

**ROLE OF KITCHEN GARDENS IN DIVERSIFYING DIETS AMONG
SEMI ARID INHABITANTS OF IGAMBA NGOMBE IN THARAKA
NITHI COUNTY, KENYA**

**A COMPARATIVE STUDY OF KITCHEN GARDEN PRACTICING AND
NON-PRACTICING HOUSEHOLDS IN IGAMBA NGOMBE**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
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**DEPARTMENT OF FOOD SCIENCE, NUTRITION AND TECHNOLOGY
FACULTY OF AGRICULTURE
UNIVERSITY OF NAIROBI**

2020

DECLARATION

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

Signature  Date 1/12/2020

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DEDICATION

It is my great delight to dedicate this dissertation to my family and mentor:

My beloved dad, Francis, for being such a great source of encouragement in the entire process

My mum, Nancy, for your continuous love and above all prayers

My sisters, Maureen and Ruth for being great sources of inspiration

To my supervisor, Professor Wambui-Kogi Makau, for mentoring me and for being a source of encouragement.

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ABBREVIATIONS AND ACROYNMS

ASALs	Arid and Semi-Arid Lands
CIDP	County Integrated development Plan
CGIAR	Consortium of International Agricultural Research Centers
DASAL	Directorate of Arid and Semi-Arid Lands
FANTA	Food and Agriculture Nutrition Technical Team
FAO	Food and Agriculture Organization
HDDS	Household Dietary Diversity Score
HFIAS	Household Food Insecurity Access Scale
IDDS	Individual Dietary Diversity Score
IYCF	Infant Young Child Feeding
K.G	Kitchen Gardening
KNBS	Kenya National Bureau of Statistics
KNH	Kenyatta National Hospital
KPHC	Kenya Population and Housing Census
MAD	Minimum Acceptable Diet
MAM	Moderate Acute Malnutrition
MDD	Minimum Dietary Diversity
MDD-W	Minimum Dietary Diversity for Women
MMF	Minimum Meal Frequency
NKG	Non Kitchen gardening
PACJA	Pan Africa Climate and Justice Alliance.
SPSS	Statistical Package for Social Sciences
USAID	United States Agency for International Development
WFP	World Food Program
WHO	World Health Organization

OPERATIONAL DEFINATIONS

Dietary Diversity	Refers to the number of different food groups, as categorized by Food Agricultural Organization, consumed by a Household (Household dietary diversity) and an individual (Individual dietary diversity) in the last 24 h
Household	Refers to a group of persons living under the same roof, related by blood, marriage or other social ties, eating from the same pot, sleeps in the same compound, relying on the same household economic and considers the same person as the household head.
Kitchen Garden	Refers to a portion of land where vegetables, fruits and sometimes other crops in small scale are planted primarily for home consumption whether within the homestead or outside the homestead.
Semi- Arid Lands	Refers to areas that have been classified by Directorate of arid and semi- arid lands (DASAL) as areas with aridity levels of between 30-79%.
Sustainability of Kitchen Garden	Kitchen gardening as an intervention will be termed sustainable if project beneficiaries can manage their gardens comfortably without external help and with no strain. This is in relation to; Labor, Planting materials, water. and Economic impact

ABSTRACT

Achieving dietary diversity in Arid and Semi-Arid lands is quite a big challenge due to the weather patterns experienced in this climatic zone. The low amounts of rainfall and high temperature levels negatively affect food production as well as livestock kept in these areas. Although Kitchen gardens are known to directly improve food security at household levels by ensuring access to foods that are nutritious and diversified, information on the role they play in Arid and Semi-arid lands is scanty. A comparative study was therefore conducted between August and September 2019 to determine the role of kitchen gardens in dietary diversity among 98 kitchen garden practicing and 221 non-practicing households. Data entry and analysis were performed using Statistical Package for Social Sciences (SPSS) version 20 and Microsoft excel. Results showed that kitchen garden practicing and non-practicing households had similar characteristics in age, sex, main occupation, and type of contribution to household ($p > 0.05$) but differed significantly ($p < 0.05$) in level of education and gender of the household head. Female-headed households were more open to the idea of owning a kitchen garden compared to male-headed households. There was a significant difference between the two groups in the gender of the household head ($p < 0.05$). The study showed significant difference ($p < 0.05$) in the dietary diversity scores between the two groups. Kitchen gardening practicing households had a more diversified diet compared to the non-practicing households. This could be contributed by the fact that all the households, 100%, that practiced kitchen gardening had planted more than one type of vegetable whereas majority of the participants, 71%, had more than two types of vegetables. Out of all the four indicators of sustainability, source of water was the biggest setback faced. In conclusion, kitchen gardens play a role in achieving dietary diversity of households by allowing the practicing households to have access to different varieties of vegetables grown in the gardens as well as boosting their economic ability hence improving their purchasing power of other foods. There is need to target men in the promotion of kitchen gardens and to find long lasting solution to ensure water availability for sustenance of kitchen gardens in this climatic zone.

CHAPTER ONE: INTRODUCTION

1.1 Background

According to a report by Consortium of International Agricultural Research Centers (CGIAR) Research Program on Dry land Systems, estimates that, more than 40% of the world's land surface falls under the Arid and Semi-Arid lands (ASALs) category and about 2.5Billion people, who translate to 30% of the world's population, live in this dry areas. Poverty in the Arid and semi-arid lands is quite alarming with an average poverty index of around 70% with some areas having a poverty index as high as 80% (Water Service Trust Fund, 2018).

According to a World Food Program (WFP, 2016) report, Kenya has diverse natural resources with highly varied terrain and topography. Further, 80% of Kenya's landmass is either Arid or Semi-arid hence limiting rain-fed crop production. This automatically leads to food insecurity and consequently low dietary diversity thus the need to innovate sustainable interventions.

Globally about two billion people or a third of the world's population suffer from lack of essential vitamins and minerals, otherwise referred to as Hidden Hunger. About 45% of Kenyans in the dry areas are afflicted by chronic malnutrition while over 500,000 children require vitamins due to food shortages (WHO, 2016). This climatic Zone is prone to higher levels of food shortages due to the low amount of rainfall they receive and the high temperature levels experienced. Micronutrient malnutrition remains one of the largest nutrition problems worldwide. Children are especially vulnerable due to their increased nutrient requirements for growth and development. In most cases, the diet provided at the household levels is often inadequate and as such increases the dietary diversity by introducing locally grown vegetables,

fruits and small animals like chicken, rabbits. Where possible, fish would go a long way in improving the micro nutrient intake.

Kitchen gardens offer great potential for improving household food security and getting rid of micronutrient deficiencies. They are known to directly improve food security at household levels by ensuring access to foods that are nutritious and diversified, increasing the purchasing power of households as well as providing a backup plan during the dry season (FAO & FHI 360, 2016). Research has shown that kitchen gardens are associated with improved dietary diversity scores, greater consumption of vitamin A rich fruits, other fruits, Vit A rich vegetables, other vegetables, pulses, and improved complementary food availability (Girard et al. 2012). Kitchen gardens have a positive impact on household food consumption patterns; they are associated with an overall increase in dietary diversity of rural low-income households (Ruel and Alderman 2013). In addition, although indirectly, kitchen gardens may supply cereals to the family, they may do so by using the money that would have been used in purchasing fruits and vegetables to purchase cereals and other foods. (Njuguna 2013).

The Pan African Climate Justice Alliance (PACJA); an organization that is spread all over Africa, mobilizes and empowers the African civil society to towards realization of environmental and climate justice for all people in Africa. It was founded in 2008 and has emerged as the most vibrant and largest civil society platform in climate change and sustainable development with a membership of more 1000 organizations and networks.

Due to the climatic conditions, Pan-African Climate Justice Alliance (PACJA) started Kitchen Gardening as an intervention from a climatic point of view. This implies the need to investigate the the implication of Kitchen Gardening on dietary diversity in households in dry land regions.

1.2 Statement of the problem

Achieving Dietary diversity in the ASALs is quite a big challenge. This can be attributed to the weather patterns experienced in this climatic zone. The low amounts of rainfall and high temperature levels affect food production and at times negatively affect livestock kept in these areas.

Lack of dietary diversity can lead to micronutrient deficiencies and consequently poor nutritional status of individuals. World Health Organization recommends a minimum daily intake of 400g of fruits and vegetables or 146 kg/person/per year. But poor communities such as those in the ASALs have a per capita consumption of 35kg/person/year (FAO, 2015). This is way below the recommended figure.

Even though Igamba Ngombe lies in the category of Semi-Arid land in Kenya, there has been promotion of kitchen gardening, an intervention that has been identified as one that can lead to adequate dietary diversity levels and has been noted to be a sustainable venture. However, there is limited information on the role of Kitchen gardening in diversifying diets of households in ASALs hence the need for current research.

1.3 Justification of the Study

Dietary Diversity is an essential component of a healthy population and good nutrition status of a people. This is rarely achieved in ASALs. The study sought to establish if kitchen gardening is an effective and sustainable intervention in ensuring diet diversity among households in ASALs. The information assembled through the study, will benefit the households in the ASAL climatic zones and help them make evidence based decisions hence promoting food and nutrition security Other researchers will also benefit from the study in identifying areas that have not been explored, hence finding other areas to research on.

1.4. Aim of the Study

The aim of the study is to contribute towards achieving Food and Nutrition Security in Semi-Arid Lands in Kenya.

1.5: Purpose of the Study

The information generated by the study can be used by the policy makers both at County and National Levels to formulate policies to benefit the communities in Semi-arid lands so as to improve the dietary diversity of communities in this climatic region.

1.6: Objectives of the Study

1.6.1 General Objective

To determine the role of Kitchen Gardens in achieving Dietary Diversity among people living in the ASALs in Kenya.

1.6.2 Specific Objectives

1. To establish the socio-economic status of kitchen gardening practicing and non – practicing households in Igamba Ngombe South Constituency in Kenya.
2. To determine the household dietary diversity of Kitchen gardening practicing and non –practicing Households in Igamba Ngombe South Constituency
3. To determine the association between Kitchen Garden ownership and dietary diversity of households in the ASALs.
4. To assess the sustainability of Kitchen Gardening as an intervention in the ASALs.

1.7 Research Questions

1. What is the socio-economic status of Kitchen gardening practicing and Non –practicing households in Igambe Ngombe Constituency?
2. What is the household dietary diversity of Kitchen gardening practicing and Non – practicing households in Igambe Ngombe Constituency?
3. Does practicing Kitchen Gardening have implications on dietary diversity of Households in Semi-Arid lands in Kenya?
4. Is kitchen gardening a sustainable intervention in the semi-arid lands in Kenya?

CHAPTER TWO: LITERATURE REVIEW

2:1 Concept of kitchen gardening

Kitchen gardens trace their origin to Northern Europe, and in particular Great Britain in the 18th Century. In Africa they are traced to Egypt, where farming began in the continent. The earliest garden of any kind was one that supplied its owner with edible and to a certain extent, medicinal substances. People created such gardens in pre-historic times to date albeit on a small scale and with fewer medicinal or household plants (Jakob, 2010)

Even in the early days productive kitchen gardens required certain essential elements that are common to all. They are usually situated close to the homestead; they need fertile soil, water and shelter from harsh climate and security from people (thieves) and animals. Security is provided by low stone or mud walls, hedges of thorns or spiky cacti, wooden or reed palings (Chris, 2010).

Various names and definitions have been used to describe what a kitchen garden is. A kitchen garden is a piece of land where herbs and vegetables are grown around the house for household use (Evans & Jakob 2010). Generally, kitchen gardening refers to the cultivation of a small portion of land which may be around the homestead or within short walking distance. The closeness to the family home is for convenience and security purposes. For this study, Kitchen garden refers to a small segregated piece of land dedicated to production of fruits, vegetables or animals primarily for home / family consumption. Noteworthy is that, recently, the term kitchen gardening is being used interchangeably with the term vegetable garden.

According to Michelle and Hanstad (2004), five intrinsic characteristics of home gardens are location of garden, near the residence; contains a high diversity of plants; production is supplemental rather than a main source of family consumption and income; occupies a small area and are a production system that the poor can easily enter at some level.

The different forms of kitchen gardens that are in existence include; planting in sacks, pot planting, garden planting and shown in Figure 2.1, respectively and animal rearing.

Planting in sacks in which a farmer puts soil, preferably top soil, in a sack and for better results mixes it with animal or farmyard manure. The vegetables are planted either from the top or along the sides by making holes (as small as possible) in the sack and then sowing the seeds/plants. Vegetables, such as Spinach, Onions, tomatoes, and kale are ideal for sack gardening.

Pot Planting- It is more or less the same like sack planting just that the plants are planted in pots. The same procedure of preparing sacks is used. Fruits such as Strawberries do well in such settings.

Garden planting- In this type of kitchen gardening, the crops are planted directly into the dedicated. The land is first prepared. This is necessary in to ensure favorable conditions for seed germination and establishment, root penetration, crop management, elimination of weeds and pathogens, improving water holding capacity of the soil and drainage, and ease later field operations. The seedbed is finely prepared, leveled and then rows and ridges are made. The seeds are then planted.

