PRODUCTION AND CONSUMPTION OF INDIGENOUS VEGETABLES IN MERU AND THARAKA NITHI COUNTIES (UPPER EASTERN KENYA)

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Production and Consumption of African Indigenous Vegetables in Meru and Tharaka Nithi counties (Upper Eastern Kenya)

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A thesis submitted in fulfillment for the degree of Master of Science in research methods in the Jomo Kenyatta University of Agriculture and Technology

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University

Signature……... Date.....……

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This Thesis has been submitted for examination with our approval as a University supervisor.

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DEDICATION

To my family, I say thank you and may God richly bless you for the companionship, understanding and encouragement through the tough days of my course work and research.

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I humbly acknowledge the immense contribution of my supervisors for their advice and tireless efforts in supervision during my research. I express my gratitude for their time, comments, suggestions and effort in evaluating and enhancing my work. Also am grateful to JKUAT and Hortinlea organization for allowing me to pursue my studies. Above all, glory and honor to God who blessed the entire course.

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LIST OF ACRONYMS AND ABBREVIATIONS

AIC	Akaike's Information Criterion
AIDS	Acquired Immuno-deficiency Syndrome
AIVs	African Indigenous Vegetables
ALV	African Leafy Vegetables
AVRDC	Asian Vegetable Research and Development Center
BIC	Bayesian Information Criterion
DFID	Department for International Development
FAO	Food and Agriculture Organization of the United Nations
GPR	Generalized Poisson Regression
HIV	Human Immuno-deficiency Virus
KMO	Kaiser-Meyer-Olkins
LLT	Log-likelihood Transformation
MDGs	Millennium Development Goals
NGOs	Non-Governmental Organizations
NRC	National Research Council
PCA	Principal Component Analysis
R4D	Results for Development
SDGs	Sustainable Development Goals
SPSS	Statistical Package for Social Sciences
TALV	Traditional African Leafy Vegetables
TAV	Traditional African Vegetables
TLV	Traditional Leafy Vegetables
TPB	Theory of Planned Behavior
WHO	World Health Organization
WVC	World Vegetable Centre

ABSTRACT

Growing and Consumption of African Indigenous Vegetables make large socio-economic contributions to many African nations, and help tackle problems of hunger and malnutrition through attainment of the Sustainable Development Goals one and three; ending poverty and hunger, and gender equality. Despite the fact that indigenous vegetables have high nutrition value among other benefits, they are not widely grown in Meru and Tharaka Nithi Counties. The general situation is no better in the upper Eastern of Kenya, both for local consumption and commercial purposes. This could be contributed by lack of adequate information on nutritional value of AIVs among other limitations. The purpose of this study was to analyze market trends and consumption of AIVs in Meru and Tharaka Nithi Counties of Upper Eastern- Kenya. Specifically, the study sought to analyze market trends with different value chain; examine socio-economic factors influencing consumption of AIVs, to determine levels of knowledge in nutrition of AIVs and establish the effect of attitude towards consumption of AIVs in Meru and Tharaka Nithi Counties. Employing descriptive survey, questionnaires were used to collect data from a sample population of 152 households. Using Statistical Package for Social Sciences to generate descriptive statistics like frequencies, percentages, Standard deviation and coefficient of variation. The data was then presented in tables, and graphs. The relationship of the variables was done using Generalized Poisson Model, and Factor Analysis. The findings of the study showed that the commonly grown and consumed AIVs were cowpeas followed by amaranth and African night shade. Income, household size, AIVs farm size were found to influence consumption of AIVs. Levels of knowledge in nutrition of AIVs was higher among consumers, then farmers and lastly, traders. Years of schooling, employment type, income level, household size and farm size significantly influenced Knowledge of nutrition among farmers. Gender, years of schooling, income level and household size significantly influenced the knowledge of nutrition among consumers. Farmer's attitude towards AIVs was associated with good health benefits of AIVs, attitude and perception towards AIVS and their future benefits. The study recommends that more financial resource should go to producing, purchasing and consumption of AIVs. Therefore, a recommendation is therefore made that more financial resource should go to growing or producing AIVs, purchasing AIVs for consumption. There was need to encourage young people to be involved in farming of the AIVs as it would solve the issue of food and nutrition security in the future.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

African indigenous vegetables (AIVs) have been grown and utilized traditionally by many African communities (Muhanji et al., 2011) and possess several advantages and potentials that have not been fully exploited (Abukutsa-Onyango, 2009). African indigenous Vegetables can be defined as those vegetables whose primary or secondary centre of origin is known to be in Africa (Onyango, 2015). Vegetables who's secondary centre of origin is Africa may be referred to as 'African traditional vegetables' (Schippers, 2000). However, the word traditional is used when indigenous or introduced species which, due to long use, have become part of the culture of a people. Vegetables are a vital component of human diet as they provide essential micronutrients that ensure proper development of the body and good health (Abukutsa-Onyango, 2007a).

A survey carried out in 2006 by the Asian Vegetable Research and Development Centre (AVRDC) now World Vegetable Centre (WVC) on consumers of AIVs at different income levels to determine their knowledge and use, indicated that high-income earners associated these vegetables with poverty. Kathure, Kavoi and Turoop (2019) posits that the middle- and average-income earners, especially in urban centers, consumed little in fear of risking their health. It was believed that most of the vegetables were grown with untreated sewage along open sewer lines or near sewage treatment plants (Muhanji et al., 2011). Studies show that low-income earners consume indigenous vegetables regularly (Hughes & Ebert, 2011, June). African indigenous vegetables have considerable potential as cash income earners, enabling the poorest people in the rural communities to earn a living (Schippers, 2000, Abukutsa-Onyango, 2003).

When studying supply chains for indigenous vegetables in urban and peri-urban areas of Uganda and Kenya, Weinberger et al. (2011) established that women participated in all segments of the chain, and dominated wholesale and retail activities in terms of their

share along the chain. Low capital requirements for entry allowed even the poorest households to participate. The study further observed that in Nairobi an estimated 30% of all vegetables sold were AIV produced in the vicinity of the city.

Socio-economic survey on traditional vegetables conducted in various parts of Africa particularly in Central, Western and Eastern Africa (Abukutsa-Onyango, 2002; Schippers 2000) revealed that indigenous vegetables are important commodities in household food security. They provide employment opportunities and generate income for the rural population. There appears to be a high demand for indigenous vegetables in cities and major towns (Mwaniki, Village & Hotel, 2008), making the intensive production and trading of the vegetables in and around towns important sources of household income for the urban poor and the unemployed (Ntawuruhunga et al., 2016). Over 70% and 10% of the traded vegetables in rural and urban markets respectively were indigenous vegetables. However, there was generally poor marketing systems in some of the countries. (Abukutsa-Onyango, 2002).

AIVs are an important source of livelihood that communities have depended on from time immemorial (Wemali, 2014). AIVs production has its advantages because of its uniqueness such as short production cycles, requirement of a few purchased inputs, can thrive in not so fertile soils, are resistant to pests and diseases, and are quite acceptable to local tastes (Ekesa et al., 2009). In addition, AIVs are well suited to the small plots and limited resources of village families and produce high yields with strong nutritional value (NRC, 2006).

Before 2000 in Kenya, AIVs were to be found only in the back-streets and in a few open-air markets but since then they have become a common occurrence in most supermarkets, where they are sold in increasing quantities on a daily basis (Otieno, Omiti, Nyanamba & McCullough, 2009). According to Ambrose-Oji (2009) there are a host of terms describing AIV. This include traditional leafy vegetables (TLV); African leafy vegetables (ALV); traditional African leafy vegetables (TALV) and all are subject to contested meanings. For this study African Indigenous vegetables (AIVs) will be used.

The priority species of AIVs marketed include African nightshades *(Solanum scabrum)*, leafy amaranth *(Amaranthus* spp.*)*, spiderplant *(Cleome gynandra),* cowpeas *(Vigna unguiculata)*, Ethiopian kale (*Brassica carinata*), *mitoo (Crotalaria ochroleuca* and *C. brevidens)), kahurura (Cucurbita ficifolia),* jute plant *(Corchorus olitorius)* and pumpkin leaves (*Cucurbita maxima and C. moschata).*

According to Owade et al. (2020), AIVs are known to be rich in micronutrients such as vitamins and minerals. A number of studies have been done on some of these vegetables and compared to exotic leafy vegetables such as cabbage, they were found to be higher in vitamin content (especially vitamins A and C), fibre and minerals. Some are known to be rich in lysine, an essential amino acid that is lacking in diets based on cereal and fibres, while others are medicinal (Kumar & Rajasree, 2018). The green, leafy AIVs contain polyphenols which have beneficial physiological effects on humans as antioxidants. They are also known to be ant carcinogenic and anti-arteriosclerotic (Imungi, 2002). A study carried out in Nairobi by Kimiywe, Waudo and Mbithe in 2006 showed that consumption of AIVs is associated with the treatment of various diseases including therapy for patients with HIV/AIDS, diabetes, high blood pressure and other common ailments.

Although there is resurgence in demand, the diversity of indigenous leafy vegetables and fruits of Africa, has in the past been seriously eroded as a result of multiplicity of environmental, political, and socio-economic factors (Adebooye and Opabode 2004). Traditionally, indigenous vegetables were grown in homestead gardens for subsistence and rarely traded. However, this has changed over the past decade and indigenous vegetables now contribute substantially to household incomes (Shackleton, *et al*., 2009). This is partly attributed to deliberate market demand creation through concerted promotion and public awareness efforts. Such efforts have been led by staff of local non-governmental organizations (NGOs), rural communities and AVRDC (Raetz et al, 2006; Oniang'o et al., 2006; Irungu et al., 2007). According to Weller, Van Wyk and Simon, (2014, August), urban consumers now appreciate indigenous vegetables as rich sources

of important nutrients as well as traditional flavors, while farmers recognize them as valuable commercial crops.

Kenya has suffered from transitory and chronic food insecurity, mainly due to drought and floods and an over reliance of maize crop. Exploitation and growing of indigenous vegetables adaptable in the local environment, can, can in the long run improve the food situation, nutrition, and health of the people by reducing over-reliance on maize. In Kenya there are more than 210 species of leafy vegetables that are part of traditional diets and have not been fully utilized despite the great potential to be harnessed (IPGRI, 2006).

African leafy vegetables form a substantial proportion of diets of most low- and middle-class populations. For rural Kenyans, the African leafy vegetables are inexpensive, easily accessible and excellent sources of micronutrients, (Vorster, 2002; Smith and Eyzaguire, 2007; Onyango et al., 2009 and Termote et al., 2013). The use of plant parts for medicine and fruit, tubers, seeds, and leaves, for food is an important old practice among pastoral and non-pastoral groups. Among traditional pastoral systems, an important use of plant parts is in soups and milk for flavor and generally to improve on health. In such cases there would not be a clear distinction between food and medicine. Cooking of leafy vegetables is, however, of more significance among agricultural communities (Maundu, 1995). The traditional vegetables have also been edged out by the introduction of exotic varieties, (Maundu, 1995). This study will therefore be aimed at gaining an insight of the indigenous vegetables' knowledge on nutrition and health and the status of production and consumption of indigenous vegetables in Meru and Tharaka Nithi counties of upper Eastern.

1.2 Statement of the Problem.

Production and consumption of AIVs as a resource is necessary for policy formulation at both county and national government. According to the NRC (2006), such policies could allow for large socio-economic contributions of AIVs to many African nations, and help

tackle problems of hunger and malnutrition through attainment of the Sustainable Development Goals (SDGs) one and three; ending poverty and hunger, and gender equality. However, such policies can only be based on sound scientific proof obtained through research. This study sought to provide this knowledge.

Despite the fact that extensive research on indigenous vegetables have shown that they have high nutrition value, AIVs are not widely grown or consumed in Meru and Tharaka Nithi Counties and generally in upper eastern of Kenya (Gido, Ayuya, Owuor & Bokelmann, 2017). Timely information on the nutrition value, cost and preparation of the indigenous vegetables over the exotic varieties, as well as alleviating the negative perception of these vegetables could be a turn-around to this problem. Hence, the timeliness of this study.

Meru and Tharaka Nithi are agricultural counties producing exotic vegetables among other crops. However, Gido et al. (2017) notes that AIVs consumption is low in the counties. Despite this knowledge, there is still paucity of information on the cause of this phenomenon. Analysis of the market trends across the value chain and determinants of AIVs consumption is key if deliberate measures to improve consumption of AIVs has to be done in these counties.

1.3 Objectives of the Study

1.3.1 General objective

The general objective of the study was to analyze production and consumption of indigenous vegetables in Meru and Tharaka Nithi counties.

1.3.2 Specific objective

i. To establish the common African indigenous vegetables consumed in Meru and Tharaka Nithi Counties of upper Eastern Kenya;

ii. To determine the levels of knowledge in nutrition of AIVs and the factors influencing them among farmers, traders and consumers;
iii. To examine the socio-economic factors which influence the consumption of indigenous vegetables among producers, traders and consumers in Meru and Tharaka Nithi counties;
iv. To establish the attitudes of producers, traders and consumers towards consumption of indigenous vegetables.

1.4 Research Questions

i. What are the common African indigenous vegetables produced in Meru and Tharaka Nithi Counties of upper Eastern Kenya?
ii. Which factors influence levels of knowledge in nutrition of AIVs among farmers, traders and consumers?
iii. Which socio-economic factors influence the consumption of indigenous vegetables among producers, traders and consumers in Meru and Tharaka Nithi counties?
iv. How do the attitudes of producers, traders and consumers influence consumption of indigenous vegetables?

1.5 Significance of the study

The study analyzed the factors making communities in upper Eastern consume or not consume vegetables, results of the study provided vital information on levels of nutritional knowledge that the producers, consumers and traders have acquired and that played an important role in choosing to produce, sell and consume AIVs in the region of study. These study findings may also lead to a better understanding of which vegetables have high nutritional potential and which farmers should grow in the study region. Thirdly, this study may contribute to policy making on factors influencing the market trends and consumption of indigenous vegetables. It helped to enlighten the Academic and Research institutions on the progress of the state of market trends and consumption

of indigenous vegetables. The significance and purpose of the study are anchored on policy relevance, answering academic and the research questions and addressing the problem statement as highlighted.

1.6 Scope of the Study.

The study focused on the AIV consumption and market trends in Meru and Tharaka Nithi Counties of Upper Eastern Kenya. This study identified vegetable varieties in the study area, evaluated the nutritional knowledge of vegetable producers, traders and consumers as well as analyzing socio-economic factors that influence consumption of nutrient-dense vegetables in the region and respondents' attitude that influence consumption of AIVs in the two Counties and generally in upper eastern of Kenya for both local consumption and commercial use.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter review relevant literature on the subject matter. Specifically, the chapter reviews literature on market trends of AIVs, knowledge levels in nutrition of AIVs, socio-economic determinants of AIVs consumption. The chapter also presents a review on the attitude of producers, traders and consumers of AIVs. However, the chapter start by presenting a brief overview of AIVs.

2.2 Overview of AIVs

African indigenous Vegetables form an important source of livelihoods to many people. Other than the fact that AIVs require less farm inputs as compared to exotic vegetables, they can be produced on less fertile soils, more are resistant to pests and diseases and have higher nutritive value. These advantages explain the higher number of people producing, trading and consuming AIVs not only in Africa but across the globe. AIVs besides being economical to produce have the added advantage of possessing other desirable traits nutritionally such as high vitamin content (vitamin A and C), fibre and minerals (Imungi, 2002). AIVs can therefore support rural, peri-urban and urban populations in terms of subsistence and income generation, without requiring huge capital investments (DFID & R4D, 2010).

