable individuals (FSAU, 2003). Those who were mildly wasted increased from 16.7% to 46.7% after intervention. Those who had normal weight decreased from 73.3% to 43.3% after the intervention. These results cannot be attributed to the impact of the project. The reason is because one year is a short time for the project activities to influence nutrition status of the children.

According to results in the Nakuru urban project, the stunting, underweight and wasting levels of the children in the farming and non-farming households did not differ significantly (Odera and Foeken, 2006). However, research shows that children in the urban households with self-provisioned food show better health than children who do not have access to self-provisioned food (Mougeot, 2006). In Korogocho Nairobi, fewer children of farmers were wasted and stunted than for the non-farmers (Foeken and Mwangi, 2000). The children’s good health is as a result of improved nutrition brought about by increased dietary diversity hence increased nutrient intake.
4.6.4 Morbidity of the children below five years two weeks prior to research.

After taking the anthropometric measurements of the child, the respondent was asked to state the type of illness that the child had suffered from two weeks prior to the interview. Malnutrition was found to be strongly associated with morbidity patterns. According to the KDHS (2003) children who were suffering or had suffered from diarrhoea, malaria, and cough/cold/runny nose in the previous two weeks before the survey were more likely to suffer from malnutrition (Government of Kenya, 2003b). The results of the baseline survey showed that 38.7% of the children did not suffer from any illness. About 15.3% had suffered from malaria. Table 4.19 represents illness that had affected the children two weeks prior to the baseline survey.

Table 4.19: Child illness two weeks prior to baseline survey

<table>
<thead>
<tr>
<th>Illness</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common cold</td>
<td>39</td>
<td>13.0</td>
</tr>
<tr>
<td>Cough</td>
<td>36</td>
<td>12.0</td>
</tr>
<tr>
<td>Cold and cough</td>
<td>35</td>
<td>11.7</td>
</tr>
<tr>
<td>Malaria</td>
<td>46</td>
<td>15.3</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>8</td>
<td>2.7</td>
</tr>
<tr>
<td>Diarrhoea and vomiting</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td>Sinuses</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>Skin diseases</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td>Others</td>
<td>15</td>
<td>5.0</td>
</tr>
<tr>
<td>None</td>
<td>116</td>
<td>38.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>300</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Common cold, cough and the two combined were common illnesses 13%, 12% and 11.7% respectively. There was one child who suffered from sinuses as the mother said and this child looked malnourished. During implementation the household with the child suffering from sinuses and was malnourished had moved from where they were staying. Those illnesses that were referred to as others included stomach and headaches, swollen legs, ear, eye problems and mouth problems. According to the Kenya Demographic and Health Survey (KDHS), 8.6% of female children and 7.7% of male children suffered from acute respiratory infections two weeks prior to the survey (Government of Kenya, 2003b)

4.6.5 Immunization status of the children in the 300 households in the baseline survey

The immunization status was confirmed from the hospital cards. In this area, mothers took their children for immunization up to nine months of measles injection. After that they did not find it important to take their children back to the postnatal clinics. This showed that the children were not getting the Vitamin A supplements that should be given to the children after every six months up to five years. From the results of the baseline survey (Table 4.20) 57% of children who were 12 months old did not receive Vitamin A supplements.
The results show that in all age groups those who did not receive the Vitamin A supplements were more than those who received (Table 4.20). The KDHS states that there was a significant drop in the population of children who received vitamin A supplements in the second year of child’s life in 2003 compared to 2000. About 69.7% of children did not receive vitamin A supplements in their second year (Government of Kenya, 2003b). Vitamin A supplements are important because they enable the body of the child to fight diseases due to the boosted immunity. Low coverage indicates high susceptibility of the children to infections. There is need to intensify the vitamin A supplements campaigns especially among the urban poor.

4.6.6 General sanitation of the household compound

Sanitation issues such as disposal of human waste, disposal of garbage and the cleanliness of the household environment affect the health of a population. Sanitation is especially important in urban areas where people are relatively congested. Poor sanitation may result in increased morbidity. To determine the general sanitation of the households’ compounds, it was observed whether there was litter in the compound, whether the
kitchen waste was in dustbins with lids or not or whether there were unkempt drainages. The households were therefore classified as either badly kept if the three characteristics were observed, moderate if two were observed and clean if one or none of the characteristics was observed. Out of the 300 households 83.7% had their compounds clean (Table 4.21)

Table 4.21: General sanitation of the household compound

<table>
<thead>
<tr>
<th>General sanitation</th>
<th>300 households</th>
<th>30 households BFI</th>
<th>30 households AFI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Badly kept</td>
<td>15</td>
<td>5.0</td>
<td>1</td>
</tr>
<tr>
<td>Moderately kept</td>
<td>34</td>
<td>11.3</td>
<td>3</td>
</tr>
<tr>
<td>Clean</td>
<td>251</td>
<td>83.7</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>100</td>
<td>30</td>
</tr>
</tbody>
</table>

Key: BFI- Before intervention
AFI- After intervention

One household among those in the intervention had an unkempt compound before the intervention but after intervention there were no households with unkempt compounds. Majority 26(86.7%) of the households before and after intervention had clean compounds. There is need to promote simple hygienic practices in the community especially in the urban areas to prevent outbreaks of illnesses such as diarrhoea and malaria which in turn contribute to malnutrition.