Animal keeping- Small animals such as Rabbits, Chicken, Goats, and Ducks are reared primarily for household consumption.



Figure 2.1 : Manifests some forms of Kitchen Gardens

2:2 Dietary diversity

Dietary diversity relates to nutrient adequacy (coverage of basic needs in terms of macro and micro nutrients) and to diet variety/balance, which are two of the main components of diet quality (UNSCN, 2008).

2:2:1 Methods and tools of assessing dietary diversity

To assess dietary diversity, Dietary Diversity Score (DDS) have proven to be useful elements. At the household level, dietary diversity indicators have been adopted as a proxy for economic status (Kennedy & Marie, 2011). At the individual level, dietary diversity indicators serve as a proxy for diet quality and for some studies, they have shown a relationship with adequacy in nutrients. Dietary diversity scores are not difficult to use as they are easy to compute and interpret. They can also be used in different regions since the list of foods used in the questionnaire can be generated in a way that reflects the locally consumed foods.

2.2.1.1 Household Dietary Diversity Scores

In 2006, the Food Agriculture and Nutrition Technical team released the Household Dietary Diversity Score (HDDS) as an indicator of food access of households. A highly diversified diet is associated with adequacy of energy giving foods and foods rich in protein as well as micronutrients (Swindale & Bilinsky, 2006). In most cases the HDDS can be used together with other indicators that point to food security. For example, the Household Food Insecurity Access Scale (HFIAS) that helps to shed more light on the access of the household to specific food groups. (Cafiero et al., 2014).

The HDDS is easy to use, as the questions are standardized and can be well articulated by the respondents and the data collectors. Additionally, the set of questions usually take less than ten minutes for one respondent. (Swindale & Bilinsky, 2006). Although the standard format is not sensitive of the different cultures around the globe, the researcher should customize the question to fit the study population. ((Kennedy & Marie, 2011).

Even with its numerous advantages, one of the limitations is that the data collected does not give a clear picture on the dietary intake of different food groups by the household members. It also does not give data on the distribution of the food within the household. There is are no globally acceptable cut-off points to distinguish the household that consume diverse food and those that do not.

The household dietary diversity score described in the FAO Dietary Assessment guidelines consists of a simple count of food groups that a household has consumed over the preceding 24hrs. Household Dietary Diversity Score (HDDS) is based on the count of 12-food groups. The

information is extracted from one qualitative 24-hour recall, excluding foods consumed outside the home. The respondent is asked to list all the foods they consumed in the last 24hrs, they are then grouped into the 12 food groups i.e (*Pulses, nuts and seeds, Vitamin A rich vegetables and tubers, other vegetables, Vitamin A rich fruits, other fruits, meat,& poultry,& fish, eggs, milk & milk products, oil & fats energy giving foods, spices & condiments & beverages*) in the dietary diversity questionnaire and a score out of 12 is given. According to FAO, a score of above 6 is considered to be good while that below 3 is considered to be poor.

HHDS assesses the quality of food access at household level. Additionally, it is useful for identifying emergencies related to food security and malnutrition (Ruel, 2013). Studies have shown that an increase in dietary diversity at household level is positively associated with household food security (Hoddinott et al., 2002).

2.2.1.2 Individual dietary diversity score

Individual dietary diversity score is a method used in assessing the quality of the diets consumed by an individual (Dere Kal et al., 2017). The individual dietary diversity can be assessed using any of the three methods depending on the target group.

- 1) The Minimum Acceptable Diet (MAD) for children 6-23 months old, is one of eight core indicators for assessing infant and young child feeding (IYCF) practices MAD was developed and finalized at the World Health Organization (WHO) Global Consensus Meeting on Indicators of IYCF in 2007. These eight indicators were developed to provide simple, valid, and reliable metrics for assessing the many aspects of IYCF that are of interest at the population level (WHO, 2008). The other seven indicators are: early initiation of breastfeeding; exclusive breastfeeding of children under 6 months;

continued breastfeeding at 1 year; introduction of solid, semi-solid, or soft foods; minimum dietary diversity; minimum meal frequency; and consumption of iron-rich or iron-fortified foods. The MAD indicator is a composite indicator composed of the Minimum Dietary Diversity (MDD) and Minimum Meal Frequency.

The MAD, along with the other seven IYCF indicators, was developed for assessment at the population level to facilitate comparisons across and within countries, to describe trends over time, to target/identify populations at risk, target interventions, make policy decisions about resource allocation, and serve as an impact measure when monitoring and evaluating IYCF programs. Because the MAD indicator captures multiple dimensions of feeding, it can be used for comparisons across populations with different rates of continued breastfeeding or be presented by breastfed and non-breastfed children (WHO, 2008).

One advantage of this indicator is that it is relatively simple to calculate and interpret and is applicable across socio-cultural contexts. It is also applicable for both breastfed and non-breastfed children. Analyses have shown that the MAD indicator is associated with child anthropometric status, particularly stunting (Jones et al., 2013). However, a weakness of this indicator is that it does not provide quantitative information about children's food and nutrient intake. The indicator was designed to capture optimal complementary feeding patterns (based on WHO recommendations), but it was not designed to capture excessive intake of energy, sugar, or fat that would yield information about risks for overweight and obesity (Lele et al., 2016).

Minimum dietary diversity for women.

The Minimum Dietary Diversity for Women (MDD-W) is a population-level indicator of diet diversity validated for women aged 15-49 years old. The MDD-W is a dichotomous indicator based on ten food groups and is considered the standard for measuring population-level dietary diversity in women of reproductive age. The MDD-W was preceded by the Women's Dietary Diversity Score (WDDS), which was a validated continuous indicator based on reported intake of nine food groups. The MDD-W was developed after additional validation using new data sets was carried out and with the objective of creating a dichotomous (easier to interpret) indicator rather than a continuous one (FAO & FHI, 2016).

According to the MDD-W, women who have consumed at least five of the 10 prescribed food groups over a 24-hour recall period are classified as having minimally adequate diet diversity. The Food and Agriculture Organization (FAO) and the United States Agency of International Development (USAID) both recommend the use of the MDD-W when a categorical indicator of individual dietary diversity for women is needed. These organizations also recommend using the 10-food group dietary diversity indicator if a continuous variable is desired.

Indicators of women's diet diversity have strongly and positively correlated with micronutrient adequacy of the diet in cross-country analyses using data from several low-income countries (Arimond et al., 2010). Micronutrient adequacy is an important element of diet quality, thus, the MDD-W can be used as a proxy for this aspect of diet quality. Although data is obtained from the resulting indicator is appropriate only for population-level (not individual-level) targeting. It can be used to monitor and evaluate programs that seek to improve diet quality in resource-constrained settings. The MDD-W can be used to calculate and report prevalence, making it a

simple and easy to understand tool that is useful for communication and advocacy materials, particularly for non-nutrition audiences (Arimond, 2016; FAO & FHI, 2016).

One of the advantages of MDD-W is that it is simple to collect, tabulate, and interpret. The results are easy to communicate (i.e. either households achieve minimally adequate diversity or not). Additionally, the threshold for adequacy is standardized which enables comparisons across time and space. However, the tool must be adapted to include culturally relevant examples of foods for each of the 10 food groups that *include 1. Grains, white roots and tubers, and plantains 2. Pulses (beans, peas and lentils) 3. Nuts and seeds 4. Dairy 5. Meat, poultry and fish 6. Eggs 7. Dark green leafy vegetables 8. Other vitamin A-rich fruits and vegetables 9. Other vegetables 10. Other fruits*

Enumerators must be properly trained to correctly categorize meals containing a mix of different food groups, and to record only food groups where more than half a cup of a food in that group was consumed, to exclude nutritionally less relevant foods, such as condiments or seasonings from the total score (FAO & FHI, 2016). A strength of the MDD-W is its simplicity as a measure of a key aspect of diet quality, but it remains a rough proxy for nutrient adequacy. Individuals interested in a more precise estimate of nutrient intake and adequacy should consider conducting a quantitative 24-hour Dietary Recall instead.

2:3 Dietary diversity and socio-economic status

Households in middle income and low income countries base their diets on very few food groups that include their normal staple foods, this results to low dietary diversity (Ruel, 2013). Through the past decades, economic development has resulted in changes in food consumption patterns in low Income and middle income countries, fat and sugar rich foods tend to replace traditional

grains and fiber rich foods. Nutrition transition affects individuals with higher Socio-Economic status first (Popkin, 2014). Although some of the changes are beneficial to some extent, they are associated with increase in obesity and non-communicable diseases (Hawkes, 2006).

In both high income and low income countries, socioeconomic status is a major determinant of healthy diets. Studies have shown that high social economic status can be associated with general healthier dietary patterns, quality of the diet, and increased diversity (Mayen et al., 2014)

In refugee camps, high prevalence of Iron Deficiency Anemia and over nutrition is indicative of double burden of disease with both hidden hunger (micronutrient malnutrition) and non-communicable diseases present in the same population or even within the same household (Grijalva et al., 2012).

A study done by Hatloy et al., (2016), in Mali, demonstrated a relationship between dietary diversity and socio-economic status of the households. The study showed that the women of low socio-economic status in the urban areas had a higher diversity score than those of low socio-economic status in the rural areas.

In low income rural areas of the Sub-Saharan Africa, of which, the majority of the people rely on rain-dependent, their diet quality remains a great challenge (Black, 2013). Individuals in high socio-economic status are more likely to eat healthy foods that may include lean meats, low-fat dairy products, vegetables and fruits, while those of the different status, tend to eat less fibre and more fat (Giskes, 2010).

A study done in 17 countries estimated that four out of five deaths due to non-communicable diseases now occur in low and middle income countries and the burden is expected to rise in the next few decades (Schmidhubler, 2015).

In general, cereals are cheaper than the other food commodities, hence less advantaged communities tend to have a monotonous diet that lacks in diversity and is rich in energy giving foods. Households that are more stable are able to complement the staple foods with foods that are both diverse and rich in micronutrients (Allen et al., 2006).

2:4 Dietary diversity and malnutrition

Malnutrition has been a serious issue globally for the longest time now. The triple burden of malnutrition is now felt more than before. In the recent past, the big role that nutrition plays in the physical and intellectual growth of children has really been emphasized. The impact that nutrition has on the economy is directly felt, through the reduced public health expenditure on healthcare (Hoddinott et al., 2008).

Adequate and proper nutrition comprises of the very fundamental requirements for a healthy human life. Credible evidence that shows the association between a diverse diet and health outcomes and economic performance is available (Oldiges, 2017).

2:5 Micronutrient malnutrition

Micronutrient malnutrition refers to diseases caused by dietary deficiency of vitamins or minerals. It is estimated that more than 2 billion in the world today could be suffering from micronutrient malnutrition (Hannah & Rithie, 2017). It can also be defined as lack of essential vitamins and minerals required in small amounts by the body for proper growth and

development. Although any person can suffer from micronutrient deficiency, children and pregnant mothers are more susceptible to developing the deficiencies. This may be as a result of low dietary intake as well as higher physiological needs. (Hannah & Max, 2017).

According to the World Health Organization 2015, around 20% of maternal deaths are attributed to Anemia alone. While Vitamin A deficiency is the leading cause of preventable blindness in children, it manifests as night blindness, and could further progress to permanent blindness in extreme cases. Zinc deficiency is mainly common in developing countries whose diet is cereal based and very low in protein. Zinc is very important for growth and recuperation. Lack of it can lead to stunting or weakened immune system and even health complications in pregnant women, neonates or children. Zinc deficiency has been associated with higher mortality and morbidity rates in mothers and newborns. (Prasad, 2013).

Micronutrient Malnutrition is extremely high in a number of countries in South Asia and Sub-Saharan Africa. The countries in North Africa, Central Europe and East Asia have been categorized as having mild micronutrient deficiencies issues (Hannah & Max 2017).

Under nutrition and micronutrient malnutrition remains a huge problem in many developing countries. Proper nutrition not only requires access to food but also higher dietary diversity and quality (Kibrom, 2015)

2:5:1 Micronutrient malnutrition management

In cases where hidden hunger cannot be solved by dietary intake single handedly, other interventions can be used. These include Food fortification, Supplementation and bio

fortification. Food fortification entails adding small amounts of the micro-nutrients to processed foods that are consumed by majority of the population. Supplementation involves giving concentrated of certain micronutrients in tablet, liquid or powder form. Bio fortification refers to making use of bio-technology to increase the concentration of certain micronutrients in certain foods that are consumed by most people (Miller & Welch, 2013).

2:6 Climatic conditions of semi-arid lands

Of all the climatic zones, Semi-Arid land is the second driest after desert climate. Semi-Arid climatic zone receives rain twice a year, amounting to 15 inches of rainfall on average. It is considered an intermediate between the desert climate and humid climate. There are two types of semi-arid lands; Hot- semi- arid climates and Cold semi-arid lands. The Hot semi-arid lands are largely found in Africa, South Asia, and Australia and in some parts of South America, North America and Europe. The Cold Semi-Arid climates experience warm, dry summers and cold winters. This type is majorly found in some parts of North America, North and South Africa, Europe and partially in South America (World Atlas, 2017). These regions do support vegetation that is also found in the desert. They have thick cuticles; thorny branches that help them reduce water loss through transpiration. Animals found in this region are those that have adapted to grassland eco-system. They include Zebras, Antelopes and Bison among others (World Atlas, 2017).