Various indigenous vegetables are cultivated worldwide. Surveys indicate that there are over 7,000 plant species across the world that are cultivated or harvested from the wild for food including the indigenous vegetables (Schönfeldt & Pretorius, 2011). According to Kiambi and Atta-krah (2003), of the 150 plant species commonly consumed by man, 115 are indigenous African species. Schönfeldt and Pretorius (2011) observe that these neglected and underutilized species could play a crucial role in food security, income generation and food culture of the rural poor.

The AIVs have several advantages over exotic vegetables that are promoted extensively by research and extension. These vegetables have a short growing period as they can be harvested within 3 - 4 weeks. They can tolerate both abiotic and biotic stress and they can respond well to organic fertilizers (Kirigia, Kasili & Mibus, 2017). Many of the leafy AIVs grow in marginal areas where exotic crops struggle to survive as well as grow under low rainfall conditions as intercrops with local staples in home gardens or fields, and management thereof is relatively low (Vorster, 2009).

In some areas, AIVs are becoming popular with commercial growers (Wemali, 2014) Wemali (2014) noted that AIVs could make a positive contribution to world food production because they adapt easily to harsh or difficult environments; also, the inputs required for growing them is lower compared with other crops such as exotic vegetables.

2.3 African Indigenous Vegetables Market Trends

Consumers' attitudes such as taste, health, and freshness have an influence on consumption. With more consumers becoming gradually increasingly aware of the medicinal as well as nutritive value in AIVs. Ngugi et al. (2007) and Lewu and Mavengahama (2011) noted that organized markets, supermarkets as well as street vendors had recorded more sales.

Pieroni et al. (2002) indicated that domesticated and wild vegetables provide opportunities for income generation. A Study by Mumbi *et al.* (2006) focused on viable market opportunities and threats for urban and peri-urban farmers for African Indigenous vegetables (AIVs). They identified poor product image and lack of consumer awareness as the leading contributor of low consumption of AIVs. On the production side, low demand, poor seed systems and weak AIVs value chains linkages further identified as major constraints to AIVs commercialization. However, Shiundu and Onyang'o (2007) based on the Marketing of AIVs have given challenges and opportunities in the Kenyan context and found among other thing the issues of quality control, reliability and pricing still remain critical to the future success of AIVs farming.

In Kenya today AIVs are commonly found in supermarkets and retail shops (Gido et al., 2017).

2.4 Socio-economic Determinants of AIV Consumption

The frequency of consumption of AIVs has been low over the years, as noted in various studies (Keller et al., 2006; Abukutsa-Onyango, 2007; Masayi & Netondo, 2012) Most people in Upper Eastern Kenya generally describe AIVs as less tasty as compared to exotic vegetables such as spinach and cabbage. This is common especially among the youth. Several factors influence the consumption of AIVs. Men, for instance, generally prefer consuming less of vegetables as compared to women (Kimiywe et al., 2007; Vorster et al., 2007). The consumption pattern and preferences for traditional vegetables vary among households within different countries (Uusiku *et al*., 2010).

Occupation is one among socio-economic factors with regard to the choice of and consumption of traditional vegetables. Consumption of traditional vegetables is high among casual laborers and/ or unemployed people in comparison to full-time employed and business people (Kimiywe *et al*., 2007). Kimiywe *et al*. (2007) noted that occupation determines the time one has for buying, preparing and cooking traditional vegetables. Income level of household is another socio-economic factor that influence consumption rates of traditional vegetables. Taboos are presumed to play an important role in many populations of developing countries. This concept is majorly influenced by three factors including culture, geography and biology (Keller, 2004). Dietary rules and regulation may be related with event in human life such as menstrual period, pregnancy, childbirth and lactation, just to mention a few (Meyer-Rochow, 2009). In Africa, these taboos work contrary to the least privileged members of the society, that is women, pregnant women, and children and elderly (Onuorah & Ayo, 2003

According to Vorster *et al*. (2007), those in income levels consumed more traditional vegetables than their wealthier counterparts. O'Connor (2012) suggested that, socio-economic variables such as gender, age, ethnicity, income level, educational level,

perceived benefits and perceptions determine fruit and vegetables consumption. Other factors like institutional factors including availability of traditional vegetables in the formal markets (Mwangi & Kimathi, 2006), traditional vegetable production and research, and public perception like knowledge about traditional vegetables as obtained through research, as well as the extent of their consumption (Taruvinga & Nengovhela, 2015).

A survey by Abuktsa-Onyango (2003) showed that AIVs offer a significant opportunity for the poor people in Western Kenya to earn a living because they require minimal capital investment. Consequently, these vegetables provide employment opportunities for those that are outside the formal sector (Adebooye & Opabote, 2004). African Indigenous Vegetables (AIVs) are well suited to the small plots and limited resources of village families and produce high yields with high nutritional value (NRC, 2006). AIVs therefore support rural, peri-urban and urban populations in terms of subsistence and income generation, without requiring huge capital investments (DFID & R4D, 2010). This is especially so for the resource poor women and men farmers with low capital investments (Mwaura, et al., 2013).

2.5 Attitude on AIVs Consumption

To address attitude related to bitter taste in some vegetable species, various varieties are mixed and cooked together, a practice that improves the taste of the relish (Lewu & Mavengahama, 2011). Healthy and fresh vegetables are also preferred especially by urban dwellers than dried ones (Ngugi *et al*., 2007; Smith & Eyzaguirre, 2007). An attitudinal challenge that has not been fully overcome, is the image of AIVs as poor people's food. This has caused gradual neglect of some of the useful vegetables that have been used for food over the years. This neglect of traditional vegetables according to Kirigia et al. (2017) is unfortunate since these crops are usually better adapted to the environment than the introduced exotic vegetables and also provide low-cost quality nutrition for large parts of the population in both rural and urban areas.

The indigenous vegetables are in danger of being lost in Africa. Farmers are replacing them with improved varieties; they lack seed, and they lack information about their performance and about input requirements. Information on how farmers can fit them into the production and marketing systems are therefore important (Chadha, 2003). Uusiku *et al.,* (2010), as well as Adebooye & Opabote (2004) argued that the introduction of exotic species decreased consumption of AIVs. This was largely attributed to the change in food preferences, which in practice translates to a change in food habits. Consumption of indigenous vegetables is influenced by many other factors; including the consumption pattern and preferences for indigenous vegetables vary among households within different countries (Uusiku *et al.,* 2010).

2.6 Conceptual framework on frequency of Production, market trends and consumption of AIVs.

This study sought to analyze the market trends and factors influencing consumption of AIVs in the upper Eastern region of Kenya including Meru and Tharaka Nithi counties. Market conditions and distance to the market were the variables determining the quantity of AIVs produced, traded and consumed in the study area. Studies have constantly showed that socio-economic (SE) characteristics of population determines the market trends. The SE characteristics considered here were age, gender and level of education. However, the attitude of the respondents towards AIVs is key in determining the trends in AIVs. This study took advantage of the theory of planned behavior to delve into the market trends and factors influencing the consumption of AIVs in the study area. Figure 2.1 presents the relationship between the dependent and independent variables of this study.

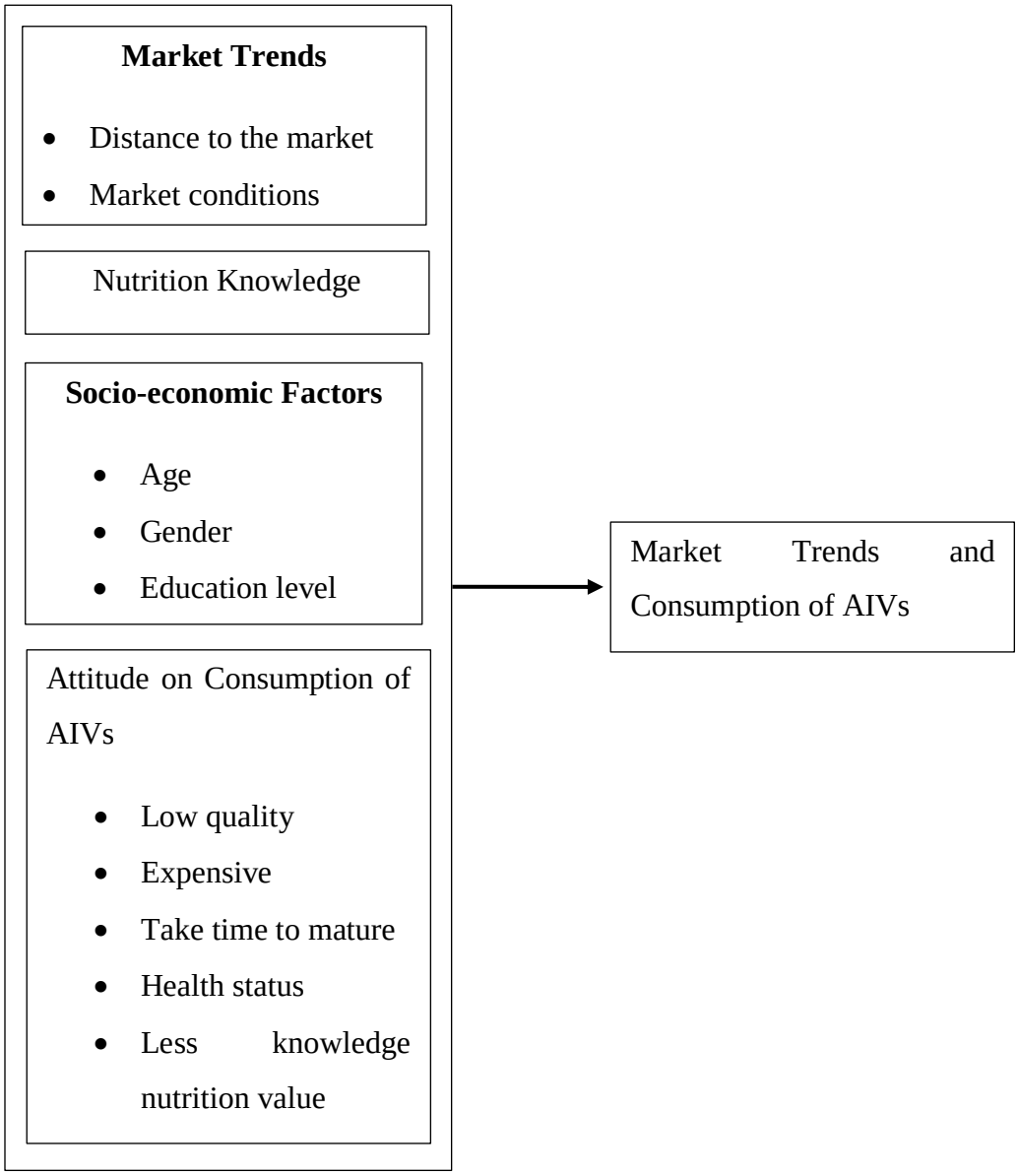

Figure 2. 1: Conceptual framework.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research design, methodology and methods used in this study. It starts with a brief description of the research design and defines variables of interest to the study. Target population, sampling techniques and sample size, construction of research instruments and pilot study are also presented here. The chapter also describes the techniques for data collection, ethical consideration and data analysis procedure.

3.2 Study Area and Design

3.2.1 Study Area

This study was conducted in Meru and Tharaka Nithi Counties of upper Eastern Kenya **.** Meru County is located east of Mt. Kenya bordering Isiolo County to the north, Tharaka/Nithi County to the East, Nyeri County to the South West and Laikipia County to the West. It spans the equator lying $0^{o}6'$ North and $0^{o}1'$ South and between latitudes 37 West and 38^{o} East. The county has a total area of 6,936.2Km^{2}. the county has nine sub-counties including Imenti South, Meru Central, Imenti North, Buuri, Tigania East, Tigania West, Igembe Central Igembe South and Igembe North. The county population was projected to grow to 1,703,945 in 2020 and 1,775,511 in 2022 from 1,545,714 in 2019 (Meru County Integrated Development Plan, 2018-2022).

Tharaka Nithi is located in Kenya's former Eastern Province and a home to the Chuka, Muthambi, Mwimbi and Tharaka people of the larger Ameru (Amiiru) community. Tharaka Nithi 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 county lies between latitude $00^{0}07'$ and $00^{0}26'$ South and between longitudes $37^{0}19'$ and $37^{0}46'$ East. The total area of the

County is 2,662.1 Km^2; including 360Km^2 of Mt Kenya forest in the county. The headquarters of the County is at Kathwana.

The County is divided into five (5) administrative sub-counties namely Tharaka North, Tharaka South, Chuka, Igamba ngo'mbe and Maara. Tharaka North Sub-county is the largest covering an area of 803.4Km^2, followed by Tharaka Southwith746.1 Km2; Maara is third in size with an area of 465.3Km^2 and Chuka fourth is with 316Km^2 and Igamba ngo'mbe is the smallest covering an area of 308Km2. The total area for Chuka and Maara sub-counties includes 179Km^2 and 184Km^2 of Mt. Kenya forest respectively. The major economic activities include tea and coffee planting, subsistence crop farming, subsistence dairy farming and keeping of other livestock such as goats and sheep. The county had a total population of 365,330 as per the 2009 population and housing census. This is projected to be 428,959 in 2018 (209,531 males and 219,427 Females), 444,540 in 2020 (217,142 Males and 227,398 Females), and 460,688 by 2022 (225,030 Males and 235,658 Females). The county's annual population growth rate is 1.8%.

Being agricultural counties, many farmers in Meru and Tharaka Nithi produce many vegetables. However, only few of them produce AIVs despite the fact that AIVs are known for their numerous nutritional advantages of exotic ones (Meru County Integrated Development Plan, 2018-2022).

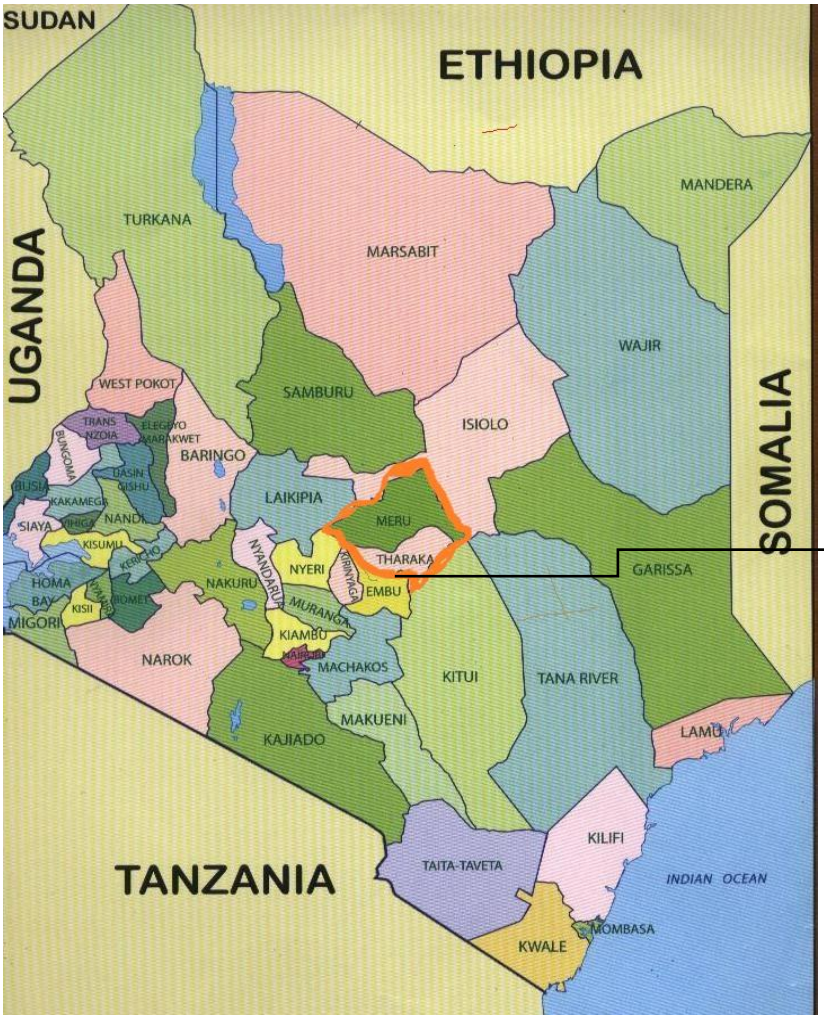

Figure 3. 1: Study area. Source; Kenya open-data project, 2012

3.2.2 Study Design

This study used descriptive survey research design. This study design was most appropriate as it allowed collection and analysis of both qualitative and quantitative data.