Access to sufficient quality and quantity of water is very essential to food and nutrition security (FSAU, 2003). Though it was not an objective of this project during focus group discussions lack of clean and safe water came out strongly as problem in this community.
The community members decided to seek a solution to this problem. They decided to contribute each 3,500 Kenya shillings to purchase water metres and pipes. This idea worked and many of the community members have access to clean and safe water.

The nutrition status of the children is a good indicator that identifies those at risk of food insecurity, monitors changes over time and evaluates projects to determine the impacts on the beneficiaries. According to the results of this project, the nutrition status of children showed mixed results whereby the nutrition status of some children improved while for others it worsened. However, these results may not be attributed to the outcomes of this project. The reason being that the time for the intervention was very short and other factors such as illness may have come into play. An intervention on diversification of farming practices of a longer duration is recommended for better and valid outcome on food and nutrition security.

4.7 A MODEL ON DIVERSIFICATION OF HOUSEHOLD FARMING PRACTICES TO ENHANCE FOOD AND NUTRITION SECURITY IN THE HOUSEHOLDS

The objective of this study was to develop a model that would be used to improve farming in urban and peri-urban areas. Diversification of farming practices involved introduction of production of diversity of crops and rearing of small livestock in the households. The diversification was combined with agricultural training, nutrition education and provision of clean water and this led to enhanced food and nutrition security (Figure 4.1)
Diversification of farming practices and Economic empowerment in the 30 households in the intervention

Crop diversification
- Cereals e.g. maize
- Non-cereals e.g. potatoes and bananas
- Legumes e.g. beans
- Vegetables e.g. kales
- Small livestock
- Chicken and Duck

Economic Empowerment
- Setting up gardens worth Ksh 10,000 in each household

Nutrition education
- Good sources of:
  - Carbohydrates
  - Proteins
  - Vitamin A
  - Iron

Health
- Child illness
- Sanitation

Agricultural training
- Soil preparation
- Compost manure making
- Planting dates
- Plant spacing
- Crop rotation
- Weeding dates
- Harvesting dates
- Harvesting techniques
- Preserving the surplus

Improved Nutrition status
- Decreased stunting
- Decreased underweight
- Decreased wasting

Improved Food security
- Increased food production
- Improved occupations and incomes
- Decrease on money spent on food per month
- Increased meals per day
- Increased calories intake
- Increased protein intake
- Increased vitamin A intake
- Increased iron intake
- Increased dietary diversity
- Improved food consumption patterns

Figure 4.1: A model on diversification of farming practices to enhance food and nutrition security in the households

The model (Figure 4.1) shows that when farming practices are diversified through agricultural training and nutrition education, more food is produced and consumed in the households. The enhanced food and nutrition security in the households was indicated in the positive relationships that existed between farming practices and household food and nutrition security.
4.8 RELATIONSHIPS BETWEEN FARMING PRACTICES AND HOUSEHOLD FOOD AND NUTRITION SECURITY

4.8.1 Crop diversity and dietary diversity

A positive and significant relationship was found to exist between crop diversity and dietary diversity \( r = 0.123 \) and \( p = 0.03 \). This shows that dietary diversity increased with increase in crop diversity. It is therefore important to promote production of a diversity of crops because it diversifies the households’ diets, thereby enhancing household food and nutrition security.

4.8.2 Nutrition knowledge and nutrient intakes

Nutrition knowledge has been seen to cause changes in consumption behaviour of people participating in the training programmes. In this project relationships existed between levels of nutrition knowledge and consumption of selected nutrients as indicated in Table 4.22.

<table>
<thead>
<tr>
<th>Variables</th>
<th>( r )</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrition knowledge and calories</td>
<td>0.040</td>
<td>0.49</td>
</tr>
<tr>
<td>Nutrition knowledge and proteins</td>
<td>0.055</td>
<td>0.34</td>
</tr>
<tr>
<td>Nutrition knowledge and vitamin A</td>
<td>0.123</td>
<td>0.03*</td>
</tr>
<tr>
<td>Nutrition knowledge and iron</td>
<td>0.052</td>
<td>0.37</td>
</tr>
</tbody>
</table>

*Significant at 0.05 confidence level
Positive relationships existed between the levels of nutrition knowledge and intake of calories, proteins, vitamin A and iron (Table 4.22). This means that increase in nutrition knowledge increased the nutrient intake. However, the only relationship that was significant was that one between nutrition knowledge and vitamin A intake. The p value was 0.03 hence less than 0.05. The reason was probably because the community members produced lots of dark green vegetables.