In Kenya, Arid and Semi-arid areas cover close to 80% of the total Kenyan land, 60% of the National Parks and Reserves are found in these areas. These lands house close to 30% of the total Kenyan population, approximately, 12 million people, 50% of the Kenyan livestock and 75% of wildlife. Out of the 47 Counties, over 50% (29) are categorized as ASALs. They include;

Kiambu, Nakuru, Homabay, Elgeyo Marakwet, Machakos, Migori, Meru, Taita Taveta, Lamu, Kilifi, Kwale, Nyeri, Laikipia, West Pokot, Embu, *Tharaka Nithi*, Kitui, Makeni, Kajiado, Narok, Garissa, Baringo, Isiolo, Samburu, Wajir, Turkana, Tana River, Marsabit and Mandera. These areas are classified in relation to aridity levels: Those that have 85-100% aridity are referred to as Arid Counties while those with 30-84 % aridity are 1st class semi-Arid and those with 10-29% aridity are 2nd class semi-arid counties(DASAL, 2018)

2:7: Gap in knowledge

A number of interventions have been carried out in the ASALs in Kenya to address the recurrent food and nutrition security problems in this climatic zone. Most of these interventions are done to empower the residents economically and not to increase their dietary diversity levels and have somehow proved to be unsustainable.

In last five to ten years, Kitchen gardening has been introduced as an intervention to help achieve food and nutrition security as well as enhance dietary diversity. Most of the researches done in regard to kitchen gardening in this climatic zone are done in light of its contribution to food security and not dietary diversity.

Therefore there is need to determine the role of kitchen gardens in dietary diversity in this climatic zone.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3:1 Study Setting

3.1.1 Study area and population

This study was conducted in Igamba-Ng'ombe constituency, Tharaka Nithi County, Kenya. Tharaka Nithi County has a total population of 393,170 according to the 2019 Kenya Population and Housing Census (KPHC) with the majority being Chuka, Muthambi, Mwimbi and Tharaka people of the larger Ameru community. The minority are the Akamba, Ambeere and Aembu who come from the neighboring counties(Tharaka Nithi County Development Plan, 2018). Tharaka Nithi County was purposively selected because it is one of the counties that is Semi-Arid lands and was selected by PACJA to be one of the counties benefiting from the kitchen gardening project.

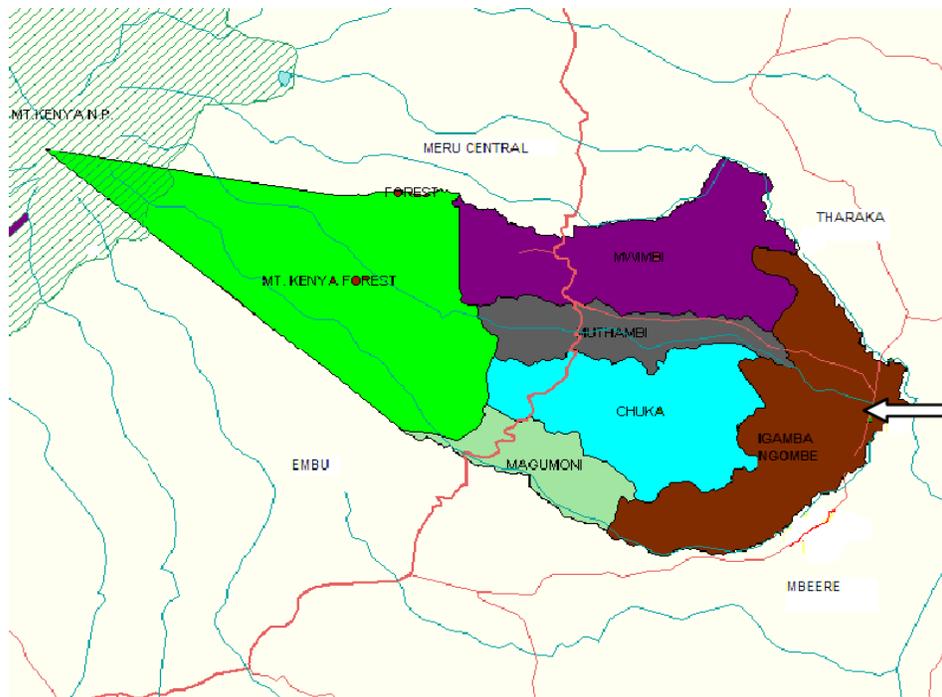


Figure 3.1: Map of Tharaka Nithi County
Source: <https://www.researchgate.net>

3.1.2 Position and size

Tharaka Nithi County lies between latitude 000 07' and 000 26' South and between longitudes 370 19' and 370 46' East. The county borders the counties of Embu to the South and South West, Meru to the North and North East, Kitui to the East and South East while sharing Mount Kenya with Kirinyiga and Nyeri to the West. The total area of the County is 2,662.1 Km²; including 360Km² of Mt Kenya forest in the county (Tharaka Nithi County Development Plan, 2018).

3.1.3 Administrative and political units

Tharaka Nithi County, whose headquarters are at Kathwana, is divided into five (5) administrative sub-counties namely Tharaka North, Tharaka South, Chuka, Igambango'mbe and Maara. Tharaka North Sub-county is the largest covering an area of 803.4 Km² while Igambango'mbe is the smallest covering an area of 308Km². Igambango'mbe constituency has 2 wards, 7 locations and 18 sub-locations (Tharaka Nithi County SMART Survey Report September 2016).

3.1.4 Climate

The County has two main ecological zones. The highlands (upper zone) comprised of Maara and Chuka which receive adequate rainfall for agriculture. The semi-arid (lower zone) covers Tharaka and receives less rainfall making it suitable for livestock production. The county has a bi-modal rainfall pattern with the long rains falling during the months of April to June and the short rains in October to December. Temperatures in the highland areas range between 14⁰C to 30⁰C while those of the lowland area range between 22⁰C to 36⁰C.

3.1.5 Health

The County has a total of 128 health facilities of which, 61 are public facilities, 6 nongovernmental facilities, 29 faith based and 32 private facilities. The prevalence of stunting for the County stands at 22.0%, which is below the national level prevalence rate of 26% (Ministry of Health, 2015).

3.1.6 Education

A majority of the County population is literate with only 17 % and 13.2% unable to read and to write, respectively. Those who cannot read or write are 16.9 %. The dropout rate is 20% for both primary and secondary schools. The dropout rate for boys, 22%, is higher than for girls (20%). The transition rate from Early Childhood Development Education (ECDE) to primary is quite high at a rate of 85%. The transition rate from primary to secondary schools is approximately 70% (Tharaka Nithi CIDP 2018-2022).

3.1.7 Farming

Agriculture is the main economic activity and source of livelihood of the communities residing in Tharaka Nithi County. Majority of the households, 92%, are involved in agricultural activities. The upper region of the County produces mainly cash crops such as coffee and tea while the lower region mainly produces food crops such as maize, beans, cowpeas, bananas, sorghum, tomatoes, paw paws, avocados and citrus fruits. Macadamia, oranges, mangoes, cotton and tobacco are grown in the lower regions of the county.

Livestock farming is also an important economic activity in the County. Both dairy farming and beef farming are practiced in the upper and lower parts of the county respectively. Sheep, cattle, chicken and goats, are among the types of animal reared in this county. In the recent past, the

residents have taken up fish farming and one of the main types of fish kept is Trout (Tharaka Nithi County SMART Survey Report September 2016).

3.2. Research Methodology

3.2.1 Study Design

The research design of the study was cross-sectional with a comparative and evaluative component. It is evaluative because, the study was conducted within an ongoing project set up, and sought to evaluate the outcome of the intervention from a nutrition point of view by comparing with the situation of households that were not practicing kitchen gardening. The study used both qualitative and quantitative methods of data collection and data analysis.

3.2.2 Study Population

The universe study population for this study is 109, 860 households in Tharaka Nithi (KNBS, 2019) while the study population is an estimate of 20,000 households within Igamba Ngombe Constituency. The Households included in this study are those that practice Kitchen Gardening within the PACJA Project and those that do not practice kitchen gardening but reside Igamba-Ng'ombe constituency.

3.2.3 Sampling

3.2.3.1 Determination of sample size

The sample size has been calculated using the Fisher *et al.* (1991) formula

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

$$d^2$$

Where

N = Desired sample size

Z= Level of significance of 95%

P= prevalence rate of Iron Deficiency Anemia among women of childbearing age (22%)

Q= 1-p (women without Iron Deficiency Anemia)

D= Level of accuracy – used 5% standard error.

$$1.96^2 \times 0.22 \times 0.88 \quad + 10\% \text{ attrition}$$

$$0.05^2$$

= 326 Households.

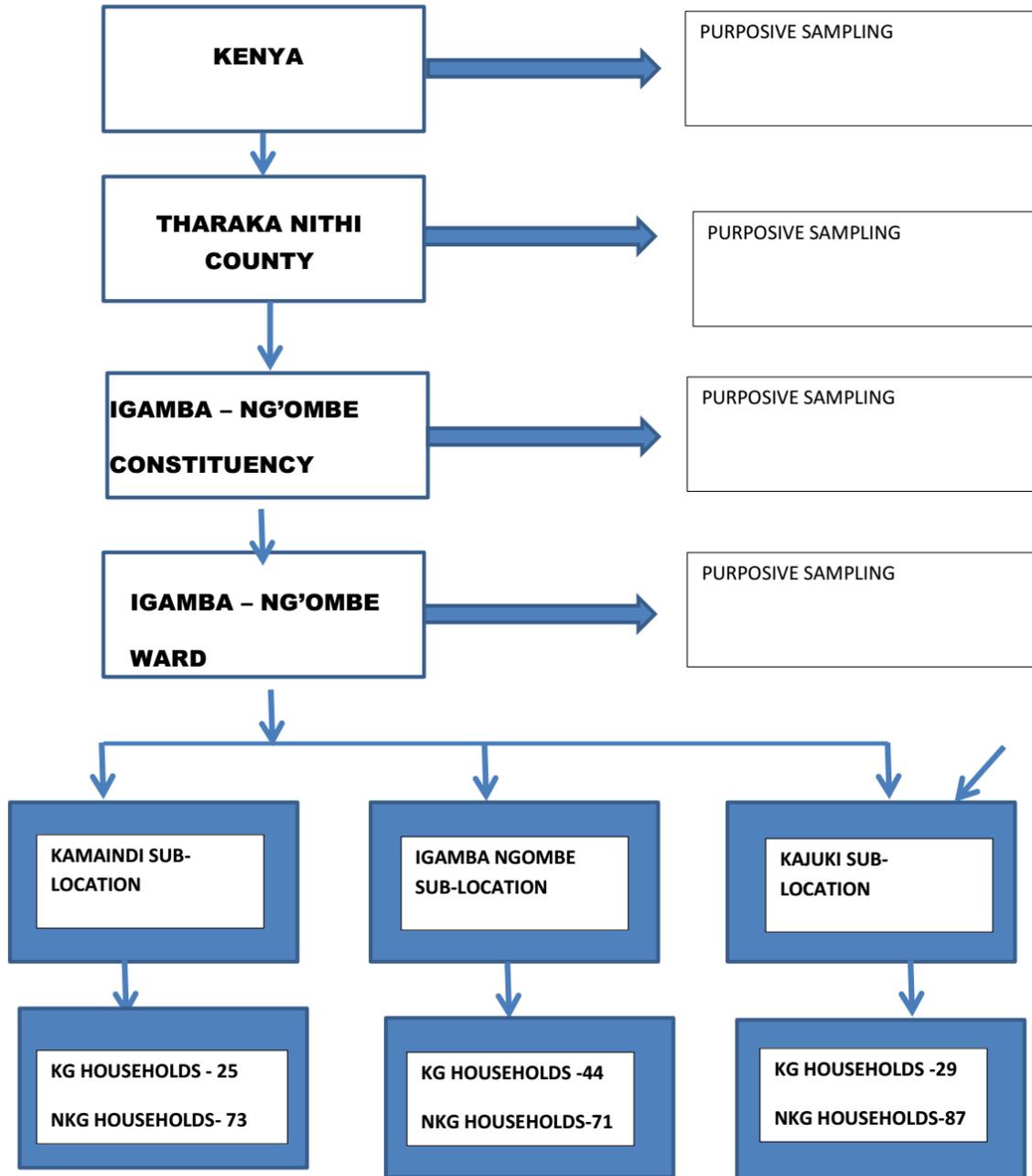
A prevalence (22%?) rate of Anemia among women of reproductive age , from KDHS 2009, was used to calculate the sample size. This is because most of the crops expected to be grown in the kitchen garden are rich sources of micronutrients and especially Iron.

A total of 326 households were interviewed. Those with Kitchen Gardens were 102 while those without were 224. This made the required sample size of 326 households. There were 7 drop outs, 4 from Kitchen garden practicing households and 3 from the non- practicing households. The reason for dropping out resulted from incomplete and wrongly filled questionnaires. The final sample of 319 households, comprised 98 with kitchen gardens and 221 without. Only 102 households were part of the kitchen gardening project run by PACJA, hence the reason why the number is double that of non-practicing households.