Table 3. 1: Sample size distribution for the study

Producers	Traders	Consumers	Total
45	57	50	152

A Gorstein (2007) fisher-based formula was adopted to obtain 152 respondents as sample. The formula is given by:

$n = \frac{z^2.p.q.D}{d^2}$Where:

n is the sample size,

Z is the standard score at 95 percent level of confidence (1.96) and

P is the variable of focus occurrence proportion**.**0.5 is used in case the figure for providing the maximum variability is not known.

q is the proportion of the variable not occurring and it is given as 1-p =0.5.

D is the design effect which in a nearly homogenous population, the researcher has set it at 1.

d is the uncertainty margin, level of significance or the error estimated within ± 0.079 or 7.9% of precision was acceptable for this study. Therefore;

$$\frac{(1.96)^2 \times (0.5) \times (0.5) \times 1}{0.079^2} = 152$$

3.2.3 Sampling technique

The study adopted stratified random sampling approach. The strata were the categories of respondents which included the farmers, traders and consumers. For farmers, selection was done from the main roads and respondents picked until they were 45 individuals. Twenty-two farmers were selected from Meru and twenty-three from Tharaka Nithi making the number forty five. The same criterion was used to select the consumers such that twenty-five respondents were selected from each county. For traders, the researcher selected ten respondents from three markets in Meru County and nine traders each from three markets from Tharaka Nithi.

3.2.4 Data Collection Method and Procedures

The study made use of both primary and secondary data; primary data provided the researcher with information from respondents while secondary data was obtained from journal and past research work. Semi structured questionnaires were used to solicit information on the views, opinions and perception of consumers, producers and traders on AIVs (Oso & Onen, 2008).

On quantitative approach, the study collected data on the socio-economic factors that influence consumption of AIVs. On the qualitative side, data was collected on the same parameters such as how socio-economic factors influenced consumption of AIVs.

The survey was conducted in two parts; first a questionnaire was administered to collect information from AIV producers, traders and consumers on production, marketing and consumption traditional African vegetables. Secondly, focused group discussions for vegetable producers, traders and consumers were conducted to discuss in more depth specific topics of interest coming out of the questionnaire. A questionnaire is an economical and time efficient tool that permits use of standardized questions and ensures uniform procedures. Data collected was entered into statistical package for social sciences (SPSS) coded and analyzed both qualitatively and quantitatively.

3.3 Theoretical framework

This study was guided by the Theory of Planned Behavior (TPB) (Fishbein & Ajzen 1975, Ajzen & Fishbein 1980). Both models are based on the premise that individuals make logical, reasoned decisions to engage in specific behaviour by evaluating the information available to them. The performance of a behaviour is determined by the individual's intention to engage in it (influenced by the value the individual places on the behaviour, the ease with which it can be performed and the views of significant others) and the perception that the behaviour is within his/her control. The key component to this model is behavioral intent; behavioral intentions are influenced by the attitude about the likelihood that the behavior will have the expected outcome and the subjective evaluation of the risks and benefits of that outcome.

The TPB states that behavioral achievement depends on both motivation (intention) and ability (behavioral control). It distinguishes between three types of beliefs - behavioral, normative, and control. The TPB is comprised of six constructs that collectively represent a person's actual control over the behavior.

1. Attitudes - The degree to which a person has a favorable or unfavorable evaluation of the behavior of interest. It entails a consideration of the outcomes of performing the behavior.
2. Behavioral intention – the motivational factors influencing a given behavior where the stronger the intention to perform the behavior, the more likely the behavior will be performed.
3. Subjective norms - the belief about whether most people approve or disapprove of the behavior. It relates to a person's beliefs about whether peers and people of importance to the person think he or she should engage in the behavior.
4. Social norms - This refers to the customary codes of behavior in a group or people or larger cultural context. Social norms are considered normative, or standard, in a group of people.

5. Perceived power - This refers to the perceived presence of factors that may facilitate or impede performance of a behavior. Perceived power contributes to a person's perceived behavioral control over each of those factors.
6. Perceived behavioral control - This refers to a person's perception of the ease or difficulty of performing the behavior of interest. Perceived behavioral control varies across situations and actions, which results in a person having varying perceptions of behavioral control depending on the situation.

This theory was ideal for this study since it helped in determination of decisions by the farmers, traders and consumers to engage in specific behaviour (production, trading and consuming) by evaluating the information available to them (levels of knowledge in nutrition of AIVs and the socio-economic determinants of consumption of AIVs) among them.

3.4 Analytical Methods

This study aimed to analyze market trends and consumption of indigenous vegetables in Meru and Tharaka Nithi counties. To achieve this aim, first, the study identified the common African indigenous vegetables consumed in Meru and Tharaka Nithi Counties of upper Eastern Kenya. Secondly, the study examined the socio-economic factors which influence consumption of indigenous vegetables in Meru and Tharaka Nithi counties among farmers, traders and consumers. Thirdly, the study determined the levels of knowledge in nutrition and the factors influencing them among farmers, traders and consumers.

To meet the research objectives, the study adopted both descriptive and inferential analysis. The study also used survey research design where a total number of 152 respondents including farmers, traders and consumers were interviewed. Descriptive statistics were used to identify the common African indigenous vegetables consumed in Meru and Tharaka Nithi Counties of upper Eastern Kenya while a generalized Poisson regression model was used to examine the socio-economic factors which influence the

consumption of indigenous vegetables as well as to determine the levels of knowledge in nutrition and the factors influencing them among farmers, traders and consumers. Finally, to establish the relationship between attitude of producers, traders and consumers and consumption of indigenous vegetables, a factor analysis was conducted where similar variables were clustered together and fewer dimensions reflecting the relationships among these inter-related variables identified.

3.4.1 Levels of Nutrition Knowledge by Value Chain

The researcher adopted a five level Likert scale as postulated by Cannoosamy, Pugo-Gunsam and Jeewon (2014). The levels include;

Understanding of nutrition terms.

Awareness of dietary recommendations.

Knowledge of foods as source of nutrients,

Ability to apply information on diet choices and

Awareness of diet-disease association.

The respondents were asked whether or not they know each of the scales identified. Hence the dependent variable was taken as the number of scale levels the respondent indicated as having the knowledge of which was measured on a scale of 0 -5. The data obtained on nutritional knowledge of farmers, traders and consumers was analyzed to address objective two. The dependent variable was the number of respondent and therefore was analyzed using count data models. Count variable models were analyzed using either standard Poisson, generalized Poisson regression (GPR) or negative binomial regression (Kirui, 2011). However, when data precludes zero responses, the strict application of standard Poisson and negative binomial regression will be inappropriate (Hilbe, 2011; Long, 1997). Generalized Poisson regression (GPR) model

was therefore used. However, analysis was also done using standard Poisson regression for comparison purposes.

A generalized Poisson model was applied to assess the factors affecting nutrition knowledge among farmers. Mean deviance and the Pearson chi-square ratio (the Pearson's chi-square value divided by its degree of freedom) which were used to assess the model's goodness of fit.

A generalized Poisson model was applied to assess the factors affecting nutrition knowledge among consumers. The mean deviance and the Pearson chi-square ratio (the Pearson chi-square value divided by its degree of freedom) which were used to assess the goodness of fit of the model. The estimated Deviance and Pearson ratios were: the

Deviance goodness-of-fit = 1.377484 and the

Pearson goodness-of-fit = 1.228731.

A generalized Poisson model was applied to assess the factors affecting nutrition knowledge among traders. The mean deviance and the Pearson chi-square ratio (the Pearson chi-square value divided by its degree of freedom) which were used to assess the goodness of fit of the model. The estimated Deviance and Pearson ratios are shown below:

Deviance goodness-of-fit = 1.019179

Pearson goodness-of-fit = 1.503265

3.4.2 Generalized Poisson Regression (GPR)

A generalization to the basic Poisson model was developed by Consul & Jain (1973) which was competently termed as generalized Poisson regression. According to Hilbe (2011) generalized Poisson regression has undergone numerous revisions, with models which had names such as the restricted generalized Poisson and three parameterizations

of a hybrid generalized Poisson. Consul and Famoye (1992) presented an excellent overview of the basic generalized. Poisson regression model and derivation. A generalized Poisson distribution is defined by a probability distribution function as:

$$f(y;\lambda,\theta) = \theta\left(\theta + \lambda_i^{y_i}\right)^{y_i} \frac{exp\left(-\theta - \lambda_i^{y_i}\right)}{y_i!}$$

Consul and Famoye 1992) and Hilbe (2011) showed that the log-likelihood (LL) transformation for the above generalized Poisson probability distribution is given by:

$$\mathcal{L}(\mu,\alpha;y) = \sum_{i=1}^{n}\left\{y_i ln\left(\frac{\mu_i}{1+\alpha\mu_i}\right) + (y_i - 1)ln(1+\alpha y_i) - \left[\frac{-\mu_i(1+\alpha y_i)}{1+\alpha\mu_i}\right] - ln\Gamma(y_i+1)\right\}$$

Or in terms of $x\beta$ as

$$\mathcal{L}(\beta,\alpha;y) = \sum_{i=1}^{n}\left\{y_i ln\left(\frac{exp\left(x_i'\beta\right)}{1+\alpha exp\left(x_i'\right)}\right) + (y_i - 1)ln(1+\alpha y_i) - \left[\frac{exp\left(x_i'\beta\right)(1+\alpha y_i)}{1+\alpha exp\left(x_i'\beta\right)}\right] - ln\Gamma(y_1+1)\right\} = 1$$

Where:

f = random response variable corresponding to the number of nutrition knowledge known to respondent (i)

x = covariate vectors of explanatory variables

y = linear predictor of random response variable

Based on the above equation, the implicit functional form of the generalized Poisson regression model estimated is:

ln (scales of knowledge in nutrition known) = f (age, gender, education, ln income, work status, type of occupation, social capital)

Link function-a Poisson

$$\text{In } (\lambda) = B_{O+}B_1X_{1+}\ldots_{+}B_5X_5$$

Where,

In **(λ)** is the natural log of dependent variable which is based on the number of the knowledge scale which was measured on the scale of 0 to 5. B_o=Constant of the model, B_1=Coefficient of X (independent variable) when $X_{1=}$Age, X_6=Capital X_2=Income X_3 = Size of household X_4=Type of occupation X_5=Gender

Nb. The model was applied for producers, traders, and consumers

This model was also used to analyze data obtained for objectives on levels of knowledge in nutrition and the socio-economic factors influencing AIV consumption.

3.4.3 Definition of variables used in the model and how they were measured;

Age - was a continuous variable and was measured in years. It is expected to have effect on knowledge though the direction of influence may not be determined prior because of the effect of other factors. The older one gets, the more knowledgeable they are expected to be on issues surrounding them.

Gender of respondents- this was a dummy variable measured as 1=male, 0=female. Men were generally expected to be more knowledgeable about their surroundings than their female counterparts. In upper Eastern Kenya there are more women farmers than men, hence its expected where house heads are women, there is more AIV farming than where there are male counterparts.

Education level of the household head - this is a human capital variable and was measured in terms of the number of years of formal education. It's expected that the more educated do less of the vegetable farming since most of them are in formal employment.

Capital – this variable form part of the financial capital owned by a household from all possible income generation sources that they were engaged. The income range as expected was too large with some households recording no (zero) incomes. To reduce spread and allow meaningful comparisons, income was linearized by using the natural logarithm.

Taboos and cultural beliefs **-** Taboos are influenced by three factors including culture, geography and biology (Keller, 2004). Dietary rules and regulation may be related with event in human life such as menstrual period, pregnancy, childbirth and lactation among others (Meyer-Rochow, 2009). In Africa, these taboos work contrary to the least privileged members of the society, that is women, pregnant women, and children and elderly (Onuorah & Ayo, 2003)

Attitude- This was measured on a 5- point Likert scale defined on 1= strongly disagree, 2=Disagree 3=Not sure, 4=Agree 5=Strongly Agree.

Distance to main road - this was a continuous variable and was measured in kilometers. The accessibility of an area is determined by the kind of infrastructure available. The distance to the market may determine the frequency of consumption of the AIVs, long distance to the market may discourage farmers, traders or the consumers. This variable was linearized by using natural logarithm.

Group membership - is a social capital variable and was measured as a dummy variable (1= group member, 0= Otherwise). For the purpose of this study group membership information was used to establish whether some respondents got financial assistance from the groups or not.

Type of occupation -It was expected that type of occupation will have either positive or negative influence on consumption and nutritional knowledge of indigenous vegetables. Occupation was categorized as traders, casual labor, formal employment, informal employment, agriculture and livestock.

Gender of household head- Considering that both growing and preparation of AIVs is associated with women, it was expected that women encourage their consumption than their male counterparts, also female take more vegetables during pregnancy and lactation periods. This was a dummy variable measured as 1-male, 0-female.

3.4.4 Socio-economic factors that influence consumption of indigenous vegetables in the two counties

In order to determine the socio-economic factors that influence consumption of AIVs. Farmers, traders and consumers listed the number of times they consume each of the listed indigenous vegetables per week; the traders were asked which of the indigenous vegetables are frequently bought per week. Other questions such as distance covered from home to the nearest market in kilometers as well were considered in the value chain and used to analyze the consumption of AIVs, Link function-a Poisson.

$$\text{In}(\lambda) = \alpha+\beta_1 X_i 1+\beta_2 Xi_2+\cdots+\beta_k Xi_k$$

Where In **(λ)** is the natural log of dependent variable which is based on count data on frequency of consumption of AIVs. Generalized poison regression model was used as explained in section 3.4.2 above. This was repeated for farmers, traders, and consumers. Independent variables are as explained as in 3.4.2.2

3.5 Factor Analysis Method

In order to assess attitude towards consumption of AIVs among consumers, they were asked a series of questions relating to consumption of AIVs. The questions were measured in a 5-point Likert scale with 1 representing strongly disagree and 5

representing strongly agree. This analysis was used to cluster together similar variables and obtain fewer dimensions that reflected the relationships among these inter-related variables.