The results of the intervention show that when the farming practices of Kamae residents were improved by introducing diversity in crop production, offering nutrition education and rearing of poultry, their food and nutrition security was enhanced. Their caloric, protein, Vitamin A, iron intake and dietary diversity increased. This is an indication of a relationship between farming practices and food and nutrition security.

4.9 HYPOTHESES

1. There is a positive relationship between the farming practices adopted by the peri-urban farmers of Kamae and the household food and nutrition security.

The hypothesis is accepted because statistical tests show existence of positive relationships between crop diversity and dietary diversity (r =0.123 and p =0.03), and between the levels of nutrition knowledge and intakes of calories (r=0.040 and p=0.49), proteins (r=0.055 and p=0.34), vitamin A (r=0.123 and p=0.03) and iron (r=0.052 and p=0.37).
2. There is an improvement in household food and nutrition security after the intervention.

The hypothesis is accepted because t-test revealed differences in nutrition knowledge, caloric, protein, vitamin A and iron intakes before and after the intervention. This hypothesis has also been proved among low-income farmers of Korogocho (Foeken and Mwangi, 2000).
CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

Food and nutrition insecurity in the urban areas especially of the developing countries has been on the high rise. The Kenyan urban poverty levels are estimated to be over 50% causing a major problem to household food and nutrition security. In an effort to curb the urban food and nutrition insecurity, urban farming has been initiated and promoted. The household food security and farming practices were determined from June to July 2005 in a baseline survey consisting of 300 households obtained through cluster sampling. An intervention to diversify the household farming practices was then designed and implemented from October 2005 to February 2006 to enhance household food and nutrition security in 30 out of the 300 households. The 30 households in the intervention were those with children found to be moderately and severely wasted (-2SD and -3SD) and had farming space.

Another survey in 180 households (30 participating and 150 non-participating) households was done at the end of the project from March 2006 to April 2006 to determine the project’s impact. Data were collected using interview schedules, observation checklists and focus group discussion guides. The quantitative data were analysed using (SPSS) Programme. Nutrients were analysed using NutriSurvey, (2004) while nutrition status data were analysed using EpiInfo, (2000). The results of the baseline survey showed that farming was not common. The nutrition status of children below five years showed high levels of stunting indicating long-term deprivation of
enough food and probably disease. The impact of the intervention indicated increased
food production, increased consumption of calories, proteins, vitamin A and iron rich
foods.

5.2 Major findings of the study

5.2.1 Social Economic Status

The occupations of the thirty (30) respondents changed considerably after intervention.
There were 13(43.3%) respondents that were housewives before intervention, but after
intervention none of them still remained as a housewife. All of them started farming and
those who had surplus vegetables were selling hence becoming business people. There
were 23(76.7%) respondents earning between 1,001 and 5,000 Kenyan Shillings before
intervention and they increased to 25(83.4%) after intervention. This means that little
economic empowerment can cause drastic changes in people’s social economic status.

5.2.2 Nutrition knowledge and farmers’ attitudes towards peri-urban farming.

Nutrition knowledge is important because it helps individuals to make informed choices
when taking care of the household members. Thirty (30) respondents were educated on
the sources of carbohydrates, proteins, Vitamin A and iron. Those who had no idea at all
about carbohydrates, proteins Vitamin A and iron decreased from 15(50%) before
intervention to 9(30%) after intervention. Those who had high knowledge on
carbohydrates, proteins, Vitamin A and iron increased from 6(20%) before intervention
to 20(66.7%) after intervention. All the 30 respondents in the intervention were positive
about farming before and after intervention. They stated that peri-urban farming is
important to the food supply and that the government should support it. Positive attitudes have led to widespread farming in Kamae area even among those who were not trained.

5.2.3 Farming practices
Before intervention there was no organized farming but after intervention there were three observable farming systems: small-scale subsistence farming system, small-scale market oriented crop production and small-scale livestock production. During the intervention all the 30 households were given seeds and seedlings. After intervention 7(23.3%) bought their own seeds and seedlings, while 23(76.7%) established their own seedbeds for vegetable seedlings. Before intervention there were 3(10%) households producing 3-4 groups of crops (middle diversity) and they increased to 24(80%) after intervention. Implementing acquired agricultural knowledge resulted in improved farming practices, which in turn increased the amount of food available in a household.

5.2.4 Household food security
Diversification of farming practices increased the amount of food available in the households. The increased availability of food improved the nutrient intake of the children in the households. Children’s intake that were below the RDAs for calories and proteins decreased from 23(76.7%) to 20(66.7%) and 17(56.7%) to 12(40%), respectively before and after intervention. Those whose intakes were above RDA for Vitamin A and iron increased from 8(26.7%) to 12(40%) and 1(3.3%) to 5(16.7%), respectively, before and after intervention. The 21(70%) households that consumed 4-6 groups of food (middle dietary diversity) before intervention increased to 26(86.7%) after intervention.
The improvement in household food security was due to increased crop diversity, which increased dietary diversity and actual nutrient intake.