3.2.3.2 Sampling Procedure

Kenya was purposively i.e. the area of study was intentionally selected , chosen, and so was Tharaka Nithi , Igamba Ngombe constituency and Kamaindi ,Igamba ngombe ,Kajuki wards. This was because it is in this constituency and the mentioned wards that the Kitchen gardening project was being carried out. For the households that practice kitchen gardening exhaustive sampling was used i.e. all the households that owned kitchen gardens within the PACJA project were involved in the study. For the non-practicing households, systematic random sampling was used in choosing the households that were involved in the study. Every tenth household was selected to participate in the study. The person responsible for preparing the family meals was chosen to represent the household in the study. **Inclusion Criteria:** The Person responsible for preparing the family meals, participants with good hearing and memory, permanent residents in the household, a person who understands the questions, willing to participate. **Exclusion Criteria:** Non-willing Participants and residents who have stayed less than 3 months within the

Household. This is represented diagrammatically in figure 3.3 as follows.+



*******Exhaustive sampling** was used for the kitchen gardening practicing households while as **Simple random sampling** was used for the non-kitchen gardening practicing households

3.2.5 Techniques for data collection for every objective

Data collection was conducted between the months of August and September 2019. The techniques used for data collection depended on the objective as detailed below:

Objective 1: To describe the socio-economic status of Kitchen gardening practicing and non –practicing households

A well detailed semi-structured questionnaire (Appendix 2) was used to obtain the data on socio-demographic and socio-economic status of the kitchen gardening practicing and non-practicing households. The variables included were; age of study participants, marital status, their level of education, contribution to household, and the relationship with the household head.

The indicators of socio-economic status used include: ownership of assets such as land, livestock, television, ownership of house and the materials used to build the houses.

Objective 2: To determine the household dietary diversity of Kitchen gardening practicing and non –practicing Households

The study used a Household Dietary Diversity Questionnaire(Appendix 2) that was adopted from the Food and Nutrition Technical Assistance, (FANTA) Household Dietary Diversity Score Indicator Guide (Swindale & Bilinsky, 2006). Minimal modifications were done to include foods that are available in the study area as well as omit foods that are not found in the study area. The questionnaire contains two parts, in the first part the respondents described the meals and snacks he/ she consumed in the last 24 hours. Once the enumerator was satisfied that the respondents recall was complete, they then filled in the food groups based on the information gathered from the recall. The enumerators were trained on how to classify the foods into the respective food groups (Appendix 3).

Objective 3: To determine the contribution of Kitchen Gardening in improving Dietary Diversity of Households in the ASALs.

The data on the contribution of kitchen gardening to dietary diversity was obtained using the information derived from the Household Dietary Diversity (HHDD) questionnaire. The Dietary Diversity Scores of the practicing and non-practicing households were analyzed and compared to determine if kitchen gardens had a significant contribution to the dietary diversity. The scores were obtained by classifying the foods consumed among the 12 food groups in the questionnaire (Appendix 2). For every food group from which an item was consumed a score of 1 was awarded whereas any food group that no item in it was consumed a score of 0 was awarded. Once all these is done the scores were summed up and the dietary diversity score obtained. The study adopted the FAO cut-off points that classify the DDS into low (<4) , medium(5-8) and high(> 8) DDS. A DDS above 5 is considered good enough while that below 3 is considered to be poor.

Objective 4: To assess the sustainability of Kitchen Gardening as an intervention in the ASALs

A detailed semi-structured questionnaire (Appendix 2) was used to collect data on the sustainability of kitchen gardens. The study focused on four key variables; Labor, Source of planting materials, Availability of water and the Economic value of kitchen gardens to the households that owned them. The indicators used to assess the economic value of the kitchen gardens involved asking the respondents how much money they saved considering the fact that they did not purchase vegetables. The respondents were also asked if they sold any of the produce from their gardens.

3.2.6: Ethical and Human Rights considerations

The enumerators explained to the participants what the study entails and how important their feedback was both to themselves, to the county as well as the nation at large. They were assured

that all the information they would give would be treated with utmost confidentiality. It was also made clear that no incentive would be given for participation. Every participant gave their voluntary informed consent (VIC) to participate in the study by signing a consent form(Appendix 1). VIC means that the participant was not coerced or forced to be part of the study, but instead they willingly took part. Approval to conduct the study in the ward was obtained from the Chief's office and, Tharaka Nithi County offices.

3.2.7: Pretesting of tools

A pretest of the tools was done in 15 households from a different ward with similar characteristics to those from the ward where the study was conducted. In the 15 households, 7 owned kitchen gardens whereas 8 did not. The pretest was conducted to validate the tool to ensure that it yielded the right and needed data. Pretest provided experiential learning by enabling the enumerators to get hands-on-experience as they familiarized themselves with the tools and the data collection exercise as well as estimate the time that was sufficient for the respondents to answer all the relevant questions.

3.2.8 Recruitment and Training of research assistants

Two research assistants both of whom were males were involved in the data collection exercise. The two were recruited with the help of the entry person into the community; they were familiar with data collection procedures having been part of other studies prior to this. Their minimum qualification was; secondary school education and residence in the area of study.

The numerators were trained for two days and had experiential exposure in the third day a through the pretest. The training covered all essential components including: how to administer the questionnaires and most specifically the diversity Score questionnaire; how to approach a

Household and get an Informed consent; topic and Objectives of the study, interviewing and Observational skills and techniques, how to conduct the 24hr Recall, how to measure the size of the Kitchen Garden, how to fill the questionnaire and what to do in case a mistake is done, how to handle cases that would interfere with the interview, e.g. when a visitor comes, and ethics in research, specifically in fieldwork, including detecting and managing fraud .

3.2.9 Data quality assurance and control

Quality control is a product oriented process and is focused on problem identification whereas quality assurance is process oriented and focuses on defect prevention. Data quality and assurance were achieved through various ways that include; hiring and training of qualified research assistants, pre-testing of the questionnaires as well as adequate supervision of the research assistants. The data collected was thoroughly crosschecked to ensure the data was recorded as expected and none was missing. The data was coded prior to data entry and the appropriate statistical procedures used during analysis of the data. All questionnaires were scrutinized for accuracy and completeness. The ones found to be uncompleted were discarded, seven questionnaires were discarded.

3.2.10 Data Management and analysis

Data entry, cleaning and coding was done using statistical package for social sciences (SPSS), and Microsoft Excel. During analysis, descriptive statistics i.e. sum, means and median were used to describe information such as socio-economic and socio-demographic status of the households. Inferential statistics were carried out to describe relationship between categorical data and the application is shown in chapter four.

CHAPTER FOUR: RESULTS

This chapter contains the results of the data collected to find out the Role of kitchen gardens in enhancing dietary diversity in Semi-Arid Lands, in Kenya with a specific focus on Igamba Ngombe constituency in Tharaka Nithi County. The results are reported in 4 Sections that are aligned to the objectives of the study. These include: The socio demographic and Socio-Economic characteristics, Dietary Diversity of the Kitchen Gardening Practicing and non-Practicing Households, Relationship between Kitchen Garden ownership and Dietary Diversity, and Sustainability of Kitchen Gardens in Semi- Arid lands .

4.1: Socio- Demographic Characteristics of the study population

The study investigated seven socio-demographic characteristics namely; age, sex, marital status, relationship with household head, education Level, occupation and contribution to the household of both the Kitchen Garden practicing and Non – Practicing households. The purpose was primarily to provide the socioeconomic context of the sample population.

4.1.1 Population Structure

The sample comprised of 319 households with a total of 1155 people with males being 47.7% while the females were 52.3%. Among the households with kitchen gardens, the males were 47.5% while in the non- practicing households they were 47.8 %. Within the households with kitchen gardens, the females were 52.5% whereas in the non-practicing households they were 47.8%. The mean household size for the study population was 3.6, whereas in the Kitchen garden practicing and non-practicing was 3.3 and 3.7 respectively. Excluding the outliers (4 households in kitchen garden practicing and 6 in the non-practicing households, with >10 members) the mean household size was 3.1 and 3.4 respectively. The mean age of the sample

population was 27.9 years with a median of 22. The minimum age was 3 months while maximum age was 79 years. The frequencies in the different age categories is illustrated in figure

4.1

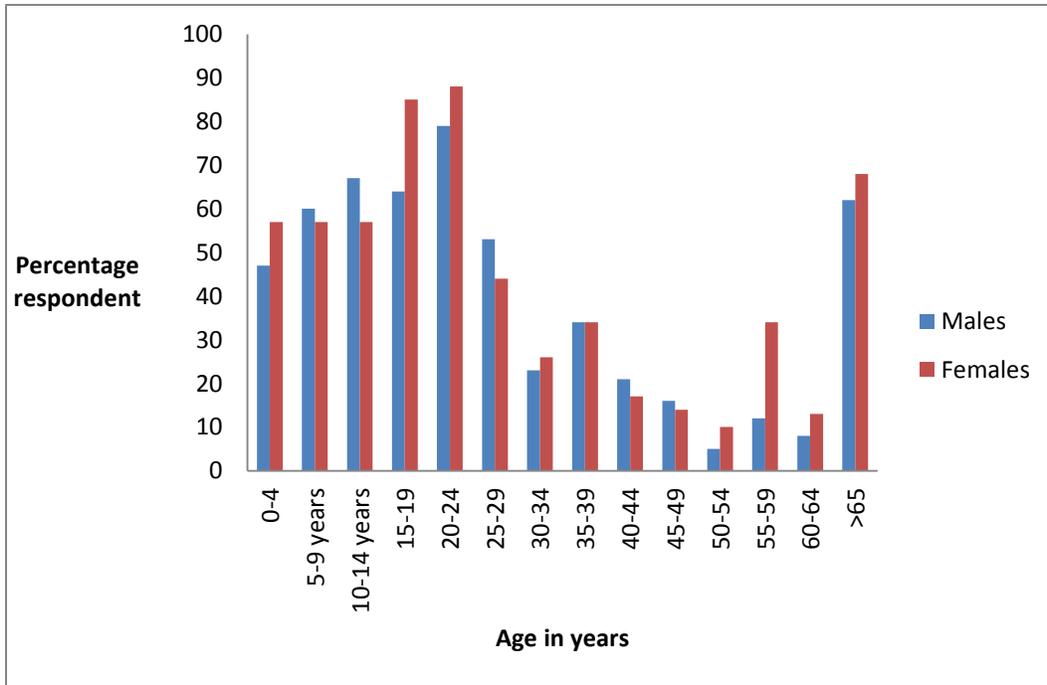


Figure 4.1: Distribution of Household members by age categories in years

4.1.2 Marital Status

More than two-thirds of the members in the households were married (69.1%) while the divorced made up the least proportion (0.4%). In both KG and NKG practicing households, the married were still majority with 60.9% and 72.6% respectively. Likewise the divorced were the least with 0.6% in NKG practicing households and none (0%) in the KG practicing households. There was a notable difference of 11.7% between the KG and NKG practicing households among the widowed as illustrated in Table 4.1. There is significant difference in marital status between the kitchen gardening practicing and non-practicing households as evidenced by an independent sample T-test *p-value of 0.008* , 4df

Table 4.1: Marital status of the household members

Marital Status	KG Households	NKG Households	p- value
	Percentage (n= 215)	Percentage (n= 726)	
Married	60.9%	72.6%	0.008
Divorced	0%	0.6%	
Separated	4.2%	3.1%	
Widowed	19.5%	7.8%	
Single	15.3%	15.9%	

*****KG- Kitchen garden NKG-Non Kitchen Gardening**

4.1.3 Household headship and relationship with other members

Out of all the 319 households, 77.7% and 22.3% had male and female household heads, respectively. Among the Kitchen gardening households, males head represented 63.3% of the households whereas females headed 36.7 %. Within the households without kitchen gardens, 84.2% had a male head whereas females headed 15.8% of the households. There was a significant difference between the two groups in the gender of the household head, as evidenced by an Independent sample T-test *p-value* <0.05.

4.1.4 Education Level

In both groups, those who had attained primary education level had the highest percentage, 31.7% in households with kitchen gardens and 38.0% among the households without kitchen gardens. Household members with no education had the least percentage of 8.4% and 7.2% in kitchen gardening practicing and non-practicing households respectively as shown in Figure 4.2. There is a significant statistical difference between the two groups as evidenced by an

independent sample T-test=18.004, df 3, $p < 0.05$. The non-school going children as well as those who had not yet completed their primary school education and attained a certificate , , were exempted during the analysis .