3.5.1 Economic Specification of Model

Farmers, traders and consumers attitude were analyzed using two main approaches i,e descriptive statistics which included summing up responses and obtaining a score or using percentage of respondents in a given Likert scale category (shibia, 2010) or scale averages for the particular questions responses (Dilisca et al; 2007; Rishi, 2007)

The second method used exploratory factor analysis. Factor analysis was used to identify latent dimensions underlying different variables that measured attributes that consumer prefers (Kimambo, 2015). Responses to five-point Likert scale items were subjected to principal component analysis (PCA) with varimax rotation the factors were subjected to Kaiser-Meyer-Olkin and Bartlett's test (KMO and Bartlett's test). Factor analysis method was used to describe variability among observed, correlated variables in terms of a potentially lower number of unobserved variables called factors (Bartholomew, Knott & Moustaki, 2011).

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.1: Introduction

This chapter presents the results of the various analytical approaches and their discussions. Generally, data on the common AIVs grown in Meru and Tharaka Nithi, levels of knowledge in their nutrition, socio-economic factors which influence consumption of AIVs and attitude of farmers, traders and consumers towards consumption of AIVs obtained from sample of farmers, traders and consumers of traditional African vegetables were analyzed.

4.2 Production trends of AIVs

Figure 4.1 the production trend of African Indigenous vegetables (AIVs) from the year 2008 to 2017 in Kenya.

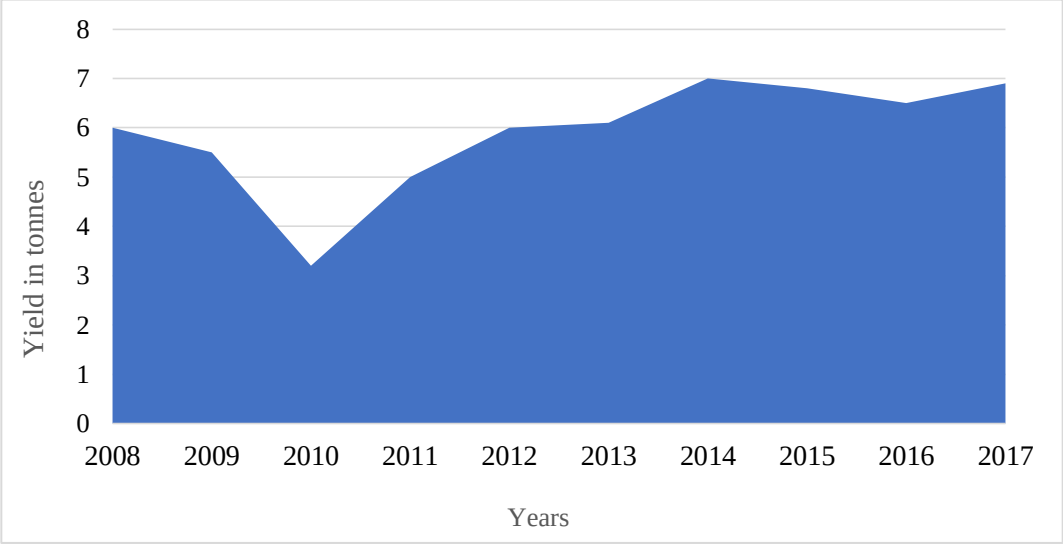

Figure 4. 1: AIVs production trends 2008 – 2017 in Kenya
Source; Hortinlea survey in Kenya.

The results revealed that there was an increasing trend in the production of AIVs in Kenya from 2010 to 2017 (Fig. 4.2). This is indicated by the high knowledge level of

AIVs among most Kenyans. Generally, there has been a general increase in production, consumption and marketing of AIVs in Kenya from 2011 to 2017, especially in Western Kenya. (Kebede *et al*., 2017). The consumption, and production patterns of farmers, traders and consumers have not been on the increase in Meru and Tharaka-Nithi compared to the National trends.

4.3 Socio-economic Characteristics

This study established the socio-economic characteristics of the respondents. Results are presented in table 4.1. The study shows that 58%, 55.6% and 64.3% of the interviewed consumers, farmers and traders were male. This indicated that there are more men involved in consumption, farming and trading of African indigenous vegetables (AIVs) as compared to female. However, this phenomenon could be as a result of the random sampling technique used to select the respondents which could have worked in favour of men.

Table 4. 1: Socio-economic Characteristics of the sample of farmers, traders and consumers

Demographic properties	Consumer (n= 50)	Farmers (n=45)	Traders (n=57)
Gender (%)			
Female	42.0	44.4	35.7
Male	58.0	55.6	64.3
Age of respondent (mean)	33.2	32.27	32.8
Household size (count) mean	4.84	4.42	4.0
AIVs Farm size (M^2) mean	-	2.04	-
Main Occupation (%)			
Agriculture	26.0	24.4	12.7
Casual labor	22.0	22.2	21.8
Formal employment	12.0	26.7	18.2
Business	14.0	15.6	30.9
Informal employment	6.0	2.2	7.3
Agriculture and livestock	6.0	8.9	9.1
Number of years of schooling (mean)	13.4	13.4	12.5
Level of education (%)			
None	-	4.4	3.6
Primary	14.0	8.9	7.1
Secondary	76.0	51.1	46.4
Middle-level college	6.0	17.8	30.4
University	2.0	17.8	12.5
Household yearly income (Kshs) (mean)	76, 041.7	132096.4	107871.9
Amount spent to purchase AIVs per week (Kshs) (mean)	106.9	-	290.6
Years in AIVs business (mean)	-	6.1	5.2
Land size under AIV (M^2)	-	2.0	-
Distance to nearest market (km) mean	2.3	2.5	4.3
Frequency intake (count) mean	2.3	2.9	3.3

In addition, the results demonstrated that majority of the consumers, farmers and traders, 46%, 51.1% and 43.9% respectively, were married to only one spouse. Further the results showed that, 10% of the consumers, 6.7% of the farmers and 12.3% of the traders of AIVs were married to more than one spouse. In addition, those who were not married

were 40% in the category of consumers, 35.6% of the farmers and 31.6% of the traders. Those who had separated with their partners were 2% for consumers, 7% for traders and none for farmers. Finally, on the divorced category, 6.7% of the farmers were divorced, 5.3% of the traders were divorced while none of the consumers were divorced. These results indicate that larger families i.e. respondents in marriage were more likely to produce, trade and consume AIVs to support the family dietary and financial needs.

The study also showed that at least 80% of the respondents had secondary school education and above indicating that respondents of the three categories were found to have an average education level. These results reveal that AIVs were produced, traded and consumed by people who were literate. The average age of the respondents interviewed was 33 years for consumers, 32.3 for farmers and 32.8 for traders. This indicated that majority of the consumers, farmers and traders were middle aged in accordance to World Health Organization (WHO) statistical report (2010). Results showed that majority of the famers were engaged in formal employment as their main occupation other than farming (26.7%), traders practicing business as their main occupation (30.9%) and consumers` main occupation as farming (26.0%). This indicated that farmers had other jobs other than farming and hence farming was not their primary job. Traders got their income majorly from trading of AIVs while consumers derived their income majorly from farming activities.

The average household yearly income of the consumers was KSH 76, 041.67 and spent an average of Ksh 106.88 weekly to purchase AIVs. The farmers had an average household income of Ksh. 132,096.43 and were found to spend Kshs. 287.20 weekly to purchase AIVs. The traders were found to earn an average household income of Kshs. 107, 871.93 yearly and spent Kshs. 290.59 weekly to purchase AIVs. Farmers and traders were found to have a higher income due to farming and trading in AIVs as compared to consumers. The frequency intake of AIVs was found to be 2.3 times, 2.9 and 3.3 times for consumers, farmers and traders respectively on weekly basis and the average size of land used by farmers to grow AIVs was found to be 2.044 M^2.

4.4 Common AIVs consumed in Meru and Tharaka Nithi Counties

The common AIVs consumed in Meru and Tharaka Nithi Counties are shown in figure 4.2.

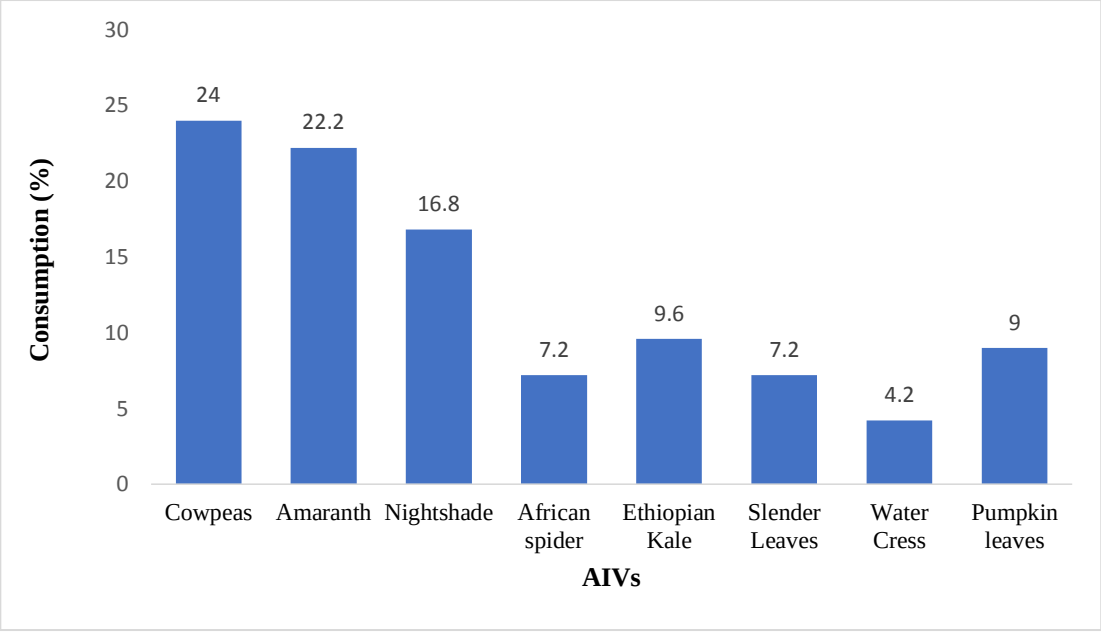

Figure 4. 2: Common AIVs consumed in Meru and Tharaka Nithi Counties

At least 24% of the respondents consumed Cowpeas, 22.2% consumed Amaranthas, 16.8% consumed Nightshade, 7.2% consumed African spider while 9.6% consumed Ethiopian kale. The study also showed that 7.2% consumed slender leaves, 4.2% consumed watercress while 9% consumed pumpkin leaves. The majority of the respondents (87.8%) grew Amaranthas, 85.4% grew Cowpeas, 51.2% grew Nightshade, 17.1% grew Ethiopian kale while 9.8% were found to grow African spider (Saga).

Table 4. 2: Common AIV's grown by the farmers in the last 12 months

		Meru	Tharaka Nithi	Overall
Commonly AIV's grown	Cowpeas	83.1	88.0	85.4
	Amaranths	89.6	85.3	87.8
	Nightshade	48.1	54.3	51.2
	African spider	10.4	9.3	9.8
	Ethiopian Kale	19.5	14.7	17.1

4.5 Levels of Knowledge in Nutrition

The knowledge level was high among consumers with a mean of 2.8, followed by farmers with a mean of 2.45 and finally traders had the least level of nutritional knowledge as indicated by a mean of 1.95. This means that most of the traders were less informed on AIVs but were selling them as a business.

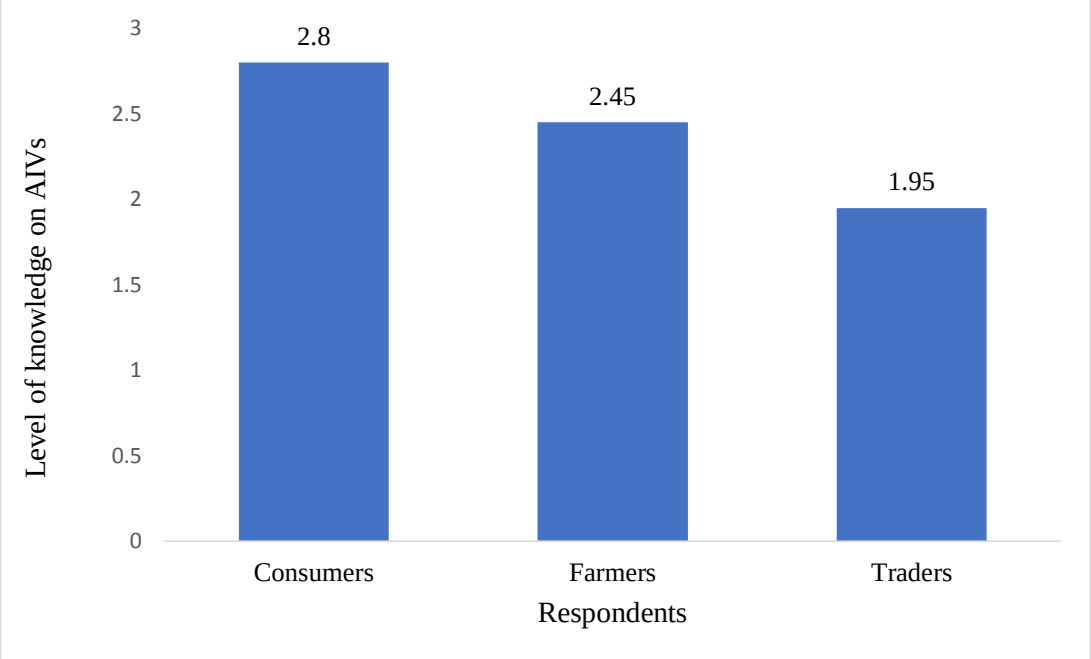

Figure 4. 3: The levels of knowledge in nutrition among the respondents

The study results revealed that consumers had the highest level of knowledge in nutrition of AIVs followed by the farmers and then the traders at 2.8, 4.5 and 2.0 respectively.

4.5.1 Levels of knowledge in nutrition and the factors influencing them among farmers, traders and consumers.

This section presented the factors influencing nutrition knowledge of AIVs in farmers, traders and consumers. This was analyzed using a generalized Poisson regression model. This model was chosen because the dependent variable (Nutrition knowledge) was a count data.

4.5.2 Farmers Model

The estimated Deviance and Pearson ratios were: Deviance goodness-of-fit = 1.5695925. The findings indicated that the model fitted the data well as the values are approximately equal to one (1) indicating that the model was a good fit. Again, Table

4.3 showed the values of AIC and BIC which also suggested a good fit. The years spent in schooling, being in a formal employment or an informal employment, yearly income level, household size and the farm size used for growing AIVs significantly influenced Nutrition knowledge (Fig. 4.3). This was so because their resultant p-values were less than 0.05 at 5% level of significance ($p<0.05$). The results hence show that years of schooling, type of employment, income, household size and farm size under AIVs had a significant relationship with knowledge of the respondents in AIVs.