5.2.5 Nutrition status of children

Nutrition status of children is an indicator of food availability in the households. Diversified farming practices in the household increased food availability. According to the results of the intervention there were 10% severely stunted children before the intervention and they decreased to 6.7% after the intervention. The children who had normal weight decreased from 73.3% to 43.3% after the intervention.

5.2.6 Model on diversification of farming practices to enhance food and nutrition security in the households

Introduction of diversification of farming practices accompanied by agricultural training and nutrition education enhanced household food and nutrition security. This was indicated in the positive relationships that existed between farming practices and household food and nutrition security. Other aspects included economic empowerment and provision of clean water.

5.2.7 Relationships between farming practices and household food and nutrition security

5.2.7.1 Crop diversity and dietary diversity

As crop diversity increased the dietary diversity increased. It was established that there was a positive relationship significant at $p=0.03$. 
5.2.7.2 Nutrition knowledge and nutrient intakes

Increase in nutrition knowledge increased nutrient intake. Relationship between nutrition knowledge and vitamin A intake was significant at p=0.03. Relationships between nutrition knowledge and calories, proteins and iron intake were not significant (p=0.49, p=0.34 and p=0.37) respectively.

5.3 Hypotheses

1. There is a positive relationship between the farming practices adopted by the peri-urban farmers of Kamae and the household food and nutrition security.

Diversified farming practices increased crop diversity which in turn increased dietary diversity p=0.03. Dietary diversity improved intakes of calories, proteins, vitamin A and iron.

2. There is an improvement in household food and nutrition security after the intervention.

There was a significant difference between iron intakes of children before and after intervention at p=0.009. The differences between calories, proteins and vitamin A intakes were not significant before and after intervention (p=0.107, p=0.138 and 0.373) respectively.

5.4 Conclusion

1. Economic empowerment given to the households in the intervention improved their social economic status.
2. Respondent's agricultural and nutrition knowledge increased after intervention. These respondents also became positive about farming and this led to widespread farming in Kamae area.

3. Farming practices in the households improved after the households implemented the agricultural knowledge they acquired during training.

4. Diversified farming practices increased the amount of food available in the households. This in turn increased dietary diversity and nutrient intakes hence improving the household food security.

5. Nutrition status of children before and after intervention showed mixed results where some improved and others deteriorated

6. A model developed out of this study shows that diversified farming practices, economic empowerment and provision of clean water enhances household food security.

7. Relationship exists between farming practices and household food security. This is because crop diversity increases dietary diversity and increased nutrition knowledge increases nutrient intakes.

5.5 Recommendations

1. Governments, donors and NGOs should empower households economically in food production so that they produce more food and to improve their social economic status.

2. Agriculturalists, nutritionists and NGOs should offer agricultural and nutrition knowledge to improve farming practices in the households.
3. Agriculturalists, nutritionists and NGOs should initiate and promote production of a diversity of crops and rearing of a small livestock in the urban and peri-urban areas because this improves the household farming practises. In turn this increases calorie, protein, vitamin and mineral intake.

4. Nutritionists should campaign for consumption of diversified diets. This is because dietary diversity in the households is an important pointer to food and nutrition security.

5. Nutritionists should educate mothers on how to provide adequate nutrition and healthcare to improve the nutrition and health status of children especially those in their early childhood to prevent stunting.

5.6 Suggestions for further research

The project promoted solar drying of vegetables as an agro-processing technique. The suggestion is that a study to be done to determine the nutritive value of the solar dried vegetables. This would be important so that the participants can get the most of the nutrients from the solar dried vegetables.

It is suggested that a study to be done to determine the household's attitudes towards consumption of solar dried vegetables.

The project was one year whereby the intervention phase was about seven months. The suggestion is that a similar project is implemented elsewhere, but with a longer intervention phase so that there are higher impacts on the participants.
REFERENCES


Feldafing, German Foundation for International Development (DSE).


Hoddinott, J. and Yohannes, Y. (2002). *Dietary Diversity as a household food security indicator*. Food and Nutrition Technical Assistance Project (FANTA) and Academy for Education Development (AED), Washington D.C.