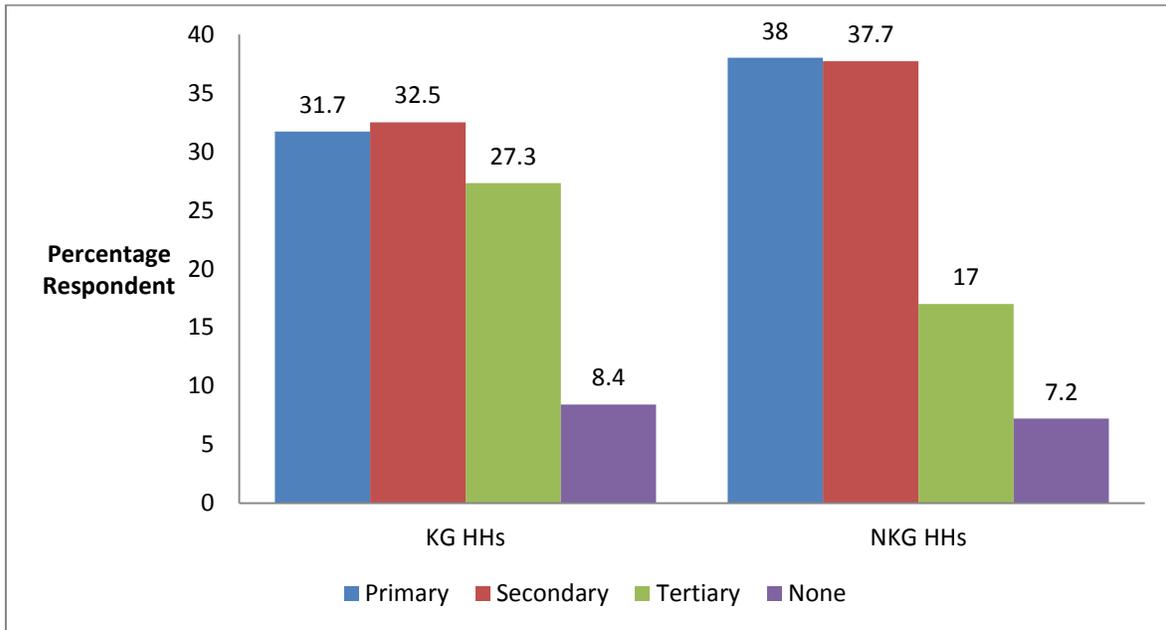


Figure 4.2: Distribution of the household members based on the level of education

4.1.5 Main Occupation of working age household members

Among the kitchen garden practicing households, the highest percentage (27%) did casual work as their main occupation whereas the least were housewives (10.7%). Within the non-practicing households, the highest percentage (28.9%) were casual laborers while the least were farmers (14.9%). The distribution by main occupation is illustrated in table 4.2 below. There is no significant difference between the kitchen garden practicing and non-practicing households as evidenced by an independent sample T-test=12.199, df 6 $p > 0.05$

Table 4.2: Main occupation of working age household members

Main Occupation	K.G. Practicing HH % (n= 178)	NK.G Practicing HH %e (n= 422)	p- value
Farmer	21.9	14.9	0.07
Small Scale Trader	23	21.8	
Casual Laborer	27	28.9	
Formally Employed	17.4	15.4	
House Wife	10.7	19	

***KG- Kitchen garden

NKG-Non Kitchen Gardening

4.1.6 Household asset ownership

In both the kitchen garden practicing and non- practicing households, the two least owned assets were a car with 7.1 % and 4.1 %, respectively and Gas cookers with 5.1% amongst the kitchen garden practicing households and 7.7 % among households without kitchen gardens. The most owned assets in both groups was radio, 93.9 % among households with kitchen gardens and 76.9% among households without kitchen gardens (Table 4.3)

Table 4.3: Ownership of selected household assets

Asset	K.G Practicing HH Percentage (N= 98)	NKG Practicing HH Percentage (N= 221)
Car	7.1	4.1
Motorcycle	18.4	17.2
Farm Implements	75.5	72.4
Television	20.4	8.1
Gas Cooker	5.1	7.7
Bicycle	37.8	32.1
Radio	93.9	76.9
Sofa set	24.5	13.6
Land Ownership	91.8	74.7

***KG- Kitchen garden

NKG-Non Kitchen Gardening

4.1.7 Livestock Ownership

The study findings showed that the mean; number of cows, goats and sheep owned by the study households as follows cows was 6.4 ± 5.3 ranging from 1 to 38 cows. There were 8 outliers (0.03%) that involved those who owned >20 cows. Once the outliers were excluded the mean dropped to 5.7 . Among the kitchen garden practicing households the mean number of cows was 9.3 ± 7.1 while amongst the non-practicing households it was 11.2 In both groups majority of the people, 88.8% amongst the kitchen garden practicing households and 76.5% amongst the non-practicing households owned goats. The mean number of goats owned was 8.1 ± 6.2 ranging from 1 to 34 goats. Sheep was the least owned livestock as seen across both groups. Only 18 households among the kitchen garden practicing households and 20 among non-practicing households did own sheep. The mean number of sheep was 2.3 ± 1.3 ranging from 1 to 6. This is illustrated in figure 4.3 .The small animals kept by the respondents include Chicken and Rabbits. Majority of the households in both groups, kept chicken, 74.5% among the households with kitchen gardens and 78.3% among those without kitchen gardens. Only 11(%) households with kitchen gardens kept rabbits while among those without, only 29 households (13.1%) kept rabbits.

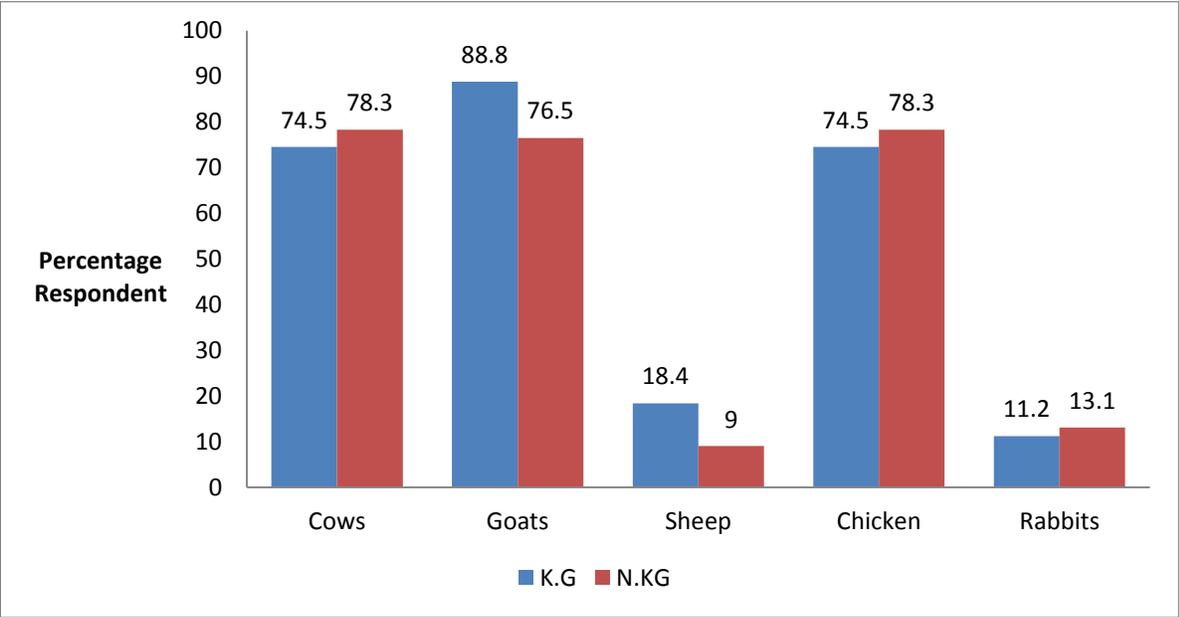


Figure 4.3 Distribution of households by livestock ownership

4.1.8 Household income and livelihood

Majority of the households, both in kitchen garden practicing and non-practicing categories, earned their income from businesses, while the least had pension as their source of income. Mixed farming was the livelihood of most households (56.1% and 46.6% among Kitchen garden practicing and non-practicing households respectively), while crop farming was the least, with 3.1% and 1.8% among Kitchen garden practicing and non-practicing households, respectively (Table 4.4)

Table 4.4: Distribution of households by source of income and livelihood

	K.G Practicing HH	NKG Practicing HH
	Percentage (N= 98)	Percentage (N= 221)
Main Source of Income		
Business	44.9	46.2
Employment	38.8	39.8
Cash Transfer	14.3	5.9
Pension	2.0	8.1
Type of Livelihood		
Crop Farming	3.1	1.8
Livestock Keeping	16.3	14.0
Mixed Farming	56.1	46.6
Employment + Mixed Farming	15.3	22.6
Employment	9.2	14.9

*****KG- Kitchen garden**

NKG-Non Kitchen Gardening

4.1.9 House ownership and characteristics

Among the Kitchen gardening practicing households, 91.8% of them owned the houses they lived in while 8.2 % were living in rented houses. The trend was the same among the non-practicing households where a majority, 91.9 % , lived in their own houses while 8.1 % lived in rented houses. In both groups, most homes had iron sheet roofs (80.6% and 87.3% in the Kitchen gardening practicing and non-practicing households, respectively, while the least number had their roofs made of tiles (1% in kitchen garden practicing households and none in the non-practicing households). The residential houses were made of four types of floors, namely; mud, cement, wood and brick or stone whose distribution is presented in figure 4.4 Majority of the kitchen garden practicing households had their walls made of bricks or stones, 56.1%, while the least percentage , 2%, had their walls made of plaster. In the non-practicing households the

highest percentage, 45.2% had their walls made of mud while as the least percentage, 0.9%, had theirs made of plaster. The distribution of the households by the types of walls is illustrated in figure 4.4

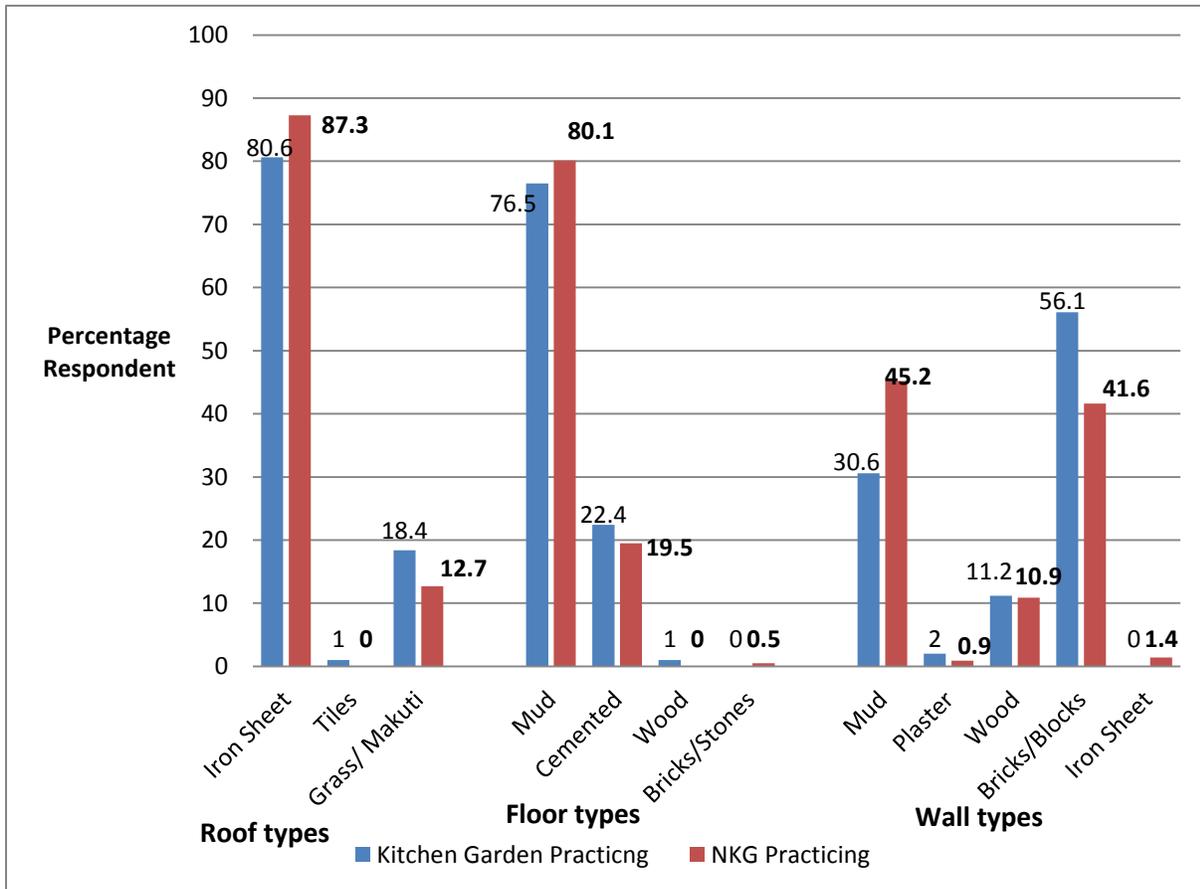


Figure 4.4: Distribution of households by type of house according to building materials