Table 4. 3: Factors which influence farmers' knowledge in nutrition

	Generalized Poisson		**Standard Poisson model**	
Dependent variable =Number of Nutrition knowledge known	**IRR**	**P-values**	**IRR**	**p-values**
Gender (f)	0.860	0.366	0.843	0.372
Years in schooling	0.980	0.032**	0.976	0.029**
Age	0.999	0.961	0.991	0.968
Occupation				
Casual labor	0.895	0.748	0.919	0.748
Formal Emp	0.589	0.048**	0.590	0.056*
Business	0.853	0.586	0.861	0.589
Informal emp	0.653	0.045**	0.657	0.049**
Agric & livestock	0.771	0.091*	0.781	0.099*
Log of Income	0.424	0.025**	0.433	0.029**
Group membership	0.909	0.686	0.911	0.697
Log of Household size	0.414	0.049**	0.419	0.056*
AIVs farm size	0.927	0.043**	0.934	0.048**
Constant	1.550	0.304	1.557	0.331
				37
Number of observations	37			
Wald chi2(8)	27.21		23.14	
Prob>chi2	0.0000		0.0012	
Pseudo R^2	0.0816		0.0962	

Table 4. 4: Akaike's and Bayesian Information Criterion

Model	Obs.	ll(null)	ll(model)	df	AIC	BIC
Generalized Poisson	18	-28.24382	-25.9398	12	175.879	186.564
Standard	18	-32.26712	-27.7865	11	186.765	199.445

From the model in Table 4.4, there was a statistically significant relationship between the knowledge in nutrition and years spent in schooling, being in a formal employment or an informal employment, yearly income level, household size and the farm size used for growing AIVs. A unit change in years spent in schooling increased nutrition knowledge level by exp(0.980) while being in a formal employment increased nutrition knowledge level by exp(0.589). the study also showed that being in an informal employment increased nutrition knowledge level by exp(0.653). One-unit increase in yearly income level increased nutrition knowledge level by 0.424, a one-unit change in the household size increased nutrition knowledge level by 0.414 while a unit increase in the farm size used for growing AIVs increased nutrition knowledge level by exp (0.927).

4.5.3 Consumers Model

The results indicated that the model fitted the data well as the values are approximately equal to one (1). The AIC and BIC values suggested a good fit of the model (Table 4.5).

Table 4. 5: Factors which influence consumers' knowledge in nutrition

	Generalized Poisson		Standard Poisson	
Dependent variable = Number of Nutrition knowledge known	IRR	P-values	IRR	P-values
Gender (F)	2.569	0.000***	2.532	0.001***
Years in schooling	1.144	0.000***	1.123	0.001***
Age	1.006	0.485	0.987	0.512
Household size	0.957	0.042**	0.972	0.051*
Occupation				
Agriculture	0.926	0.516	0.952	0.554
Casual labor	0.881	0.395	0.910	0.451
Formal Emp	1.093	0.463	0.934	0.468
Business	1.021	0.906	1.003	0.922
Agric and Livestock	0.697	0.108	0.664	0.123
Log of Income	1.000	0.047**	0.994	0.049**
Group membership	1.036	0.487	1.000	0.495
Constant (intercept)	0.207	0.004***	0.196	0.018**
Number of observations		37		37
Wald chi2(10)		126.77		107.65
Prob>chi2		0.0000		0.0001
Pseudo R^2		0.2289		0.1969

, ** and * denote significance level at 10, 5 and 1 percent respectively*

Table 4. 6: Akaike's and Bayesian Information Criteria

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
Generalized Poisson	37	-69.5223	-53.6115	12	131.223	150.554
Standard Poisson	37	-82.3876	-61.6321	11	151.343	192.434

Consumers' knowledge in nutrition was found to be influenced positively by the gender of the respondents, the number of years in schooling of the respondent and the household size. The model also revealed that one being female changes the nutrition knowledge level by exp (2.569) while being male increases the nutrition knowledge level by exp (0.207). A unit change in years spent in schooling increased nutrition knowledge level by exp (1.144). Again, a one-unit increase in yearly income level increased nutrition knowledge level by 1.000 and finally a one-unit change in the

household size increased nutrition knowledge level by exp (0.957). This shows that the level of education and household size had a positive significant relationship with knowledge in nutrition of AIVs among the consumers.

The consumer's age, occupation, income and group membership of the respondent did not statistically influence consumers' nutrition knowledge.

4.5.4 Traders Model

The results indicated that the model fitted the data well as the values were approximately equal to one (1). The results in Table 4.7 show the values of AIC and BIC suggested a good fit of the model.

Table 4. 7: Factors which influence traders' knowledge in nutrition

	Generalized Poisson		Standard Poisson	
Dependent variable= Frequency	**IRR**	**P-values**	**IRR**	**P-values**
Intake of AIVs				
Gender (F)	4.871	0.036**	4.524	0.045**
Years in schooling	1.153	0.148	1.006	0.157
Age	0.917	0.045**	0.892	0.053*
Occupation				
Agriculture	2.032	0.114	1.987	0.215
Casual labor	1.315	0.305	1.023	0.354
Formal Emp	3.330	0.188	3.003	0.219
Business	20.43	0.320	22.32	0.402
Agric and Livestock	3.9e-06	0.000***	3.2e-06	0.005***
Others	0.423	0.150	0.404	0.163
Income	1.000	0.445	0.965	0.535
household size	0.865	0.045**	0.815	0.049**
distance to Mkt	1.019	0.452	1.000	0.487
Culture/taboos	3.6e-32	0.024**	4.1e-32	0.034**
Medicinal value	2.808	0.028**	2.654	0.038**
Price of AIVs	0.999	0.731	0.954	0.776
AIVs Weekly spent	0.985	0.247	0.964	0.266
Constant (intercept)	1.197	0.784	1.100	0.799
Number of observations		21		21
Wald chi2(10)		37.13		34.98
Prob>chi2		0.0000		0.002
Pseudo R^2		0.2371		0.2049

, ** and * denote significance level at 10, 5 and 1 percent respectively*

Table 4. 8: Akaike's and Bayesian Information Criterion

Model	Obs.	ll(null)	ll(model)	df	AIC	BIC
Generalized Poisson	21	-36.1381	-28.0059	11	78.012	89.5015
Standard Poisson	21	-42.3193	-35.9300	10	89.572	101.4815

The knowledge in nutrition was positive significant relationship with gender of the respondents, age, being in agriculture and livestock occupation, household size, culture taboos and the medicinal value of the AIVs (Table 4.8). One being female increased the

nutrition knowledge by exp (4.871) while being male did not have a significant effect or influence. A unit change in the age of Traders increased nutrition knowledge level by exp (0.917), being in agriculture and livestock occupation increased nutrition knowledge level by exp (3.9e-06) while a one unit increase in household size increased nutrition knowledge level by exp (0.865). Finally, a one-unit change in the culture taboos increased nutrition knowledge level by exp (3.6e-32) while a unit increase in the medicinal value of AIVs increased nutrition knowledge level by exp (2.808). The results indicate the medicinal value of AIVs had a positive influence on the knowledge on nutrition value of the AIVs.

From the results, it was revealed that there were differences in levels of knowledge among the respondents and factors that determined knowledge of AIVs. For instance, knowledge of AIVs among the farmers were positively influenced by years of education, type of employment (formal or informal), income level and farm size under AIVs. For consumers, the factors included gender, years of education, household size and annual income level. Lastly, traders' knowledge of AIVs was positively influenced by gender, age, agriculture and livestock, respondents' culture and taboos and finally the medicinal value of the AIVs.

4.6 Socio-economic factors that influence the consumption of the AIVs

4.6.1 Socio-economic factors Influencing Consumption among Farmers

The results in this survey showed the mean deviance and the Pearson chi-square ratio (the Pearson chi-square value divided by its degree of freedom) which were used to assess the goodness of fit of the model. The estimated Deviance and Pearson ratios are shown below:

Deviance goodness-of-fit = .9368648

Pearson goodness-of-fit = .9421731

The findings indicated that the model fitted the data well as the values are approximately equal to one (1). Table 4.10 showed AIC and BIC values which suggested that the model was a good fit.

Being in agriculture and livestock occupations increased the frequency of AIVs consumption level among farmers by exp (1.398) units (Table 4.9.) This indicated that occupation of the farmers had a significant influence on the consumption of AIVs. The results further indicated that a one-unit increase in household size increased the AIVs consumption level among the farmers by 1.568. This indicated that the household size was a significant factor influencing the consumption of AIVs. Further a significant influence of the household income and the farm size used to grow AIVs among farmers on the consumption of AIVs. This indicated that a one unit increase in income increased the consumption of AIVs by 1.000 while a one unit increase in AIVs farm size increased the frequency of AIVs production level by exp (0.893). There was no significant influence of gender, years spent in schooling, age and group membership on the consumption of AIVs among the farmers.

Table 4. 9: Factors influencing AIVs' consumption among Farmers

	Generalized Poisson		Standard Poisson	
Dependent variable = Number of Nutrition knowledge known	**IRR**	**P-values**	**IRR**	**P-values**
Gender (f)	1.039	0.671	1.039	0.671
Years in schooling	1.083	0.253	1.083	0.253
Age	0.961	0.151	0.961	0.151
Occupation				
Casual labor	1.333	0.105	1.333	0.105
Formal Emp	0.839	0.257	0.839	0.257
Business	1.008	0.974	1.008	0.974
Informal emp	1.332	0.565	1.332	0.565
Agric and livestock	1.398	0.040**	1.398	0.040**
Log of Income	1.000	0.031**	1.000	0.031**
Group membership	1.090	0.663	1.090	0.663
Log of Household size	1.568	0.002***	1.568	0.002***
AIVs farm size	0.893	0.008***	0.893	0.008***
Constant	0.746	0.506	0.746	0.506
Number of observations	18		18	
Wald chi2(8)	-		-	
Prob>chi2	-		-	
Pseudo R^2	0.1458		0.1907	

Table 4. 10: Akaike's and Bayesian Information Criterion

Model	Obs.	ll(null)	ll(model)	df	AIC	BIC
Generalized Poisson	18	-31.858	-27.213	12	78.422	89.107
Standard Poisson	18	-42.976	-38.321	11	85.234	100.326

4.6.2 Socio-economic factors Influencing Consumption among Consumers

The results in this survey showed the mean deviance and the Pearson chi-square ratio (the Pearson chi-square value divided by its degree of freedom) which were used to assess the goodness of fit of the model. The estimated Deviance and Pearson ratios are shown below:

Deviance goodness-of-fit = 1.4912

Pearson goodness-of-fit = 1.25658

The findings indicated that the model fitted the data well as the values are approximately equal to one (1). Table 4.11 showed AIC and BIC values which suggested that the model was a good fit.

Table 4. 11: Factors influencing the consumption of AIVs among Consumers

	Generalized Poisson		Standard Poisson	
Dependent variable = Number of AIVs consumed	**IRR**	**P-values**	**IRR**	**P-values**
Gender (f)	0.586	0.048**	0.613	0.048**
Years in schooling	0.995	0.032**	1.212	0.043**
Age	1.003	0.026**	0.987	0.091*
Household size	1.962	0.190	1.451	0.234
Occupation				
Agriculture	0.832	0.586	0.889	0.576
Casual labor	1.133	0.776	1.00	0.854
Formal Emp	1.849	0.024**	2.124	0.056*
Business	0.809	0.779	0.769	0.912
Agric and Livestock	0.517	0.228	0.589	0.228
Income	1.000	0.034**	1.187	0.041**
Group membership	0.964	0.754	0.956	0.756
Constant	2.595	0.194	2.132	0.218
Number of observations	35		35	
Wald chi2(10)	35.49		35.49	
Prob>chi2	0.0002		0.0015	
Pseudo R2	0.0942		0.0269	

, ** and * denote significance level at 10, 5 and 1 percent respectively*

Table 4. 12: Akaike's and Bayesian Information Criteria

Model	Obs.	ll(null)	ll(model)	df	AIC	BIC
Generalized Poisson	35	-60.6504	-54.9355	12	133.871	152.535
Standard Poisson	**35**	**-68.0987**	**-73.5935**	**11**	**167.178**	**187.765**

Gender, years in schooling, age, being in formal employment and income significantly influenced or affected the frequency of AIVs consumption (Table 4.12). The results indicated that gender increased the AIVs consumption level among consumers by exp (586). Further, a unit change in years spent in schooling among farmers increased the AIVs consumption level by exp (0.995) while a one unit increase in age increased the AIVs consumption level by exp (1.003). One being in formal employment was found to increase the AIVs consumption level by exp (1.849) while a one unit increase in yearly income level increased the AIVs consumption level by exp (1.000).

4.6.3 Factors Influencing Consumption among Traders

The results in this survey showed the mean deviance and the Pearson chi-square ratio which were used to assess the goodness of fit of the model. The estimated Deviance and Pearson ratios are shown below:

Deviance goodness-of-fit = 1.40825

Pearson goodness-of-fit = 1.371782

The findings indicated that the model fitted the data well as the values are approximately equal to one (1). Table 4.13 showed AIC and BIC values which suggested that the model was a good fit.

Table 4. 13: Factors influencing consumption of AIVs among Traders

	Generalized Poisson		Standard Poisson	
Dependent variable = Number of AIVs consumed	**IRR**	**P-values**	**IRR**	**P-values**
Gender (f)	0.888	0.620	0.765	0.754
Years in schooling	1.314	0.000***	1.11	0.000***
Age	0.905	0.000***	1.052	0.000***
Occupation				
Agriculture	4.835	0.000***	3.972	0.000***
Casual labor	1.444	0.031***	1.321	0.041***
Formal Emp	11.12	0.000***	11.12	0.001***
Business	466.41	0.000***	471.01	0.016***
Agric and Livestock	34.16	0.000***	33.76	0.000***
Income	0.999	0.000***	1.000	0.000***
household size	0.977	0.552	0.867	0.563
distance to Mkt	1.034	0.000***	1.434	0.000***
Culture/taboos	1.08e+52	0.000***	1.23e+52	0.000***
Medicinal value	3.639	0.003***	3.654	0.022***
Price of TAVs	0.997	0.000***	1.012	0.000***
TAVs Weekly spent	0.973	0.000***	0.943	0.0012**
Constant	0.626	0.243	0.615	0.254
Number of observations	21		21	
Wald chi2(10)	581.81		491.54	
Prob>chi2	0.000		0.000	
Pseudo R2	0.2237		0.1893	

, ** and * denote significance level at 10, 5 and 1 percent respectively*

Table 4. 14: Akaike's and Bayesian Information Criterion

Model	Obs.	ll(null)	ll(model)	df	AIC	BIC
Generalized Poisson	21	-39.892	-30.969	15	91.937	107.605
Standard Poisson	21	-47.243	-46.925	14	113.765	139.400

Age, Years in schooling, Occupation, income, household size, distance to the market, culture taboos the medicinal value of the AIVs, the price of AIVs and AIVs spent weekly significantly influenced or affected consumption of AIVs among traders (Table 4.14). This was so because their resultant p-values were less than 0.05. However, all the other factors were found to be insignificant as their p-values were insignificant at 5% significance level ($p>0.05$).

The results indicated that a unit increase in the years spent schooling and age increased the consumption of AIVs among traders by exp (1.314) and exp (0.905) respectively. In occupation, one being in Agriculture, casual laborer, formal employment, business, agriculture and livestock and others increased the consumption of AIVs among traders by exp (905), exp (4.835), exp (1.444), exp (11.12) exp(466.41), exp(34.16) and exp(1.605) respectively. A unit increase in income, household size, distance to the market, culture taboos the medicinal value of the AIVs, the price of AIVs and AIVs spent weekly increased consumption of AIVs among traders by exp (0.999), exp (0.977), exp (1.034), exp (1.08e+52), exp (3.639), exp (0.997) and exp (0.973) respectively.