IFPRI (2001) *Women: The key to food security: Food policy report*


Ottawa, ON, Canada


SEAMEO-TROPMEN. www.nutrisurvey.de


APPENDIX 1: RESEARCH PERMIT

This is to certify that:

Prof./Dr./Mr./Mrs./Miss EUNICE WAMBUI NJOGU

of (Address) KENYATTA UNIVERSITY

P.O. BOX 43844, NAIROBI

has been permitted to conduct research in

KASARANI Location,

NAIROBI District,

NAIROBI Province,

on the topic DIVERSIFICATION OF FOOD PRODUCTION SYSTEMS TO ENHANCE HOUSEHOLD FOOD SECURITY AMONG PERI-URBAN FARMERS IN KAMAE NAIROBI

for a period ending 31st December, 2006

Research Permit No. MOEST 13/001/55C 338
Date of issue 5th July, 2005
Fee received Shs. 500

For: Permanent Secretary
Ministry of Education Science and Technology

[Signature]
APPENDIX 2: INTRODUCTION LETTER

Eunice Wambui Njogu
Kenyatta University
P.O BOX 43844,
NAIROBI

REF: RESPONDENTS CONSENT REQUEST

Dear respondent,

I am a postgraduate student from Kenyatta University undertaking a project on the diversification of household farming practices to enhance household food security in Kamae area-Nairobi. I wish to request information from you on this project. The results of this study will be of great benefit to you as a participant and the community at large as this information will be used by the organizations interested in food security and the well being of people in the division.

Answer the questions as honestly as possible, and please cooperate. All the information will be treated with strict confidentiality.

Thank You.

Yours Sincerely

Eunice Wambui Njogu
APPENDIX 3: INTERVIEW SCHEDULE
DIVERSIFICATION OF HOUSEHOLD FARMING PRACTICES
FOR ENHANCED HOUSEHOLD FOOD AND NUTRITION
SECURITY AMONG PERI-URBAN FARMERS IN KAMAÉ AREA-
NAIROBI.

SECTION A
DEMOGRAPHIC INFORMATION

Date __________________________________________

Interview Number _________________________________________

Household Number __________________________________________

1. Gender  1Male ☐  2 Female ☐


3. What is your age in years? _________

4. What is your marital status?
   1. Single
   2. Married
   3. Widow/widower
   4. Divorced
   5. Sister or Aunt to child

5. Who heads this household?
   1. Husband
   2. Wife
   3. Children
   4. Others
   5. Husband & wife
   6. Parents
6. How many people live in your household you included? _________

7. How many living children do you have as your own?

   Male ________________________
   Female _______________________
   Total _______________________ 

8. How many are: Below 5 years _________________

9. What is the highest level of education that you have achieved?

   1. None
   2. Primary
   3. Secondary ‘O’ level
   4. Secondary ‘A’ level
   5. Diploma College
   6. University

SECTION B
SOCIAL ECONOMIC STATUS AND HOUSEHOLD FOOD SECURITY INFORMATION

Household income and asset ownership

10. What is your occupation?

   1. Casual labourer
   2. Farmer
   3. Housewife
   4. Business
   5. Unemployed
   6. Combination
   7. Private sector
   8. Casual labourer & farmer
   9. Pupil
   Others, Specify ____________________
11. How much money in Kenya shillings do you receive monthly from all sources?

   Amount in Kenya shillings

12. Who decides on the use of this available income?

   1. Husband
   2. Wife
   3. Husband & wife
   4. Children
   5. Others, Specify
   6. Parents

13. How much of this income do you spend on food per month?

   Amount in Kenya shillings

14. Do you own the following assets?


   0 None   (1) low 1-3   (2) Middle 4-6   (3) High 7-9

   Household food production and livestock keeping

15. How large is this piece of land?  

16. Is this land yours?

   YES 1
   NO 0

17. If YES, how did you acquire it?

   1. Resettlement
   2. Buying
   3. Inheriting
   4. Others, Specify
   5. NA
18. If NO, what are the terms of usage? 1. Caretaker 2. Renting 3. NA

19. Do you produce any crops on your land?
   YES 1
   NO 0

20. If YES, what are the uses of the crops that you produce?
   1. For home consumption
   2. For sale
   3. Consumption & sale
   4. Others, Specify ________________
   5. NA
21. Crops produced and their uses in one season

<table>
<thead>
<tr>
<th>Crop group</th>
<th>Specified crops</th>
<th>Amount harvested</th>
<th>Amount consumed</th>
<th>Amount sold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starchy (cereals)</td>
<td>Maize</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rice</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Millet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sorghum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wheat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starchy (non-</td>
<td>Potatoes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cereals)</td>
<td>Sweet potatoes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cassava</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Yams</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Green bananas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sugarcane</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legumes &amp; Nuts</td>
<td>Frenchbeans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(fresh)</td>
<td>Green peas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All other types of fresh beans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legumes &amp; Nuts</td>
<td>All beans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(dry)</td>
<td>Peas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Green grams</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Groundnuts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>Carrots</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All green leafy vegetables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sukumawiki</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spinach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Terere</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruits</td>
<td>Oranges</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Avocados</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tomatoes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Passion fruits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pawpaws</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

0 None (1). Low 1-2 (2). Middle 3-4 (3) High 5-6 (4). NA
22. Do you have any stored food at present?

1 Yes [ ] 0 No [ ]

If YES, how do you store this food?

i. Own production

<table>
<thead>
<tr>
<th>Type of food</th>
<th>Amount in Kgs</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ii. Buying

<table>
<thead>
<tr>
<th>Type of food</th>
<th>Amount in Kgs</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

iii. Other sources

<table>
<thead>
<tr>
<th>Type of food</th>
<th>Amount in Kgs</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

23. How do you acquire the seeds/ seedlings to plant?

1. Own production

2. Buy

3. Donation

4. NA

5. Own production & donation

6. Own production & buy

Other ______________________________

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24. Who decides on crops to be produced?