4.1.10 Sources of Lighting and Cooking

Among the kitchen garden practicing households, the most commonly used source of lighting were Hurricane Lamps (56.1%), Tin lamps (53.1%) and Torches (38.8%) whereas among the non-practicing households, the most commonly used source of lighting were, Hurricane Lamps (61.5%) Torch (57.9%) and Tin Lamps (36.7%). Among the Kitchen Garden practicing and non-

practicing households respectively, the most common source of cooking fuel were wood 84.7% and 86.0% , Paraffin 63.3% and 62.9% and Charcoal 44.9% and 43.0% (Figure 4.5)

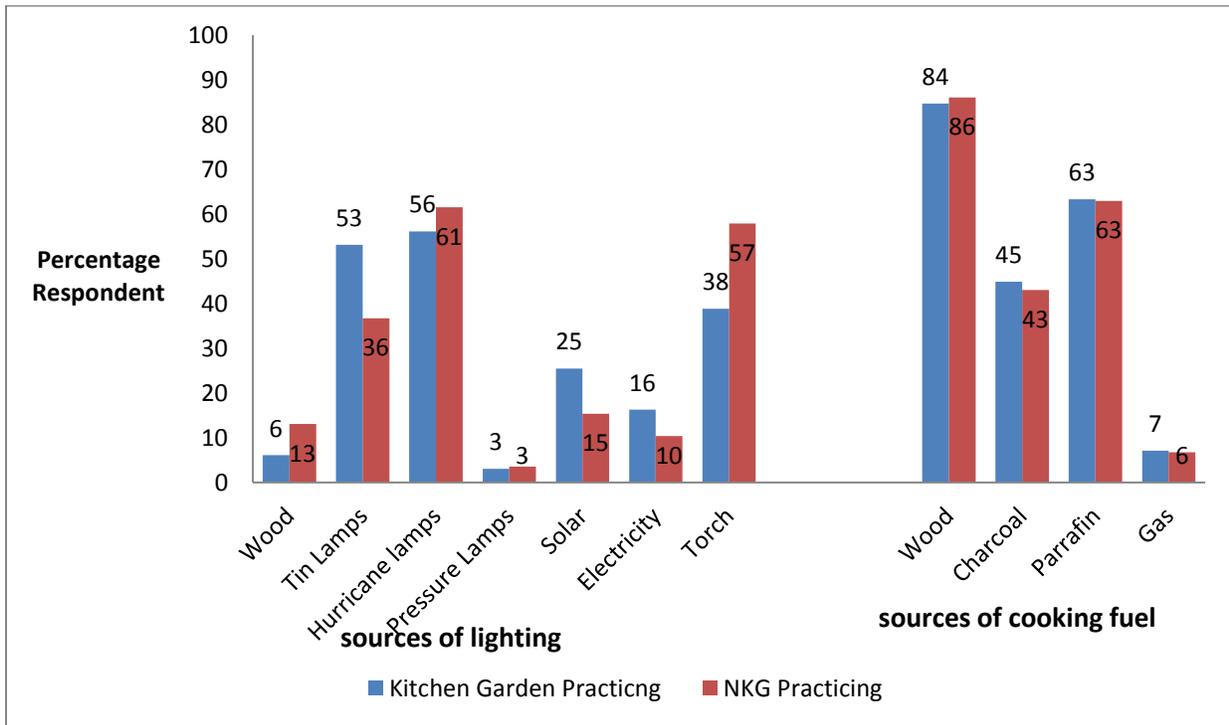


Figure 4.5: Distribution of Households by Sources of Lighting and sources of fuel

4.2 Household Dietary Diversity Scores

Within the kitchen garden practicing households, the mean dietary diversity score was 5.8 ± 1.2 , with the maximum score being 8 and the minimum score being 3. A similar trend was observed within the non-practicing households, a mean of 5.0 ± 1.5 , a maximum score of 9 and a minimum score of 3. In both groups, less than half of the households attained the recommended dietary diversity score of ≥ 5 , 47.9% in the practicing and 33.9% in the non-practicing households, figure 4.6 and Figure 4.7. Though similar trends are observed in the two groups, where most of the households had scores lying between 5 and 8 there was a significant difference between the two groups, $p < 0.05$. The most consumed foods were pulses and energy giving foods 83% and 89% respectively whereas the least consumed foods were animal meat and nuts and seeds, 13% and

2% respectively. Consumption of Vitamin A rich and other vegetables was significantly higher in kitchen garden practicing households than in non-practicing households.

Dietary diversity score was significantly affected by the source of food, source of income, kitchen garden ownership, $p < 0.05$, whereas land ownership and house ownership had no significant effect on dietary diversity, $p < 0.05$

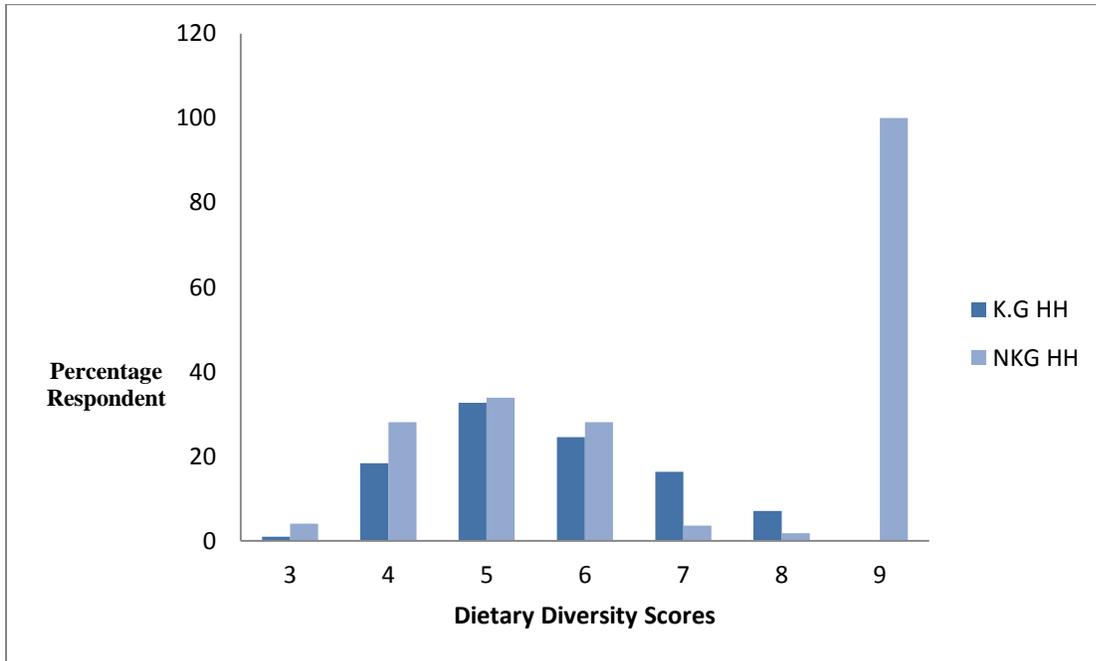


Figure 4.6: Distribution of Households by Household Dietary Diversity Scores

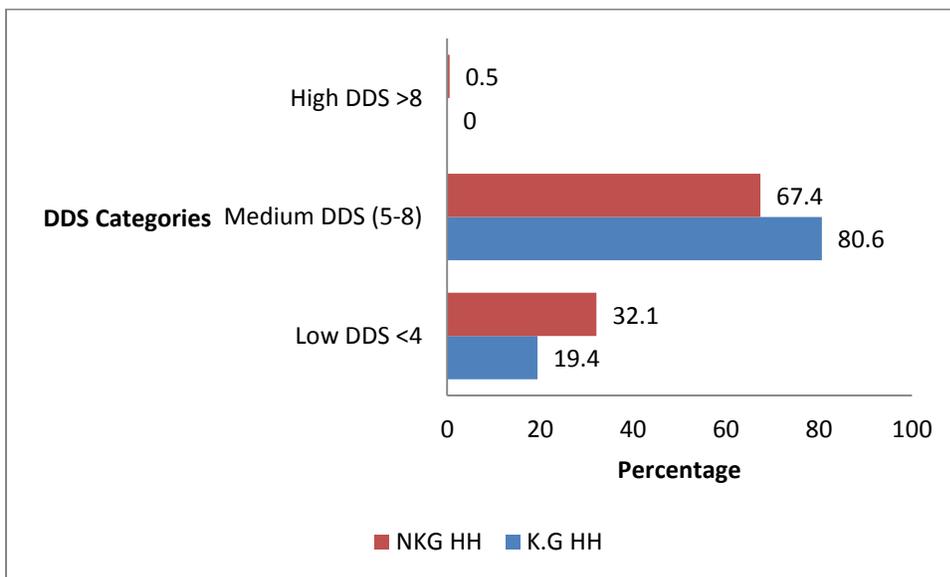


Figure 4.7: Classification of households by dietary diversity Scores

4.3 Contribution of Kitchen gardening to dietary diversity

Majority of the households that own kitchen gardens, 71%, had grown more than 2 types of crops in their kitchen gardens. Out of all the crops grown, kale was the most common, 96.9% of the households reported to have grown the crop in the last two seasons. This was followed by spinach at 82.7%, cow peas at 80.6%. The least grown vegetables were; black night shade (Managu) at 6.1% and amaranth (terere) at 37.8% . Among the fruit trees the most common was Banana plants at 74.5 % followed by mango trees at 57.1%. The least commonly planted trees were lemon trees at 2% and avocado trees at 18.4%. No households had planted macadamia trees, which would be a good source of nuts. The distribution of households according to cultivated crops is depicted in figure 4.8 and figure 4.9.

Over three quarters of the households practicing kitchen gardening reported that owning one proved important for the following reasons; It helps them save money used on purchasing food; saves time used to go purchase the vegetables from the markets. When they sell the surplus, it is a source of income hence enabling them buy food they cannot grow, it keeps them busy a couple of days in the week. The maximum amount of money reported to have been saved by household owning a kitchen garden was 250ksh per week while the minimum amount was 30ksh per week. There was a significant difference, p-value <0.05 between the kitchen gardening practicing and non-practicing households on the money spent on purchasing food.

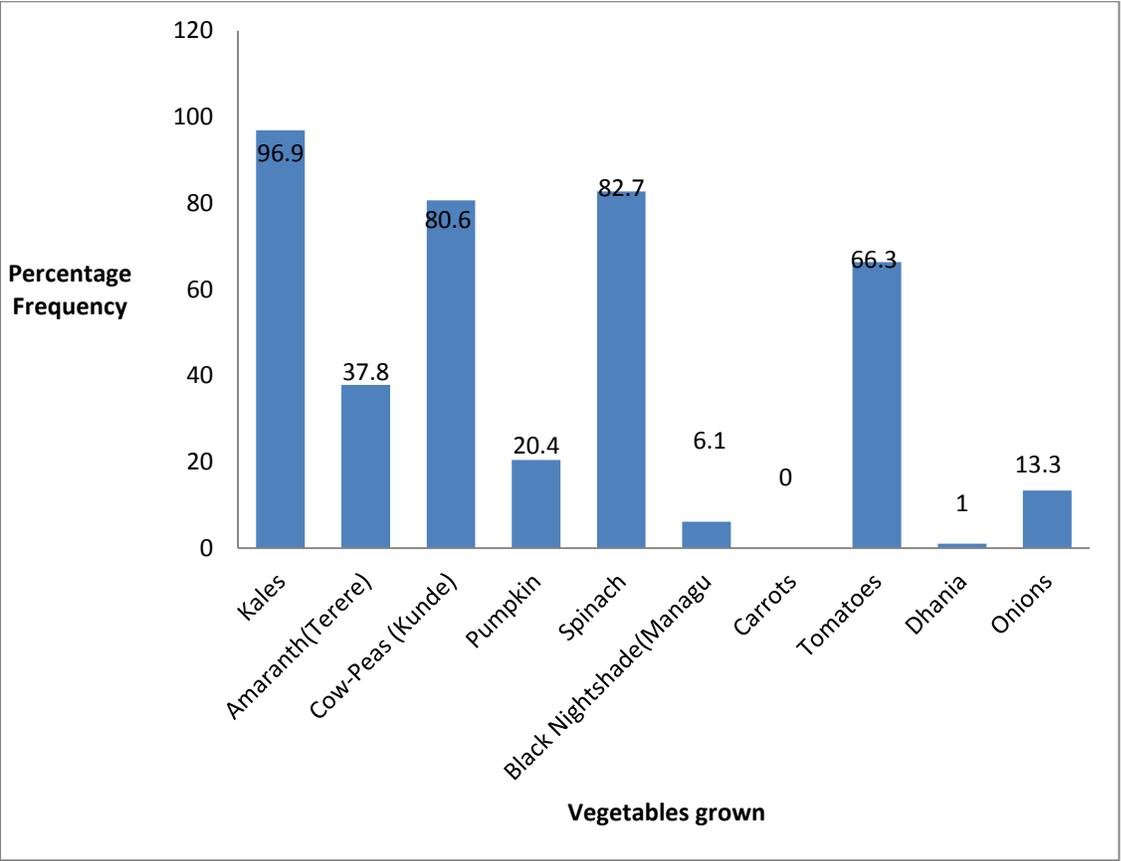


Figure 4.8: Distribution of households by types of Vegetables grown in the Kitchen Gardens