The study results reveal that different SE characteristics had varying influence on consumption of AIVs among the three categories of respondents. Most of the factors positively influenced the decision by traders to consume AIVs other than gender of the respondents and the household size. However, for farmers; engagement in agriculture and livestock keeping, annual income level, household size and farm size under AIVs had a positive influence on AIVs consumption. Gender of the respondents, years of

schooling, age of the respondents, being in formal employment and annual income level had a positive influence on the consumers decision to consume AIVs.

4.7 Attitude Towards Consumption of Traditional African Vegetables

4.7.1 Attitude Towards Consumption of AIVs among Farmers

This study sought to establish the attitudes of producers, traders and consumers towards consumption of indigenous vegetables. Table 4.15 presents the results.

Table 4. 15: Farmers Attitude towards AIVs Consumption

Items	Percent of households within the response				
	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
Consumption of AIVs is important	0.00	0.00	4.80	42.90	52.40
AIVs are inferior foods, when one doesn't have much money or food	11.90	23.80	16.70	40.50	7.10
Fresh AIVs contain more nutrients than dried ones	0.00	11.90	31.00	31.00	26.20
Intake of AIVs variety each day gives vitamins and minerals needed	0.00	7.10	23.80	47.60	21.4
Important to choose daily diet accompanied by AIVs	0.00	10.0	15.0	45.0	30.0
Eating AIVs improve eyesight and boost Immunity	0.0	7.3	22.0	46.3	24.4
AIVs are best consumed when fresh	0.0	0.0	22.5	55.0	22.5
AIVs takes more time to prepare	31.7	24.4	19.5	9.8	14.6
AIVs are not good to me	47.5	27.5	12.5	10.0	2.5
AIVs are tasteless and bitter I am committed to preserve AIVs for next	34.1	29.3	14.6	19.5	2.4
Generation	5.0	5.0	27.5	50.0	12.5

Table 4.15 showed the attitude of farmers towards consumption of AIVs among. A series of questions relating to consumption of AIV'S were asked to farmers and were measured in a 5-point Likert scale with 1 representing strongly disagree and 5 representing strongly agree. Points were added from each statement and divided by the highest sum to calculate a score in percentage terms.

The results showed that 52.4% of the respondents strongly agreed that consumption of AIVs is important to women, children and men. 42.90% agreed, 4.80% were not sure while none disagreed nor strongly disagreed. Further the results showed that 7.10% of the respondents strongly agreed that AIVs are inferior foods when one doesn't have much money or food. 40.50% agreed, 16.7% were not sure, 23.80% disagreed while 11.90% strongly disagreed.

26.20% of the respondents strongly agreed that fresh AIVs contained more nutrients than dried ones. 31% agreed, 31% were not sure, 11.90% disagreed while 0.00% strongly disagreed. The farmers were asked whether intake of AIVs variety each day gives vitamins and minerals needed and out of all the respondents 21.4% of the respondents strongly agreed, 47.60% agreed, 23.80% were not sure, 7.10% disagreed while 0.00% strongly disagreed. The results showed that 30% of the respondents strongly agreed that it was important to choose daily diet accompanied by AIVs, 45% agreed, 15% were not sure, 10% disagreed while 0.00% strongly disagreed.

They were asked whether Eating AIVs improve eyesight and boost immunity and out of all the respondents 24.4% of them strongly agreed, 46.3% agreed, 22% were not sure, 7.3% disagreed while 0.00% strongly disagreed. Further, the respondents were asked whether AIVs are best consumed when fresh and 22.5% of the respondents strongly agreed, 55% agreed while 22.5% were not sure. The results revealed that 14.6% of the respondents strongly agreed that AIVs takes more time to prepare, 9.8% agreed, 19.5% were not sure, 24.4% disagreed while 31.7% strongly disagreed.

The results also indicated that 2.5% of the respondents strongly agreed that AIVs are not good to the respondents, 10% agreed, 12.5% were not sure, 27.5% disagreed while 47.5% strongly disagreed. Moreover, 2.4% of the respondents strongly agreed that AIVs are tasteless and bitter, 19.5% agreed, 14.6% were not sure, 29.3% disagreed while 34.1% strongly disagreed and finally, 12.5% of the respondents strongly agreed that the respondents were committed to preserve AIVs for the next generation, 50% agreed, 27.5% were not sure, 5% disagreed while 5% strongly disagreed.

The data was subjected to a factor analysis using principal axis factoring and orthogonal varimax rotation. This analysis was used to cluster together similar variables and obtain fewer dimensions that reflected the relationships among these inter-related variables. The factors were identified using an eigenvalue cut-off of 1.0. From this, items that met a minimum criterion of having a primary factor loading of 0.5 or above were chosen to belong to a specific factor.

Under the farmers, Kaiser's overall measure of sampling adequacy obtained was 0.530, which suggest that the data was marginally appropriate for factor analysis. In the factor analysis, four factors were identified which were found to have an Eigen value of 1.0 and above and explained a cumulative variance of 63.4 percent. Items belonging to each specific factor met a minimum criterion of having a primary factor loading of 0.5 or above.

The findings were indicated in appendix V and Table 4.16. Table 4.16 and appendix V shows the findings of the factor analysis. The findings revealed that four factors were identified and categorized as health-related factors, attitude factors, perception factors as well as future of AIVs factors.

Table 4. 16: Results of exploratory factor analysis

Factor and item description	Factor loading	Initial Eigen value	% variance Explained
Factor 1 Health related factor		**2.341**	**21.282**
Eating a variety of traditional vegetables each day probably gives you all the vitamins and minerals you need	0.862		
Consumption of traditional vegetables improve eye sight and boost immunity	0.775		
Fresh traditional vegetables are likely to contain more nutrients	0.610		
It is important to choose a daily diet accompanied by traditional vegetables	0.595		
Factor 2 Attitude		**2.094**	**19.038**
Fresh traditional vegetables are likely to contain more nutrients	0.514		
AIV's inferior foods that are good when one doesn`t have much money or food at home	0.571		
Traditional vegetables are best consumed when fresh	0.827		
Traditional vegetables take more time to prepare.	0.677		
Factor 3 Perception		**1.491**	**13.550**
Traditional vegetables are not good to me.	0.828		
Traditional vegetables are tasteless and bitter	.806		
Factor 4 Future of AIVs		**1.052**	**9.563**
Consumption of AIV's is important for women and children, it is also important for men.	0.771		
I am willing to contribute my resources including my time to safeguard and preserve traditional vegetables for the next generation.	-0.649		

4.7.2 Consumers Attitude Towards Consumption of AIVs

The attitude of consumers towards consumption of AIVs among consumers were established. A series of questions relating to consumption of AIV'S were asked to consumers and were measured in a 5-point Likert scale with 1 representing strongly disagree and 5 representing strongly agree. Points were added from each statement and

divided by the highest sum to calculate a score in percentage terms. Table 4.17 presents the results.

Table 4. 17: Consumers Attitude towards AIVs Consumption

Items	Percent of households within the response				
	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
Consumption of AIVs is important to women, children and men	0.00	0.00	8.2	38.8	53.1
AIVs are inferior foods, when one doesn't have much money or food	8.2	4.1	10.2	55.1	22.4
Fresh AIVs contain more nutrients than dried ones	4.2	6.3	18.8	45.9	25.0
Intake of AIVs variety each day gives vitamins and minerals needed	0.00	4.10	24.5	53.0	18.4
Important to choose daily diet accompanied by AIVs	2.1	12.8	19.1	46.8	19.1
Eating AIVs improve eyesight and boost immunity	0.0	4.3	31.9	38.3	25.5
AIVs are best consumed when fresh	2.2	19.6	28.3	23.9	26.1
AIVs takes more time to prepare	32.6	43.5	6.5	8.7	8.7
AIVs are not good to me	56.8	31.8	4.5	6.8	0.0
AIVs are tasteless and bitter	36.2	29.8	14.9	14.9	4.3
I am committed to preserve AIVs for next generation	4.2	8.3	14.6	37.5	35.4

The results showed that consumption of AIVs is important to women, children and men having 53.1% of the respondents strongly agreeing and 38.8% agreeing and 22.4% of the respondents strongly agreed and 55.1% agreed that AIVs are inferior foods when one doesn't have much money or food (Table 4.17). Fresh AIVs contain more nutrients than dried ones having 25% of the respondents strongly agreeing and 45.9% agreeing. These results indicate that AIVs are a lot better when eaten fresh than when they are dried.

Eighteen percent of the respondents strongly agreed and 53% agreed that intake of AIVs variety each day gives vitamins and minerals needed. Majority believed that it is important to choose daily diet accompanied by AIVs as 19.1% of the respondents strongly agreed and 46.8% agreed. The results also showed that Eating AIVs improve

eyesight and boost immunity as 25.5% of the respondents strongly agreed and 38.3% agreed. 26.1% of the respondents strongly agreed that AIVs are best consumed when fresh and 23.9% agreed.

The results revealed 43.5% disagreed and 32.6% strongly disagreed that AIVs takes more time to prepare and 31.8% disagreed and 56.8% strongly disagreed that AIVs are not good to the respondent. The results further showed that 29.8% disagreed and 36.2% strongly disagreed that AIVs are tasteless and bitter 35.4% of the respondents strongly agreed and 37.5% agreed one is committed to preserve AIVs for the next generation.

The consumer's data was subjected to a factor analysis using principal axis factoring and orthogonal varimax rotation. This analysis was used to cluster together similar variables and obtain fewer dimensions that reflected the relationships among these inter-related variables. The factors were identified using an eigenvalue cut-off of 1.0. From this, items that met a minimum criterion of having a primary factor loading of 0.5 or above were chosen to belong to a specific factor.

Under the farmers, Kaiser's overall measure of sampling adequacy obtained was 0.660, which adequately suggested that the data was marginally appropriate for factor analysis. In the factor analysis, five factors were identified which were found to have an Eigen value of 1.0 and above and explained a cumulative variance of 72.233%. Items belonging to each specific factor met minimum criteria of having a primary factor loading of 0.5 or above. The findings were indicated in the figure and table below.

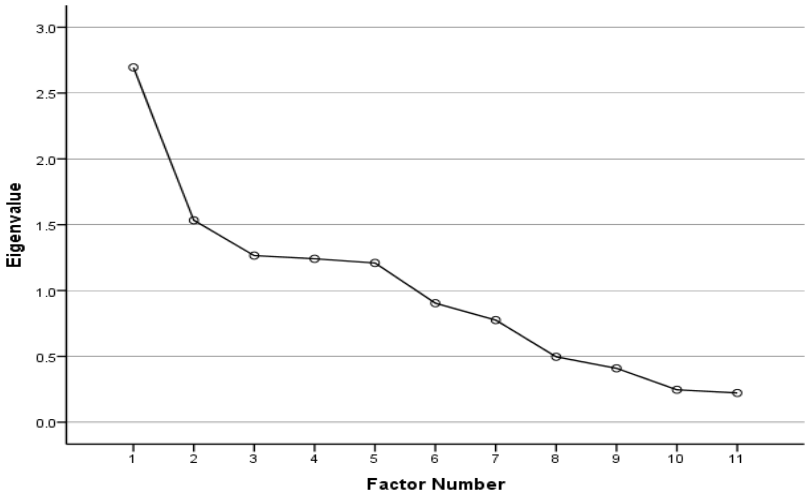

Figure 4. 4: A Scree plot having the consumers Eigen values vs Factor Number

A total number of five factors were identified as seen in Figure 4.3 and Table 4.18. These factors were; Health related factors, Taste, perception, attitude and preparation of the AIVs.

Table 4. 18: Results of exploratory factor analysis

Factor and item description	Factor loading	Initial Eigen value	% variance Explained
Factor 1 Health related factors		2.695	24.501
Consumption of traditional vegetables improve eye sight and boost immunity	.822		
Eating a variety of traditional vegetables each day probably gives you all the vitamins and minerals you need	.800		
It is important to choose a daily diet accompanied by traditional vegetables	.538		
I am willing to contribute my resources including my time to safeguard and preserve traditional vegetables for the next generation.	.517		
Traditional vegetables are not good to me.	-.490		
Factor 2 Taste		1.534	13.941
Traditional vegetables are best consumed when fresh	.709		
Traditional vegetables are tasteless and bitter	-.844		
Factor 3 Perception		1.266	11.507
Traditional vegetables are not good to me.	-.495		
AIV's inferior foods that are good when one doesn`t have much money or food at home	.866		
Fresh traditional vegetables are likely to contain more nutrients	.490		
Factor 4 Attitude		1.241	11.286
It is important to choose a daily diet accompanied by traditional vegetables	.641		
Consumption of AIV's is important for women and children, it is also important for men.	.811		
Factor 5 Preparation of vegetables		1.210	10.998
Fresh traditional vegetables are likely to contain more nutrients	.562		
Traditional vegetables take more time to prepare.	.852		

4.7.3 Traders Attitude Towards Consumption of AIVs

This study sought to establish the attitude of traders towards consumption of AIVs. Table 4.19 presents the results.

Table 4. 19: Traders Attitude towards AIVs Consumption

	Percent of households within the response				
	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
Consumption of AIVs is vital to women, children and men	1.8	0.00	7.0	28.1	63.2
AIVs are inferior foods, when one doesn't have much money or food	17.9	30.4	10.7	35.7	5.4
Fresh AIVs contain more nutrients than dried ones	0.0	6.3	41.7	25.0	27.1
Intake of AIVs variety daily gives vitamins and minerals needed	0.00	20.4	29.6	29.6	20.4
Important to choose daily diet accompanied by AIVs	5.5	12.7	20.0	43.6	18.2
Eating AIVs improve eyesight and boost immunity	1.9	3.8	24.5	17.0	52.8
AIVs are best consumed when fresh	3.6	5.4	16.1	46.4	28.6
AIVs takes more time to prepare	20.4	24.5	34.7	20.4	0.0
AIVs are not good to me	44.4	25.9	11.1	11.1	7.4
AIVs are tasteless and bitter	61.1	14.8	11.1	11.1	1.9
Generation	9.1	5.5	25.6	29.1	30.9

Table 4.19 showed the attitude of Traders towards consumption of AIVs among. A series of questions relating to consumption of AIV'S were asked to Traders and were measured in a 5-point Likert scale with 1 representing strongly disagree and 5

representing strongly agree. Points were added from each statement and divided by the highest sum to calculate a score in percentage terms.

The results in Table 4.19 showed that consumption of AIVs is important to women, children and men having 63.2% of the respondents strongly agreeing and 28.1% agreeing and 5.4% of the respondents strongly agreed and 35.7% agreed that AIVs are inferior foods when one doesn't have much money or food. The results showed that fresh AIVs contain more nutrients than dried ones having 27.1% of the respondents strongly agreeing and 25% agreeing. 20.4% of the respondents strongly agreed and 29.6% agreed that intake of AIVs variety each day gives vitamins and minerals needed. Majority believed that it is important to choose daily diet accompanied by AIVs as 18.2% of the respondents strongly agreed and 43.6% agreed.

The results also showed that Eating AIVs improve eyesight and boost immunity as 52.8% of the respondents strongly agreed and 17% agreed. 28.6% of the respondents strongly agreed that AIVs are best consumed when fresh and 46.4% agreed. The results revealed 24.5% disagreed and 20.4% strongly disagreed that AIVs takes more time to prepare and 25.9% disagreed and 44.4% strongly disagreed that AIVs are not good to the respondent. The results further showed that 14.8% disagreed and 61.1% strongly disagreed that AIVs are tasteless and bitter 29.1% of the respondents strongly agreed and 30.9% agreed one is committed to preserve AIVs for the next generation.