1. Husband
2. Wife
3. Husband & wife
4. Children
5. Others, Specify ____________
6. NA
7. Mother

25. Who provides labour for crop production?

1. Husband
2. Wife
3. Husband & wife
4. Children
5. Employed labourers
6. Casual labourers
7. NA
8. Husband, wife & Children
9. Mother
10. Others, Specify ____________
26. What type of tools do you use for crop production?

<table>
<thead>
<tr>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>--------</td>
</tr>
<tr>
<td>Manure</td>
</tr>
<tr>
<td>Crop residues</td>
</tr>
<tr>
<td>Chemical fertilizers</td>
</tr>
<tr>
<td>Chemical pesticides</td>
</tr>
<tr>
<td>Local seeds/seedlings</td>
</tr>
<tr>
<td>Improved seeds/seedlings</td>
</tr>
</tbody>
</table>
28. What inputs do you use for the specific crops that you produce?

<table>
<thead>
<tr>
<th>Crop</th>
<th>Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereal crops e.g. maize</td>
<td>1 Manure</td>
</tr>
<tr>
<td>Root and tubers e.g. potatoes</td>
<td>2 Fertilizer</td>
</tr>
<tr>
<td>Leguminous crops e.g. beans</td>
<td>3 Crop residues</td>
</tr>
<tr>
<td>Vegetables e.g. spinach</td>
<td>4 Pesticides</td>
</tr>
<tr>
<td>Fruits e.g. passion, tomatoes</td>
<td>5 NA</td>
</tr>
<tr>
<td></td>
<td>6 none</td>
</tr>
<tr>
<td></td>
<td>7 Combination</td>
</tr>
</tbody>
</table>

Inputs: 1 Manure 2 Fertilizer 3 Crop residues 4 Pesticides 5 NA 6 None 7 Combination

29. What are some of the farming practices that you adopt?

<table>
<thead>
<tr>
<th>Practice</th>
<th>1 Yes</th>
<th>2 No</th>
<th>3 NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop rotation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terracing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spraying</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mulching</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irrigation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed cropping</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

30. Where did you acquire the above practice?

1 Agriculture extension service
2 School
3 Media (TV, Radio, Newspapers)
4 Friends
5 Parents
6 On farm training
7 NA
8 Experience
9 Others, Specify
**Livestock production**

31. What type of livestock do you rear?

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicken</td>
<td></td>
</tr>
<tr>
<td>Goat</td>
<td></td>
</tr>
<tr>
<td>Cow</td>
<td></td>
</tr>
<tr>
<td>Rabbit</td>
<td></td>
</tr>
<tr>
<td>Doves</td>
<td></td>
</tr>
<tr>
<td>Sheep</td>
<td></td>
</tr>
<tr>
<td>Duck</td>
<td></td>
</tr>
<tr>
<td>Turkey</td>
<td></td>
</tr>
<tr>
<td>Pig</td>
<td></td>
</tr>
</tbody>
</table>

32. Do you receive the following livestock extension services?

- 1 Artificial Insemination
- 2 Vaccination
- 3 Others
- 4 NA
- 5 No
- 6 Combination

**Household food consumption**

33. How do you acquire food to meet the household food needs?

- 1 Own urban production
- 2 Purchased
- 3 Urban production and purchase
- 4 Rural production and purchase
- 5 Own urban prod, Rural prod & purchase
34. Is this food enough?

1. Yes always
2. Most of the time
3. About half of the time
4. Now and then
5. Hardly enough

35. If Not Yes always, roughly for how many days in a month do you go without food?

36. Who prepares and cooks food for the family? (1) Mother (2) Father (3) Children
   (4) Grandmother (5) House help (6) Mother & children (7) All family members

37. During the previous 24-hr period, did you or anyone in household consume?

<table>
<thead>
<tr>
<th>NO. OF TIMES FOOD IS EATEN</th>
<th>YES 1</th>
<th>NO 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any food before a morning meal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A morning meal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any food between morning and midday meals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A midday meal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any food between midday and evening meal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>An evening meal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any food after the evening meal</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Food consumption of the child