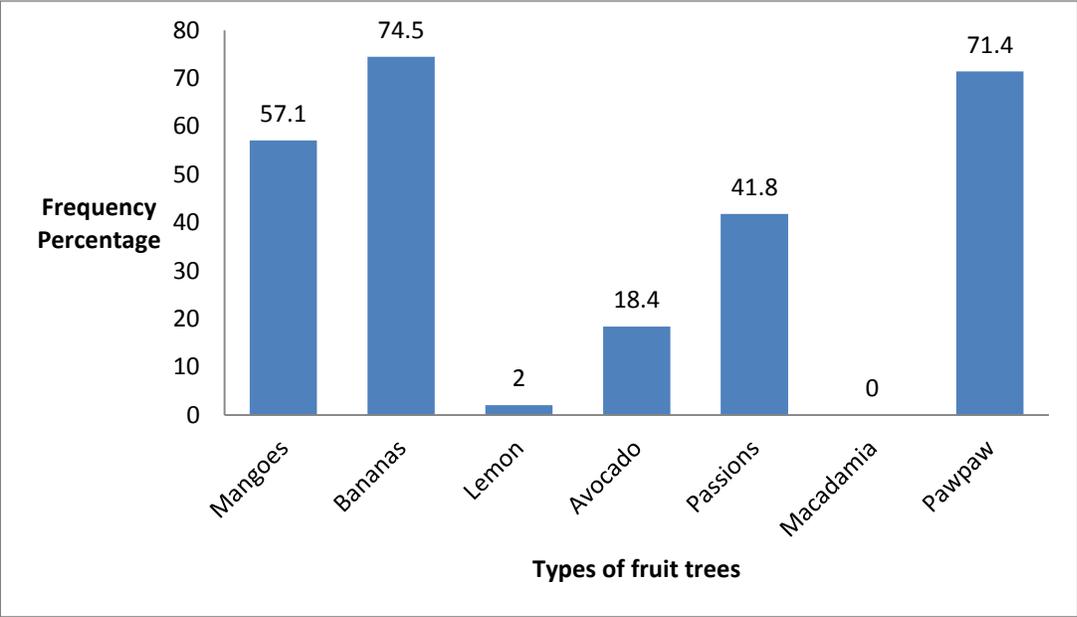


Figure 4.9: Distribution of households by types of Fruit trees grown

4.4 Sustainability of kitchen gardens

Kitchen gardens are important in both the Nutrition and Agricultural sectors due to their role in ensuring food and nutrition security. The study used indicators for sustainability as elaborated by the World Resource Institute 2016 that include; Agricultural inputs (Planting materials and labor), Water and Economic value.

4.4.1 Sources of Planting Materials

Majority of the respondents, 54.1% reported to have obtained their first seeds/seedlings from the project, whereas the 35.7% got them from the agro vet and the rest , 10.2% got them as gifts from family or friends. In relation to the source of subsequent planting materials, Majority sourced them from Agro vets (92.9%), whereas 2% got them from the project and the remaining sourced them from family or friends , figure 4.10

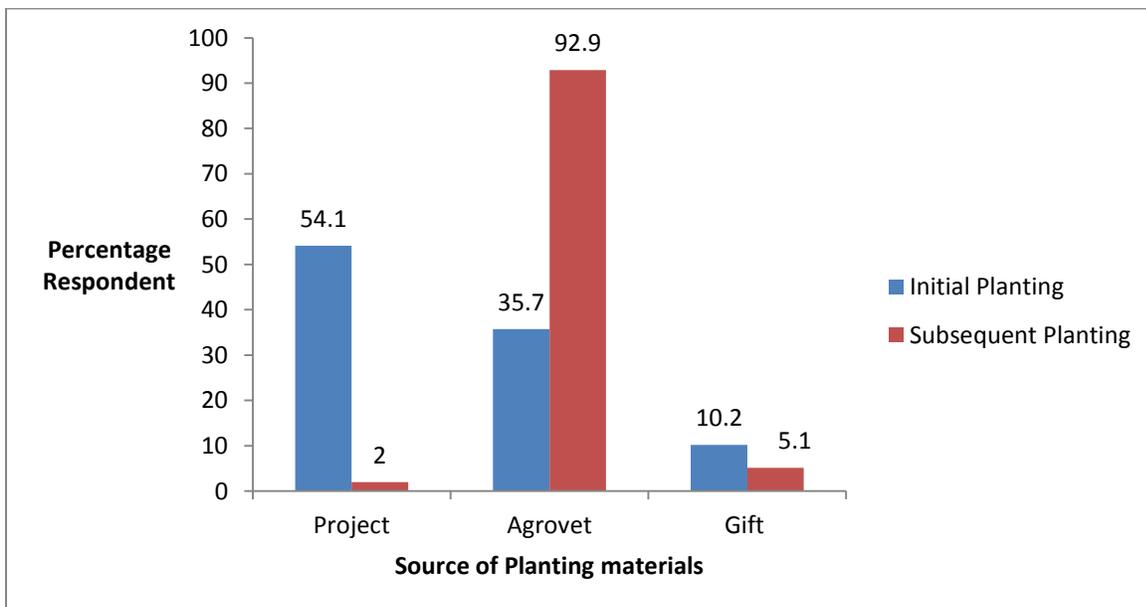


Figure 4.10: Sources of planting materials in the first and subsequent planting times

4.4.2: Labor

For most respondents, 80.9%, the labor involved in preparation, planting and maintenance of the kitchen gardens was from the family members. Only 19.1% reported to have sourced the labor outside the family. In 85.3% of the households, the responsibility of attending to the kitchen garden was mostly left to the women and children. Over three quarters, 90.8% of the respondents reported that the time used in attending to the kitchen garden did not affect their normal routine hence allowing them to carry out other activities as well as look after the kitchen garden.

4.4.3: Source of water used in kitchen gardening

Majority of the respondents reported that their main source of water used in kitchen gardening was the river (60.2%), this includes those whose kitchen gardens were along the river and those who relied on the irrigation scheme that sourced its water from the river. As for the rest of the households, 11.2%, 10.2%, 9.2%, 8.2% and 1% relied on rainfall, borehole, stored water Kitchen Waste and tap water respectively (figure 4.11). Those that reported use of water from kitchen waste clarified that any water without soap or other detergents was used in the kitchen garden.

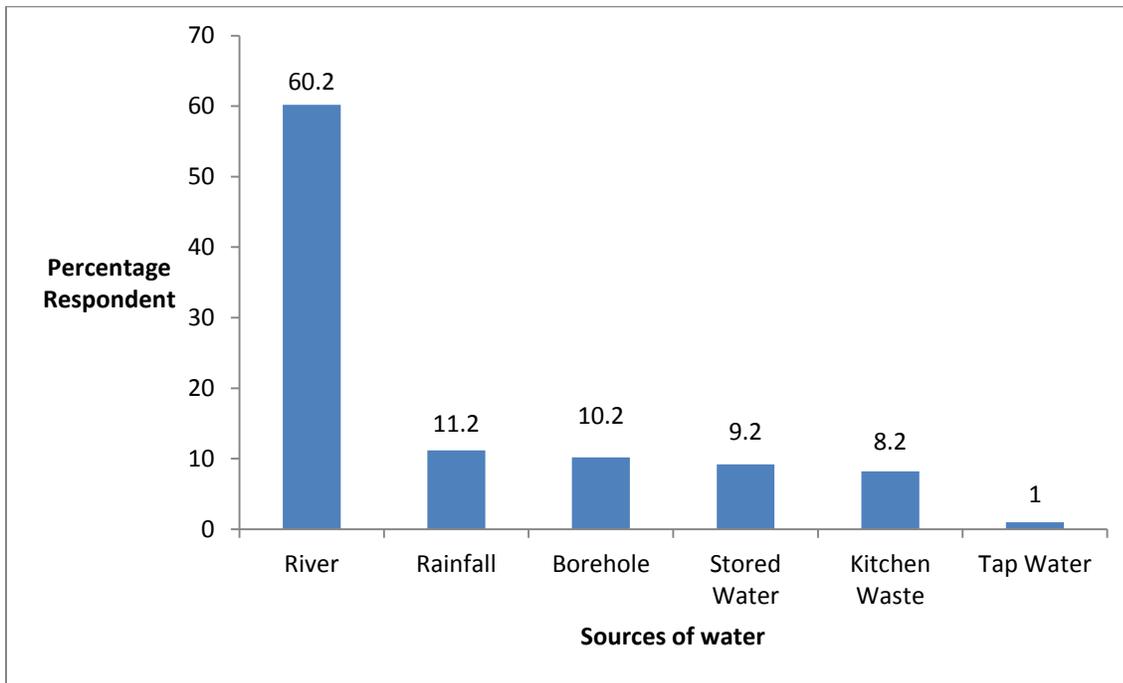


Figure 4.11: Sources of water used in kitchen gardening

4.4.4: Economic value of kitchen gardens to the households

Over three quarters of the households, 93.7% agreed that owning a kitchen garden has contributed both monetary and non-monetary benefits to them. For majority (99%) households consumption was the main mode of utilizing the kitchen garden produce whereas 77.6% reported to having sold their kitchen produce when in surplus. The maximum amount of money reported to have been saved by household owning a kitchen garden was 250ksh per week while the minimum amount was 30ksh per week. There was a significant difference, p-value of <0.05 between the kitchen gardening practicing and non-practicing households on the money spent on purchasing food.

CHAPTER FIVE: DISCUSSION

5.1 Introduction

The main objective of this study was to determine the role of kitchen garden in dietary diversity in Semi-Arid lands in Kenya. It involved characterizing the Kitchen Garden practicing households and non-practicing households population by socio-economic and socio-demographic characteristics. Household dietary diversity questionnaire was used to determine the dietary diversity scores of the respondents. The study also sought to establish if kitchen gardening is a sustainable intervention in Semi-Arid lands in Kenya. This chapter entails discussion on the findings reported in chapter 4.

5.2 Socio-demographic and socio-economic characteristics of the study population

The study investigated seven socio-demographic characteristics. The two groups were similar in 4 of the characteristics, which are: Age, sex, main occupation, and contribution of the household members to the welfare of the home. The two groups differed in three of the characteristics namely, Marital status, gender of the household heads and Education level. These results indicate that these three variables have an impact in the adoption of kitchen gardens among the households. Female-headed households have a higher chance of owning a kitchen garden compared to male-headed households. These results are similar to those of a study conducted in Tanzania on Status and scope of kitchen gardening of green leafy vegetables in rural Tanzania, (Rybak et.al, 2018), which found that the log odds of having a vegetable garden increase by 2.8 for a female head household than a male. According to the results of the study, members of the households without kitchen gardens were more educated than those with. Among the kitchen gardening households, 8.4% had no formal education whereas within the non-practicing households 7.2% had no formal education. The findings differ with the findings of Tanzania on

Status and scope of kitchen gardening of green leafy vegetables in rural Tanzania (Rybak et.al, 2018) which found that for a person that is educated compared to one who is uneducated, the logs of owning a kitchen garden increases by 3.8.

5.3 Dietary diversity

According to the findings of the study, there is a significant difference in the dietary diversity scores between the two groups. The results show that the households with kitchen gardens had a more diversified diet compared to those without. Within the kitchen-gardening households 47.9% had a DDS above five that is considered normal whereas among the non-practicing households only 33.9% had attained the recommended DDS. Consumption of Vitamin A rich and other vegetables was significantly higher in kitchen garden practicing households than in non-practicing households. This can be explained by the fact that most kitchen gardens owners had planted vegetables including kales Cowpeas, and Spinach. These findings are similar to a study conducted in Kericho County at James Finlay among workers who agreed that kitchen gardening promotes nutritional diversity (Njuguna, 2013). The most consumed foods were pulses and energy giving foods, whereas the least consumed foods were animal meat and nuts& seeds,. These findings are similar to those obtained from a smart survey conducted in Tharaka nithi county in 2016 that reported Oils and cereals were the most consumed whereas organ meats and fish were least consumed (Tharaka Nithi County survey report 2016).

5.4: Contribution of Kitchen gardening to Dietary Diversity.

From the findings of this study, all the households that owned kitchen gardens had planted more than one type of vegetable in their kitchen gardens. Majority of the participants, 71%, had more than two types of vegetables, hence increasing the dietary options for the households. These

results resemble the findings of a study conducted in Kericho County where majority of the respondents had more than four varieties growing in their kitchen gardens (Njuguna, 2013).

According to The World Vision Organization report 2019 on kitchen gardening project in Uganda, the sale of surplus produce from the kitchen gardens increased the purchasing power of other foods not grown in the garden. The respondents from the kitchen gardening practicing households echoed these same sentiments.

The results of the study show that the households had grown fruit trees that were common in rural homes. At least most of the homesteads with or without kitchen garden owned at least one type of fruit trees. Exotic varieties of the same were rarely grown but instead the households focused on indigenous varieties.

5.5 Sustainability of Kitchen gardens in Semi-Arid lands

The factors that were considered in assessing the sustainability of kitchen gardens included: Labor, Source of planting materials, Source of water and the Economic impact of the kitchen gardens.

Over three quarters of the households with kitchen gardens acquired labour from within the households. These findings are similar to those obtained by a study done in Tanzania on Status and scope of kitchen gardening of green leafy vegetables in rural Tanzania, where family labor was a common (Rybak et al., 2018).