The Trader's data was subjected to a factor analysis using principal axis factoring and orthogonal varimax rotation. This analysis was used to cluster together similar variables and obtain fewer dimensions that reflected the relationships among these inter-related variables. The factors were identified using an eigenvalue cut-off of 1.0. From this, items that met a minimum criterion of having a primary factor loading of 0.5 or above were chosen to belong to a specific factor. Under the Traders, Kaiser's overall measure of sampling adequacy obtained was 0.554, which adequately suggested that the data was

marginally appropriate for factor analysis. In the factor analysis, four factors were identified which were found to have an Eigen value of 1.0 and above and explained a cumulative variance of 64.776%. Items belonging to each specific factor met a minimum criterion of having a primary factor loading of 0.5 or above. The findings were indicated in the figure and table below.

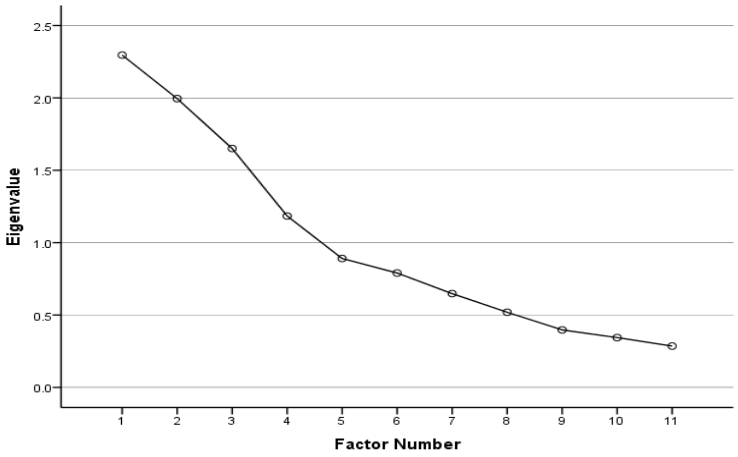

Figure 4. 5: A Scree plot having Traders Eigen values vs Factor Number

Figure 4.4 and Table 4.20 shows that a total of 4 factors of on the attitude of Traders towards AIVs were identified. These factors were: Health related factors, Perception factors, attitude factors and the future of AIVs factors.

Table 4. 20: Traders Attitude towards AIVs Consumption

Factor and item description	Factor loading	Initial Eigen value	% variance Explained
Factor 1 Health related		**2.296**	**20.871**
Traditional vegetables take more time to prepare.	.703		
AIV's inferior foods that are good when one doesn`t have much money or food at home	.554		
Fresh traditional vegetables are likely to contain more nutrients	-.524		
It is important to choose a daily diet accompanied by traditional vegetables	-.642		
Eating a variety of traditional vegetables each day probably gives you all the vitamins and minerals you need	-.699		
Factor 2 Perception		**1.995**	**18.138**
Consumption of traditional vegetables improve eye sight and boost immunity	.777		
Traditional vegetables are best consumed when fresh	.799		
Traditional vegetables are tasteless and bitter	-.693		
Factor 3 Altitude		**1.650**	**15.003**
Traditional vegetables are not good to me.	.678		
I am willing to contribute my resources including my time to safeguard and preserve traditional vegetables for the next generation.	-.796		
Fresh traditional vegetables contain more nutrients	.610		
Factor 4 Future of AIVs		**1.184**	**10.764**
Consumption of AV's is important for women and children, it is also important for men.	-.863		

CHAPTER FIVE

SUMMARY AND RECOMMENDATIONS

5.1 Introduction

This section presents a summary of the research findings, conclusions and recommendations. The summary of the research findings sought to briefly explain and present the results and remarks of each of the research objectives. Finally, the recommendations were based on the outcome of the study as well as areas of further research.

5.2 Summary of the research findings

African indigenous vegetables have been found to have a very high nutritional value. Growth of these vegetables does not require very large tracts of land nor does it require many resources. However, from literature, it has been found that African indigenous vegetables (AIVs) are not widely grown in Meru and Tharaka Nithi Counties and generally in upper eastern of Kenya for consumption, yet if consumed they could improve the livelihood and nutritional situation in the Upper Eastern Kenya.

5.2.1 Identification of the common AIVs consumed in Meru and Tharaka Nithi Counties of upper Eastern Kenya

It was found out that Amaranths (Terere), Cowpeas (Nthoroko), Nightshade (manage), Ethiopian kale (Sarati), African spider (Saga), slender leaves (Murenda), watercress (saladi) and Pumpkin leaves were the common AIVs consumed with cowpeas being the most popular followed by Amaranths (Terere), followed by Nightshade/manage followed by African spider (saga) followed by Ethiopian Kale (sarati), followed by slender leaves (murenda), then watercress (saladi) followed by pumpkin leaves.

5.2.2 Examination of the socio-economic factors which influence the consumption of indigenous vegetables among Farmers, Consumers and Traders

Household annual income, household size, AIVs farm size and being in agriculture & livestock occupation were found to significantly influence consumption of the AIVs among the farmers in Tharaka Nithi and Meru counties. However, schooling years, Age of the farmer, being a casual laborer, being in formal employment, being in business, being in informal employment and group membership were found to be less important factors in influencing the consumption of the AIVs.

Schooling years, one being female, Age of the consumer, Years in schooling, being in formal employment and income were found to be the important factors influencing consumption of AIVs among the consumers. Women were more likely to purchase, cook and hence consume AIVs than their male counterparts. The factors found to influence consumption among the traders were: schooling years, Age of the trader, being in Agriculture, being a casual laborer, being in a formal employment, being in business, being in business and being in both Agriculture and Livestock occupation, household annual Income, distance to the market, culture / taboos, medicinal value found in the AIVs, Price of the AIVs and money spent weekly on AIVs. However, being male or female and the household size were found not to have influence on consumption of the AIVs among the traders.

5.2.3 Determination of the levels of knowledge in nutrition and the factors influencing them among farmers, traders and consumers

The findings revealed that the knowledge level was high among consumers followed by farmers. Traders had the least level of nutritional knowledge. The years spent in schooling, being in a formal employment or an informal employment, yearly income level, household size and the farm size used for growing AIVs were found to significantly influence the Knowledge of nutrition among farmers. Gender (being male or female), the years spent in schooling, yearly income level and the household size were found to be the significant factors influencing the knowledge of nutrition among consumers. Finally, gender (being male or female), age, being in agriculture and

livestock occupation, household size, culture taboos and the medicinal value of the AIVs were found to be the factors influencing the nutrition knowledge level among Traders.

5.2.4 Establishment of the effect of the attitude from producers, traders and consumers towards consumption of indigenous vegetables

The findings revealed that the farmer's attitude towards consumption of AIVs was associated with good health benefits, personal attitude towards AIVs and individual perception and the future benefits of AIVs. The attitude of the consumers towards consumption of AIVs was found to be associated with health benefit that comes with the AIVs, the taste, perception and attitude and the ease in preparing them. Among the traders, the attitude towards consumption was associated with health benefits, perception and attitude and the future benefits of AIVs. Results shows that on average, farmers, consumers and traders had the same score on consumption of AIVs. In conclusion, the attitude of farmers, consumers and traders had a positive effect on the consumption of AIVs.

5.3 Conclusions

This section presents the conclusion of this study presented objectively.

5.3.1 Common AIVs Consumed in Meru and Tharaka Nithi Counties

This study established that cowpeas was the most consumed (24%) AIV followed by amaranths (22.2%) and night shade (16.8%). However, amaranths was the most produced AIVs (87.8%) followed by cowpeas, night shade, Ethiopian kales and African spider at 85.4%, 51.2%, 17.1% and 9.8% respectively.

5.3.2 Socio-Economic Factors Influencing Consumption of Indigenous Vegetables

Years of schooling, type of employment, annual level, household size and farm size had a positive influence on consumption of AIVs among the farmers. Gender, household size

and income level influenced consumption among the consumers while agricultural practice, culture and taboos, medicinal values and age of the respondents influenced traders' consumption of AIVS.

5.3.3 Levels of Knowledge in Nutrition and the Factors Influencing Them

The study established that consumers had the highest level of knowledge about AIVs (2.8) followed by farmers and traders of AIVs with means 2.5 and 1.9 respectively. Years spent in schooling, being in a formal employment or an informal employment, yearly income level, household size and the farm size influenced levels of knowledge of AIVs among farmers. Level of knowledge among the traders was influenced by gender, age, household size, culture/taboos and the medicinal value of the AIVs.

5.3.4 Effect of the Attitude on Consumption of Indigenous Vegetables

Health benefits of the AIVs, taste, respondents' perception and ease of preparing the AIVs were positively associated with the attitude of the respondents towards consumption of AIVs.

5.4 Recommendations

With reference to the research objectives and findings of the study the following are the recommendations:

Cowpeas/Nthoroko, Amaranths/Terere, Nightshade/manage, African spider/saga and Ethiopian Kale/sarati should be grown for consumption and commercial purposes in Meru and Tharaka Nithi counties as they are popular among the residents respectively and seem to do well.

Household income was found to greatly influence consumption of AIVs among the farmers, consumers and traders of the people living in Tharaka-Nithi and Meru counties. Therefore, a recommendation is therefore made that more financial resource should go

to growing or producing AIVs, purchasing AIVs for consumption. AIVs farm size was found to influence production of AIVs. Therefore, it is recommended that the residents of Meru and Tharaka Nithi to allocate a bigger portion of land for growing the AIVs. It was also recommended that the more the household size, the more they should grow or produce AIVs. Finally, those in Agriculture and Livestock farming were found to influence production and consumption and therefore, they should grow and consume more of the AIVs.

Being female was found to influence marketing of the AIVs. This might have been due to the nature of women in the marketing industry. Therefore, it was recommended that more women should venture into marketing of AIVs. Again, education majorly influenced both marketing as well as consumption. Therefore, it was recommended that consumers and traders should be well schooled in order to understand AIVs as it is necessary for consumption as well as trading or marketing.

Age also influenced marketing and consumption. Elderly people seemed to be well knowledgeable on AIVs and therefore recommended that they should venture into trading/marketing as well as consume more. This would also help traders to target the elderly as they are the main market. There was need to encourage young people to be involved in farming of the AIVs as it would solve the issue of food and nutrition security in the future. One's culture and medicinal value of AIVs influenced greatly the consumption of AIVs. Therefore, it was recommended that one carry out a research on the market as well as the medicinal value content in the AIVs before trading. Again, traders are encouraged to take the AIVs near the consumers as distance to the market seemed to influence consumption of the AIVs.

5.5 Areas of Further Research

The following areas were recommended for further research. One, a further research can be carried out to identify other factors other than attitude and SE characteristics that influence consumption, production as well as marketing of the AIVs.

Secondly, the current study was limited to farmers, traders and consumers in Tharaka Nithi and Meru Counties. There is need for another study to be carried out in other counties.

REFERENCES

Abukutsa-Onyango, M. O. (2003). Unexploited potential of indigenous African vegetables in Western Kenya. *Maseno Journal of Education, Arts and Science 4 (2): 103-122.*

Abukutsa-Onyango, M. O. (2005). Conservation and seed production of African Leafy Vegetables. Africa Crop Science Proceedings Vol. 7, 1200-1204.

Abukutsa-Onyango, M. O. (2007). The diversity of cultivated African Leafy Vegetables in three communities of Western Kenya. *African Journal of Food Agriculture Nutrition and development online 7(3) pages1200-1203*

Abukutsa-Onyango, M. O. (2009). Development and promotion of technologies for sustainable production and utilization of indigenous vegetables for nutrition security and wealth creation in Kenya. *Agricultural Innovations for Sustainable Development*, *2*(1), 100-108.

Adebooye, O. C. & Opabote, J. T. (2004). Status of conservation of the indigenous leaf vegetables and fruits of Africa. *African Journal of Biotechnology 3,* 700-705.

Ambrose-Oji, B. (2009). Urban Food Systems and African Indigenous Vegetables: Defining the Spaces and Places for African Indigenous Vegetables in Urban and Peri-Urban Agriculture Urban food systems and trends in vegetable production in urban. In African indigenous vegetables in urban agriculture (pp. 33-66). Routledge.

Bartholomew, D. J., Knott, M., & Moustaki, I. (2011). *Latent variable models and factor analysis: A unified approach* (Vol. 904). John Wiley & Sons.

Cannoosamy, K., Pugo-Gunsam, P., & Jeewon, R. (2014). Consumer knowledge and attitudes toward nutritional labels. *Journal of nutrition education and behavior*, *46*(5), 334-340.

Chadha, M. L., & Oluoch, M. O. (2003). Home-based vegetable gardens and other strategies to overcome micronutrient malnutrition in developing countries. Food Nutrition and Agriculture, (32), 17-23.

Chweya, J. A., & Eyzaguirre, P. B. (1999). The biodiversity of traditional leafy vegetables (No. 581.15 B615b). IPGRI, Roma (Italia).

Creswell, J. W. (2009). Mapping the field of mixed methods research. *Journal of Mixed Methods Research, 3(2),* 95-108.

DFID & R4D (2010). Opportunities and Constraints in the Subsistence Production and Marketing of Indigenous Vegetables in East and Central Africa. R4D Project. Retrieved March 5th 2015, from www.dfid.gov.uk/R4D/Project/1702/Default.aspx.

Ekesa, B. N., Walingo, M.K., & Abukutsa-Onyango, M. O., (2009). Accessibility to and Consumption of Indigenous Vegetables and Fruits by Rural Households in Matungu Division,

Faber, M., Oelofse, A., Van Jaarsveld, P. J., Wenhold, F. A. M., & Jansen van Rensburg, W. S. (2010). African leafy vegetables consumed by households in the Limpopo and KwaZulu-Natal provinces in South Africa. *South African Journal of Clinical Nutrition, 23(1),* 30-38.

Gido, E. O., Ayuya, O. I., Owuor, G., & Bokelmann, W. (2017). Consumption intensity of leafy African indigenous vegetables: towards enhancing nutritional security in rural and urban dwellers in Kenya. *Journal o*f *Agricultural and Food Economics, 5(1),* 14.

Hughes, J. D. A., & Ebert, A. W. (2011, June). Research and development of underutilized plant species: the role of vegetables in assuring food and nutritional security. In *II International Symposium on Underutilized Plant Species: Crops for the Future-Beyond Food Security 979* (pp. 79-92).

Imungi, J. K. (1999). Traditional green leafy vegetables of Kenya. In Chweya JA and Eyzaguirre, PB Eds. The Biodiversity of Traditional Leafy Vegetables pp. 51-83. IPGRI, Rome, Italy.

Imungi, J. K. (2002). The brighter side of phenolic compounds abundance in African leafy vegetables in IPGRI. Newsletter for Sub-Saharan Africa, 17, 7-13.

Imungi, J. K., & Potter, N. N. (1983). Nutrient contents of raw and cooked cowpea leaves. *Journal of food science*, *48(4)*, 1252-1254. `

Irungu, C. I. (2002). Outreach performance of Non-governmental development organizations in Eastern Kenya. Wissenschaftsverlag Vauk.

Kathure, M., Kavoi, M. M., & Turoop, L. (2019). Analysis of market trends and consumption of indigenous vegetables in Meru and Tharaka Nithi Counties (Upper Eastern Kenya). *Journal of Emerging Trends in Economics and Management Sciences*, *10*(1), 24-32.