38. A 24-hr recall

<table>
<thead>
<tr>
<th>Time of meal</th>
<th>Type of the dish</th>
<th>Method of cooking</th>
<th>Ingredients in the dish</th>
<th>Household measure</th>
<th>Amount in grams</th>
<th>Volume of dish cooked</th>
<th>Volume served to child</th>
<th>Leftover</th>
<th>Volume taken by child</th>
<th>Amount taken by the child in grams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snack</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Lunch</td>
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<tr>
<td>Snack</td>
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<tr>
<td>Supper</td>
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<tr>
<td>Snack</td>
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<td></td>
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</tr>
</tbody>
</table>
Assessment of nutrition status of the child

39. Sex of the child
   1. Male
   2. Female

40. Date of birth: Month __________ Day __________ Year __________

<table>
<thead>
<tr>
<th>Birth order</th>
<th>1st Reading</th>
<th>2nd Reading</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

41. What disease(s) has your child suffered from for the last two weeks?

____________________________
____________________________
____________________________

42. Immunization status (From documents).

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>1 YES</th>
<th>0 NO</th>
<th>3 NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCG at birth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diphtheria/Pertussis/ Tetanus/ Hepatitis B/ Haemophilus influenza Type b</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st dose 6wks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd dose 10 wks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd dose 14 wks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral Polio vaccine OPV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st dose 6wks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd dose 10 wks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd dose 14 wks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow fever vaccine 9 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measles vaccine 9 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin A Capsule</td>
<td>6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>54 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 months</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 43. Dietary diversity

Yesterday did you or anyone in the household consume the following foods?

<table>
<thead>
<tr>
<th>Food group</th>
<th>Specified food</th>
<th>YES 1</th>
<th>NO 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starchy (cereals)</td>
<td>Maize, rice, millet, wheat, sorghum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Starchy (non-cereals)</td>
<td>Potatoes, sweet potatoes, cassava, yams, green bananas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legumes and nuts (fresh)</td>
<td>Frenchbeans, green peas, all types of fresh beans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legumes and nuts (dry)</td>
<td>All beans, peas, green grams, groundnuts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>Sukumawiki, Spinach, terere, kunde, pumpkin leaves</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oranges, avocados, tomatoes, passion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruits</td>
<td>pawpaw, ripe bananas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eggs</td>
<td>Chicken eggs, duck eggs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat and fish</td>
<td>Beef, chicken, fish, rabbit, pork, goat meat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1)=1-3 low diversity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2)=4-6 middle diversity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3)=7-9 high diversity</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total: 115
### 44. Frequency of intake of some food items

<table>
<thead>
<tr>
<th>Food Group</th>
<th>Specific food</th>
<th>Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Everyday</td>
</tr>
<tr>
<td>Starchy (cereals)</td>
<td>Maize, rice, millet, wheat, sorghum</td>
<td>5</td>
</tr>
<tr>
<td>Starchy (non-cereals)</td>
<td>Potatoes, sweet potatoes, cassava yams, green bananas sugarcane</td>
<td></td>
</tr>
<tr>
<td>Legumes and nuts (fresh)</td>
<td>Frenchbeans, green peas, all types of fresh beans</td>
<td></td>
</tr>
<tr>
<td>Legumes and nuts (dry)</td>
<td>All beans, peas, green grams, groundnuts</td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>All green leafy vegetables (NB. Specify, carrots)</td>
<td></td>
</tr>
<tr>
<td>Fruits</td>
<td>Oranges, pawpaw, avocados, tomatoes, passion</td>
<td></td>
</tr>
<tr>
<td>Eggs</td>
<td>Chicken eggs, duck eggs</td>
<td></td>
</tr>
<tr>
<td>Meat &amp; Fish</td>
<td>Beef, chicken, fish, rabbit, pork, goat meat</td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Contribution of urban farming to household food consumption

45. What is the contribution of urban farming to your household food consumption?

1. Most of the food
2. About half of the food
3. Less than half of the food
4. Only a small portion of the food
5. Negligible
46. What are the problems that you encounter with both animal and crop rearing?

**Crops**
- Lack of water
- Crop pests/diseases
- Poor market
- Being stolen
- High prices of inputs
- Destruction by neighbours’ livestock

**Animals**
- Animal diseases
- Lack of fodder
- High prices of inputs
- Lack of safe drinking water
- Lack of capital
- Lack of space
- Poor market

Others, specify ________________________________

**Nutrition knowledge**
1 = Zero/no idea 2 = 1-5 low 3 = 6-10 middle 4 = 11-15 high knowledge

47. Answer the following questions to the best of your knowledge.

i) Do you know what a balanced diet is? 1 Yes ☐ 0 No ☐

ii) If yes, what are the three food groups? (Carbohydrates, proteins and vitamins)
- Three groups ________ ________ ________ 3
- Any two groups ________ ________ 2
- Any one group ________ 1
- Wrong answer or don’t know ________ 0
iii) **What are the sources of Carbohydrates?** (Cereals, roots and tubers e.g. maize, rice, potatoes, yams green bananas e.t.c.)