Majority of the households, 90.8% reported that the time used in tending to the gardens has not affected their normal routine. Majority of the 90.8% practiced mixed farming or crop farming

hence working on the kitchen gardens was not such a new concept to them and could easily fit into their schedules. The other 9.2% mainly consisted of small scale traders and employed people. Due to the nature of their occupation, they had to squeeze some time to ensure the kitchen gardens are well taken care of.

A study on ‘Constraints faced by farmers in adoption of kitchen gardening in Punjab’, established that unavailability of quality seed was one of the major problems faced by farmers in establishing and maintain kitchen gardens (Kaur & Sharma 2018). The decline, from 54.1 % to 2% of people that obtained the seedlings from the project and consequently a sharp increase from 35.7 % to 92.9% of participants that obtained the planting materials from local sources shows a positive indication of independence of the households from the project since the planting materials are available and affordable.

The biggest setback for communities that live in semi-arid lands who practice farming activities is lack of enough rainfall, (World Food Program, 2016). The households that owned kitchen gardens echoed the same sentiments. Though practices such as using kitchen waste are been encouraged the kitchen gardens owners find it difficult to practice that since even the water they get is not enough for their domestic uses. Majority of the kitchen garden owners relied on the river both directly and indirectly as their source of water both for domestic use and for tending to the kitchen garden. Only 9.2% has water storage facilities and used stored water as their main source of water during the time of data collection.

According to the sustainable livelihood approach, an intervention is sustainable if it has a positive economic impact on a people alongside other benefits. Slightly less than 100% of the

kitchen garden owners used their produce for home consumption while 77% sell the surplus from their gardens. The mean profit gained from selling the surplus was 119 ± 60.5 and as the respondents reported, the money gained was used to buy other types of food as well as pay other utilities.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusions

Kitchen garden practicing and non-practicing households are similar in six socio-demographic and socio-economic characteristics and differed in two, that is level of education and gender of the household head which are to be the major determinants in adoption of kitchen gardens.

In both kitchen gardening practicing and non-practicing households, the trends in the distribution of the household dietary diversity scores are similar although the kitchen garden practicing households had a more diversified diet. Kitchen gardening positively influences households' consumption of vegetables, especially Vitamin A rich vegetables. Its ownership affected by; Level of education, gender of the household head and Land Ownership.

Kitchen gardening as an intervention is sustainable in light of availability of labor, Availability and affordability of planting materials, and the positive economic impact it has on the owners. The biggest setback is the source and availability of water.

6.2 Recommendations

More emphasis should be put on Identification and implementation of Strategies that will help reach the men within the households and educate them on the need and importance of adopting kitchen gardens

More emphasis should be put in growing of indigenous vegetables, such, Black nightshade (Managu), and Amaranthas (Terere) hence promoting consumption of dark green vegetables.

A similar longitudinal study that will take into consideration variations in seasons is highly recommended.

The County government in liaison with the NGOs in the area should train the residents on water harvesting and storage techniques so as to ensure the kitchen garden owners have enough water all year round to tend to their gardens.

Project officers, with the help of the county agricultural extension officers should train the kitchen garden owners on pest management so as to reduce losses of the kitchen garden produce.

Studies resembling this can be done in other semi-arid parts of the country to establish if the findings of this study can be replicated in other areas.

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APPENDIXES

Appendix 1: Consent form

UNIVERSITY OF NAIROBI

DEPARTMENT OF FOOD SCIENCE, NUTRITION AND TECHNOLOGY

APPLIED HUMAN NUTRITION

ROLE OF KITCHEN GARDENS IN DIETARY DIVERSITY IN SEMI-ARID LANDS IN KENYA

Hello, My name isI am part of a research team that seeks to get information about the role kitchen gardens play in dietary diversity. We are conducting the survey in your area and your household has been selected to be part of the study. If you agree, you shall answer the questions on behalf of the other household members.

The Information you provide will be useful in finding the role that kitchen gardens play in dietary diversity in this climatic zone. A copy of the report will be submitted to your leaders who may use it for planning of development projects in this area.

All the information you give will be confidential. The information will be used to prepare a general report but will not include any specific name. There will be no way to identify that you are the one who gave the information.

We do encourage you to participate in this study and your cooperation will be highly appreciated.

If you do agree, may we proceed to ask you some questions related to your household?

Respondent answer.....1= Yes 2= No

Signature of the Interviewer.....

Signature of the Interviewee.....

Date.....

SECTION B: SOCIAL ECONOMIC STATUS

2) Observe/Ask Does the Household own the following assets?

Serial no	Household Assets	Owned (Tick where applicable)	Number owned/Number of acres/ Sets/ animals
2.1	Car		
2.2	Motorcycle/Scooter		
2.3	Tractor/ Farming machinery		
2.4	Television		
2.5	Gas cooker		
2.6	Bicycle		
2.7	Radio		
2.8	Sofa set		
2.9	Land		
2.10	Cows		
2.11	Goats		
2.12	Sheep		
2.13	Rabbits		
2.14	Chicken		
2.15	Donkey		
2.16	Others(Specify)		

2b) What is your households’ source of income?

1= Employment 2= Business 3= Pension 4= Cash Transfer

3. Do you rent land? 1= Yes 2= No[If no skip to question 6]

4. [If yes] How much Land do you rent?.....acres

5. How much do you pay per rented land per year? Ksh

6. Is the house you live in your own or rented? 1= owned 2= Rented

7 How many sleeping rooms, living room and kitchens do you have in your compound?

Sleeping.....Living room.....Kitchen.....

8 (If rented) How much do you pay a month? Ksh.....

9 [Observe] What material has been used to construct the main house?

10.1 Roof

1= Makuti 2= Iron Sheets 3= Tiles 4= Grass/ thatch 5=others specify

10.2 Wall

1= Mud 2= Plaster 3= Woods 4= Brick / Block/ stones 5=Iron Sheets

6= Others Specify.....

10.3: Floor

1= Mud 2= Cemented 3= Wood 4= Brick / Block/ stones 5= Others Specify.....

11. What are the two main sources of energy for lighting?

1= Wood 2= Tin Lamps 3= Hurricane Lamps 4= Pressure Lamps 5= Gas 6= others (Specify).....

12. What are the two main sources of energy for Cooking?

1= Wood 2= Charcoal 3= Paraffin 4= Electricity 5= Gas 6= Others (Specify).....

13 What is your type of livelihood?

1= Crop farming 2= Livestock Farming 3= Mixed Farming 4= Employment + 1,2,3

SECTION C: Dietary Diversity Score Sheet as Adopted from FAO.

13. Please describe the foods (meals and snacks) that you ate or drank yesterday during the day or night , here at home or outside the home. Start with the first food or drink of the morning.

Breakfast	Snack	Lunch	Snack	Dinner	Snack

In order of priority, what is the source of the food you consumed?

	1	2	3	4	5
Kitchen Garden					
Grocery Shops					
Kiosks					
Gifts from friends					
Others (Specify)					

When the respondent recall is complete, fill in the food groups based on the information recorded above. For any food groups not mentioned, ask the respondent if a food item from this group was consumed

Question number	Food group	Examples	YES=1 NO=0
1	PULSES	Beans, Peas, Lentils, Njahi, Kamande,	
2	NUTS AND SEEDS	Groundnuts, Macadamia, Simsim	
3	VITAMIN A RICH VEGETABLES AND TUBERS	pumpkin, carrot, squash, or sweet potato that are orange inside + <i>other locally available vitamin A rich vegetables (e.g. red sweet pepper)</i> <i>Dark green leafy vegetables, including wild forms+ locally available vitamin A rich leaves such as amaranth, cassava leaves , kale spinach</i>	
4	OTHER VEGETABLES	other vegetables (e.g. tomato, onion, eggplant) + <i>other locally available vegetables</i>	
5	VITAMIN A RICH FRUITS	ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from these + <i>other locally available vitamin A rich fruits</i>	
6	OTHER FRUITS	other fruits, including wild fruits and 100% fruit juice made from these	
7	MEAT, POULTRY, FISH	beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects liver, kidney, heart or other organ meats or blood-based foods	
8	EGGS	eggs from chicken, duck, guinea fowl or any other egg	
9	MILK AND MILK PRODUCTS	milk, cheese, yogurt or other milk products	
10	OILS AND FATS	oil, fats or butter added to food or used for cooking	
11	ENERGY GIVING FOODS	Ugali, mchele, chapatti, spaghetti, noodles sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes	
12	SPICES, CONDIMENTS, BEVERAGES	spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages	
		Did you eat anything (meal or snack) OUTSIDE the home Yesterday?	

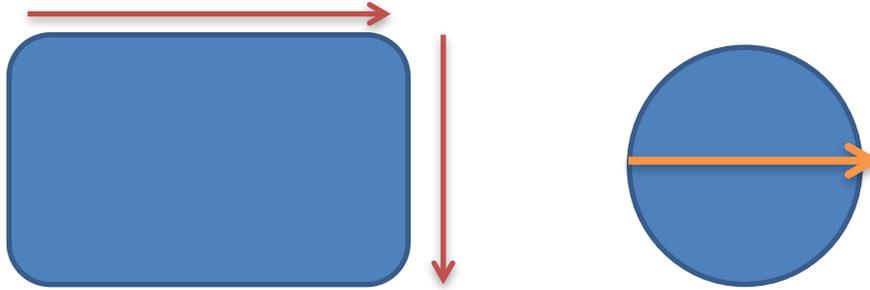
SECTION D: Aspect of Contribution & Sustainability

15. Do you have a kitchen Garden? 1=Yes 2=no (If no skip to question 27)

16 (If yes), How long have you had your Kitchen Garden?

17 (*Observe/ Ask*) How far is your kitchen garden from the Homestead?

18 (*Observe/ Ask*) What is the size of your Kitchen Garden?



19 Did you produce the following in your Kitchen Garden between October 2018 and may 2019?

Serial No	Vegetable /Fruits	1= Yes, 2= No	Serial No		1= Yes, 2= No
1	Kales(Sukuma)		10	Onions	
2	Amaranth(Terere)		11	Mangoes	
3	Cowpeas (Kunde)		12	Bananas	
4	Pumpkin Leaves		13	Lemon	
5	Spinach		14	Avocado	
6	Blacknight shade(Managu)		15	Passions	
7	Carrots		16	Macadamia	
8	Tomatoes		17	Pawpaw	
9	Dhania		18	Others(Specify)	

b) Do you think growing vegetables/ and or fruits is useful to you?.....

20. Where did you get the seeds/ seedlings for planting the first time?

1= Project 2= Agrovet 3= Gift (From a friend/Family Member 4= Others (Specify)

21 Since the first time you received planting materials have you planted again ? 1= Yes, 2=No

[If yes] How many times more?.....

22 What was the source of the subsequent planting materials?

1= Project 2= Agrovet 3= Gift (From a friend/Family Member 4= Others (Specify)

22 How many times have you harvested from your K.G?.....

23 In order of priority how do you utilize the produce form your K.G?.....

1= Home Consumption 2=Selling 3= Others (Specify)

b) [If they sell] How much money do you make from selling the produce?.....

24 What is the source of the water you use in your kitchen Garden? (In order of priority)

Source of Water	Score	1= Most frequently Used 2=Frequently Used 3=Sedomly used 4=Rarely Used 5=Never Used
River		
Kitchen Water Waste		
Rely On Rainfall		
Stored Water		
Borehole		
Tap Water		

25
Who
atten
ds to
your
Kitch
en
Gard

en? (e.g. Children, Husband, Worker.)

26. Has the timing of attending to the garden affected your normal routine? If yes
How has it affected?

.....
.....

26b) Since you have a Kitchen Garden, how much money do you think you save?.....

27 How much money do you spend in buying food?

27b) How much money do you think you would save if you had a kitchen garden?

THANK YOU FOR YOUR TIME AND COOPERATION

Appendix 3: Training curriculum & program

TRAINING CURRICULUM

The enumerators will be trained on the following sub-headings

- How to approach a Household and get an Informed consent
- Topic and Objectives of the study
- Interviewing & Observational skills and techniques
- How to conduct the 24hr Recall
- How to measure the size of the Kitchen Garden
- How to fill the questionnaire and what to do in case a mistake is done
- How to handle cases that would interfere with the interview, e.g. when a visitor comes
- Ethics in Research including dangers of fraud.

The topics will be covered following the **program** below

DAY	8:00-10:30AM	10:30-10:50am	11:00-1:00 Pm	1:00-1:50Pm	2:00-4:00Pm
1	Introduction of the Topic <ul style="list-style-type: none"> • How to approach a Household and get an Informed consent • How to handle disruptions during the interview 	TEA BREAK	Aim& Purpose of the study Objectives of the study.	LUNCH BREAK	Ethics in Research <ul style="list-style-type: none"> • Things to observe while conducting a research • Fraud in Research
2	Interviewing Skills & Observational Skills		How to fill the questionnaire How to fill the questionnaire and what to do in case a mistake is done		Practical
3	How to conduct a 24 hr Recall		Pre-Test		Conclusion