<table>
<thead>
<tr>
<th>Sources</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any three sources</td>
<td>3</td>
</tr>
<tr>
<td>Any two sources</td>
<td>2</td>
</tr>
<tr>
<td>Any one source</td>
<td>1</td>
</tr>
<tr>
<td>Wrong answer or don’t know</td>
<td>0</td>
</tr>
</tbody>
</table>

iv) **What are the sources of proteins?** (Any kind of meat, eggs, and legumes and nuts e.g. beef, chicken, fish, all types of beans and nuts)

<table>
<thead>
<tr>
<th>Sources</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any three sources</td>
<td>3</td>
</tr>
<tr>
<td>Any two sources</td>
<td>2</td>
</tr>
<tr>
<td>Any one source</td>
<td>1</td>
</tr>
<tr>
<td>Wrong answer or don’t know</td>
<td>0</td>
</tr>
</tbody>
</table>

v) **What are the sources of vitamin A?** (Liver, eggs, Dark green vegetables and yellow-orange fruits e.g. spinach, carrots, papaw, tomatoes)

<table>
<thead>
<tr>
<th>Sources</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any three sources</td>
<td>3</td>
</tr>
<tr>
<td>Any two sources</td>
<td>2</td>
</tr>
<tr>
<td>Any one source</td>
<td>1</td>
</tr>
<tr>
<td>Wrong answer or don’t know</td>
<td>0</td>
</tr>
</tbody>
</table>

vi) **What are the sources of iron?** [Hint-formation of blood] (Meat, egg, fish, whole cereals, legumes and green leafy vegetables)

<table>
<thead>
<tr>
<th>Sources</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any three sources</td>
<td>3</td>
</tr>
<tr>
<td>Any two sources</td>
<td>2</td>
</tr>
<tr>
<td>Any one source</td>
<td>1</td>
</tr>
<tr>
<td>Wrong answer or don’t know</td>
<td>0</td>
</tr>
</tbody>
</table>
Agricultural and post harvest knowledge

48. Do you know that farming can be done in this area? 1 Yes 0 No

49. For the past one year, have the agricultural extension officers trained you (on-farm training) on the following?

<table>
<thead>
<tr>
<th>Farming practice</th>
<th>YES</th>
<th>NO</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil preparation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compost manure making</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planting dates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant spacing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crop protection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crop rotation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weeding dates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harvesting dates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harvesting techniques</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preserving the surplus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Attitudes towards urban agriculture

50. What would you say about urban agriculture?

<table>
<thead>
<tr>
<th>Attitudes</th>
<th>Agree</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is a good thing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is good for neighbours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Should be accepted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is important in urban food supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Should be supported by the government</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

51. What are the problems caused by urban agriculture?

1. Pollution
2. Noise
3. Diseases
4. Others
5. None
APPENDIX 4: OBSERVATION CHECKLIST

1. Type of cooking facility

1. Traditional three stone
2. *Jiko* (metal all through)
3. Improved facility
4. Paraffin stove
5. Electric cooker
6. Gas cooker
7. Others _____________________________

2. Location of kitchen.

1. Separate
2. Together
3. Separate and together

3. General sanitation of the compound and household.

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litters in the compound</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disposal of kitchen waste</td>
<td>Well</td>
<td>Badly</td>
</tr>
<tr>
<td>Presence of unkempt drainage</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

1. Badly kept
2. Moderately clean
3. Clean

2. Types of crops produced

________________________
________________________
________________________
________________________
________________________
5. Farming practices

1. Mono cropping
2. Mixed cropping
3. Terracing
4. Zero grazing
5. Mixed farming
6. Others
7. NA
8. Mixed farming and mixed cropping

6. The labour providers

1. Men
2. Women
3. Children
4. Others, Specify
5. NA

7. Tools used for working on the farm

____________________
____________________
____________________
____________________
APPENDIX 5: FOCUS GROUP DISCUSSION GUIDE IN BASELINE SURVEY

1. What type of crops and livestock do you rear?

2. Do you receive any extension services in crop and livestock production?

3. What is your opinion about peri-urban farming as a source of food for the households?

4. How is the adequacy of the food that you produce for your household food needs?

5. What are the major sources of income in the households in this area?

6. What are the nutrition and health problems affecting children in this area?

7. What do you think are possible solutions to these nutrition and health problems?

8. What do you think about diversifying the farming practices?
APPENDIX 6: FOCUS GROUP DISCUSSION GUIDE FOR THE 30 HOUSEHOLDS IN THE INTERVENTION

1. What new activities did you gain from this project?
2. What new knowledge did you gain from this project?
3. How has this project helped you in the provision of food to your household members?
4. How sustainable is this food source?
5. What problems are you encountering so far in food and livestock production?
6. What have you done and will do to impart this knowledge to the other community members?
APPENDIX 7: GEOGRAPHICAL LOCATION OF KAMAE AREA IN THE CITY OF NAIROBI

Source: Foeken and Mwangi (2000)