Kebede S. W, & Bokelmann, W. (2017). African Indeginous Vegetables and their production practices: Evidence from the HORTINLEA Survey in Kenya.

Keller, G. B., Mndiga, H., & Maass, B. L. (2004). Production and consumption issues of traditional vegetables in Tanzania from the farmers‟ point of view. Seminar presented at Deutscher Tropentag, 5–7 October 2004, Berlin, Germany.

Keller, G. B., Mndiga, H., & Maass, B. L. (2005). Diversity and genetic erosion of traditional vegetables in Tanzania from the farmer's point of view. Plant Genetic Resources, 3(3), 400–413.

Kiambi, D. & Atta-Krah, K. (2003). Plant Genetic resources in the global and African setting. Proc. of the 1st PROTA Int. Workshop 23-25 September, 2002, Nairobi, Kenya. pp. 269-270.

Kimiywe, J., Waudo, J., & Mbithe, D. (2006). Reducing hidden hunger and malnutrition through traditional foods. *Nairobi, IPGRI Newsletter for sub-Saharan Africa. Issue*, (21).

Kimiywe, J., Waudo, J., Mbithe, D., & Maundu, P. (2007). Utilization and Medicinal Value of Indigenous Leafy Vegetables consumed in Urban and peri-urban Nairobi. *African Journal of Food Agriculture and Development, .Volume* 7 no.4. 1-15. online

Kirigia, D., Kasili, R., & Mibus, H. (2017). African Leafy Vegetables Pre-harvest and Post-harvest constrains and Technologies for losses reduction along the field to consumer chain. *African Journal of Horticultural Science*, *12*, 51-60.

Kumar, R., & Rajasree, V. (2018). Underutilized vegetables as rich source of medicinal value: A boon for the pharmaceutical industries and farmer income. *IJCS, 6*(4), 3320-3323.

Lewu, F. B., & Mavengahama, S. (2011). Utilization of wild vegetables in four districts of northern KwaZulu-Natal Province, South Africa. *African Journal of Agricultural Research,* 6(17), 4159-4165.

Masayi, N., & Netondo, G. W. (2012). Effects of sugarcane farming on diversity of vegetable crops in Mumias Division, Western Kenya. *International Journal of Biodiversity and Conservation,* 4(13), 515-524.

Maundu, P. M. (1997, August). The status of traditional vegetable utilization in Kenya. In *Traditional African Vegetables. Proceedings of the IPGRI International workshop on Genetic Resources of Traditional Vegetables in Africa. Conservation and Use. ICRAF-HQ, Nairobi. Institute of Plant Genetic and Crop Plant Research, Rome* (pp. 66-71).

Maundu, P. M. (2004). Traditional African leafy vegetables: from despised to prized. *Geneflow, a publication about the Earth's genetic resources, Rome, IPGRI*.

Muhanji, G., Roothaert, R. L., Webo, C., & Stanley, M. (2011). African indigenous vegetable enterprises and market access for small-scale farmers in East Africa. *International Journal of Agricultural Sustainability*, *9*(1), 194-202.

Mumbi, K., Karanja, N., Njenga, M., Kamore, M., Achieng, C., & Ngeli, P. (2006). Investigative Market Research: Viable Market Opportunities and Threats for Urban and Peri-Urban Farmers. Farm Concern International, Urban Harvest and International Potato Centre, Nairobi.

Mwangi, S., & Kimathi, M. (2006, October). African leafy vegetables evolves from underutilized species to commercial cash crops. In Research Workshop on Collective Action and Market Access for Smallholders. Cali, Colombia (pp. 2-5).

Mwaniki, P., Village, D. B., & Hotel, N. K. B. B. (2008). Cataloguing and Evaluation of Available Community/Farmers-Based Seed Enterprises on African Indigenous Vegetables (AIVS) Four Eca Countries.

National Research Council [NRC] (2006). Lost Crops of Africa: Volume II: Vegetables. Washington, DC: The National Academies Press,

Ngugi, I. K., Gitau, R., & Nyoro, J. (2007). Access to high value markets by smallholder farmers of African indigenous vegetables in Kenya. Regoverning Markets Innovative Practice Series, IIED, London.

Ntawuruhunga, D., Assefa, F. A., Mambo, W., Momanyi, H. M., & Omeli, M. R. (2016). Farmers' Knowledge, Attitude and Practice towards African Indigenous Vegetables in Kenya.

O'Connor, T. M., Hughes, S. O., Watson, K. B., Baranowski, T., Nicklas, T. A., Fisher, J. O., & Shewchuk, R. M. (2010). Parenting practices are associated with fruit and vegetable consumption in pre-school children. Public health nutrition, 13(1), 91-101.

Oniang'o, R. (2012). Do multiple interventions improve health and nutrition outcomes at the family level? *African Journal of Food, Agriculture, Nutrition and Development*, 12(1).

Onyango, A. (2015). African indigenous vegetables in Kenya. *Available: researchgate. net*.

Onyango, C. M., Imungi, J. K., Mose, L. O., Harbinson, J., & Kooten, O. V. (2009). Feasibility of commercial production of amaranth leaf vegetable by small-scale farmers in Kenya. In *9th African Crop Science, Conference Proceedings, Cape Town, South Africa, 28 September-2 October 2009* (pp. 767-772). African Crop Science Society.

Otieno, D. J., Omiti, J., Nyanamba, T., & McCullough, E. (2009). Market participation by vegetable farmers in Kenya: A comparison of rural and peri-urban areas. *African Journal of Agricultural Research*, *4*(5), 451-460.

Pieroni, A., Nebel, S., Quave, C., Münz, H., & Heinrich, M. (2002). Ethnopharmacology of liakra: traditional weedy vegetables of the Arbëreshë of the Vulture area in southern Italy. *Journal of ethno pharmacology*, 81(2), 165-185.

Raetz, C. R., Garrett, T. A., Reynolds, C. M., Shaw, W. A., Moore, J. D., Smith, D. C., & Reichart, D. (2006). Kdo2-Lipid A of Escherichia coli, a defined endotoxin that activates macrophages via TLR-4. *Journal of lipid research*, 47(5), 1097-1111.

Schippers R.R. (2002). African indigenous vegetables: an overview of the cultivated species. Chatham, UK. Natural Resources Institute /ACP-EU Technical Centre for Agricultural and rural Cooperation

Shackleton, C. M., Pasquini, M. W., & Drescher, A. W. (Eds.). (2009). African indigenous vegetables in urban agriculture. Routledge.

Smith, I. F., & Eyzaguirre, P. (2007). African Leafy Vegetables: their role in the World Health Organization's Global Fruit and Vegetables. Journal of food. Agriculture, Nutrition and Development, Rural Outreach Kenya 7(3), Retrieved from https://www.researchgate.net/publication/43554717/download

Taruvinga, A., & Nengovhela, R. (2015, March). Consumers' perceptions and consumption dynamics of African leafy vegetables (ALVs): Evidence from Feni communal area, Eastern Cape province, South Africa. In 5th international conference on biomedical engineering and technology (ICBET 2015). IPCBEE (Vol. 18, No. 1, pp. 89-95).

Uusiku, N. P., A. Oelofse, A., Duodu, K. G., Bester, M. J. & Faber, M. (2010). Nutritional value of leafy vegetables of sub-Saharan Africa and their potential contribution to human health: A review. *Journal of Food Composition and Analysis* 23, pp499-509.

Vorster, H. J. (2009). The role and production of traditional leafy vegetables in three rural communities in South Africa (Doctoral dissertation, University of Pretoria).

Vorster, H. J., Van Rensburg, J. and Sonja, V. (2007). The importance of Traditional leafy vegetables in South Africa. *African Journal of food Agriculture Nutrition and Development* Vol 7 no.4 online. Accessed on 27th May 2013.

Weinberger, K., Pasquini, M., Kasambula, P., & Abukutsa-Onyango, M. (2011). Supply chains for indigenous vegetables in urban and peri-urban areas of Uganda and Kenya: a gendered perspective. Vegetable production and marketing in Africa: Socio-economic research, 169-181.

Weller, S. C., Van Wyk, E., & Simon, J. E. (2014, August). Sustainable production for more resilient food production systems: case study of African indigenous vegetables in eastern Africa. In *XXIX International Horticultural Congress on*

Horticulture: Sustaining Lives, Livelihoods and Landscapes (IHC2014): 1102 (pp. 289-298).

Wemali, E. N. C. (2014). Contribution of cultivated African indigenous vegetables to agro biodiversity conservation and community livelihood in mumias sugar belt, Kenya. Unpublished PhD Theses, Kenyatta University. Kenya.

APPENDICES

Appendix I: Letter to the Respondent

Martha Kathure Mungathia,
P.O. Box, 01000-314
Thika.
Email -mkmasinde@yahoo.com

Respondents,
Meru and Tharaka Nithi Counties

Dear Sir/Madam,

RE: REQUEST FOR RESEARCH DATA

I am a student at Jomo kenyatta University of science and technology pursuing Masters of science RESEARCH METHODS at JKUAT. I am carrying out a research on 'Analysis market trends and consumption of indigenous vegetables in Upper Eastern.' The case adopts Meru and Tharaka Nithi Counties as the sample group. To enable me collect data for this research, I humbly request you to peruse the questionnaire and respond. I assure you that any information you provide in this questionnaire will only be used for academic purpose. Upon request, a copy of the final paper will been made available to you

Yours Sincerely,

Martha

Appendix II: Analysis of Market Trends and Consumption of Indeginous Vegetables in Uppper Eastern; Case Study (Meru And Tharaka Nithi Counties)

1. Farmers' questionnaires for traditional African Vegetables

Name of Enumerator: _____ Questionnaire Number: _____

Date of Interview: _____ Start time: _____ Time to finish: _____

Location: _____ Name of Respondent: _____

Section 1: Demographic Characteristics of Respondent

Farmer Characteristics

Sex 1 = Male 2 = Female	Age in years	Marital Status *(codes below)*	Highest level of education *(codes below)*	Number of years in school	Main Occupation *(see codes)*

Marital status 1=Monogamous Married, 2=Polygamous Married, 3=Single, 4=Separated, 5=Divorced, 6=Widow or Widower.

Education Level 1=None 2= Primary 3=Secondary 4=Middle-level college 5=University 6= others

(*Specify*)

_____

Occupation 1=Agriculture 2=Casual labourer 3=Formal Employment 4=Business 5= Informal employment 6= Agriculture and livestock 7= other (*specify*) _____

1. What size of income did your household have for the past 12 months? _____ kshs.
2. What is the size of your household? …….
3. What ethnicity group do you belong to?

Imenti ( ) Chogoria ( ) Tharaka ( ) Chuka ( ) Tigania ( )

Any other _____

Section 2: Production of traditional African Vegetables

1. Do you plant traditional vegetables on your farm? ___ [1 = Yes, 0 = No]
   If "Yes", go to number 2b of this section; if No, answer number 2a then stop.
2. (a) If you do not grow any of the traditional vegetables on your farm, why is it so? Reasons for not cultivating (*please tick as appropriate*)

1 = Size of land is Small	2 = Changes in consumption tastes, perceptions and preferences	3 = Labor intensiveness	4 = High cost of seeds	5 = Lack of awareness campaigns	6 = Water unavailability	7 = Others (*Please specify*)

(b) Which of the following traditional vegetables have you grown on your farm in the last 12 months? (*Please tick as appropriate)*

1= cowpeas /Nthoroko	2 = Amaranths / Terere	3 = Night shade/managu	4 = spider plant / saga	5= Ethiopian kale / Sarati	6= Others (Specify)

(c) From the question (b) above ranks your crops according to the order of their nutritional potential.

1= cowpeas /Nthoroko	2 = Amaranths / Terere	3 = Night shade/managu	4 = spider plant / saga	5= Ethiopian kale / Sarati	6= Others (Specify)

3. A) Do you grow your traditional vegetables under any of the following scale? (*Tick the appropriate answer only*)

   i) Kitchen garden ( )

   ii) Home garden ( )

   iii) Commercial farm ( )

   B) What is the average size of your land under traditional vegetables? _____ Acre or M^2.

4. What is main purpose for growing traditional vegetables on your farm? *(Tick all that apply)*

1 =	2 = Family	3 = Contract with	4 = Both 1 and	5 = Others

Commercial	consumption	traders`	2	(*specify*)

Section 3. Nutrition Knowledge

1. Understanding of nutrition terms

   (a) Do you know what a balance diet is? ____ [1= Yes, 0 = No] If yes, explain

   _____

2. Please, mention five groups of foods that constitute a balance diet. [*Fruits, vegetables, grain, protein, dairy*]

   _____

   Awareness of dietary recommendation

   Do you know the quantity of fruits and vegetable that one should consume per day? __ [1 = Yes, 0 = No]. If yes, how much_____. (*It should be 400gm/day/ person.*)

3. Knowledge of foods as a source of nutrients

   Is a balanced diet important to your body? ___ [1 = Yes, 0 = No] If yes, mention the benefits of a balance diet.

   _____

4. Ability to apply nutrition information in choices.

   Do you consider nutritional value before you grow traditional vegetables? [1 = Yes, 0 = No] If yes, can you explain a bit?

   _____

5. Awareness of diet-diseases associations

   Are you aware of nutritional disorders caused by lack of sufficient consumption of traditional vegetables? _____ [1 = Yes, 0 = No]

If yes, please mention any three diseases related to lack of a balance diet or essential nutrients.

_____

Total Nutrition Knowledge scored: [_____]

Section 4. Consumption Frequency of Traditional African Vegetables

1. Do you consume traditional African vegetables in your household? ___ [1 = Yes, 0 = No]

If "Yes", go to number 2b of this section; if No, answer number 2a then stop here.

2. (a) i) If you do not consume any of the traditional vegetables in your household, what other types of vegetables do you consume?

_____

ii) What is the reason for not consuming traditional vegetables? _____

iii) Did you use to consume traditional vegetables in the past? [1 = Yes, 0 = No] If yes, why, if no why

_____

iv) Would you want to consume traditional vegetables in the future? ___ [1 = Yes, 0 = No]

(b) Which of the following traditional vegetables did you consume in your household a week ago? (*please tick as appropriate*)

(Do not tick but place number for source: 1 = Purchased; 2 = Produced, 3 = Collected; 4 = gift; 5 = other)

Traditional African	**Per Week**	**Source**

Vegetables	Once or twice	3 or 4 times	5 or 6 times	More than 6 times	Never/ almost never	
1= Cowpeas / ***Nthoroko***						
2= Amaranth /Terere						
3= African nightshade /managu						
4= Spider plant / **Saga**						
5= Ethiopian kale / **Sarati**						
6= Slender leaves /murenda						
7= Watercress/ ***Saladi***						
8= Pumpkin / ***marenge***						
9= Others (*specify*) i. _____ ii. _____						

3. If you were to buy traditional vegetables for use in your household, how much would you think you will spend per week? _____kshs.

4. a) Does your culture have any taboos regarding the consumption of traditional vegetables? ___

   [1 = Yes, 0 = No]

   b) If Yes, which taboos/regulations? Please explain. _____

c) Has this affected your consumption of traditional vegetables? … [1=Yes, 0 = No]

5. What are the reasons for you to consume traditional vegetables? (*Tick as appropriate*)

1 = Vegetable takes a short time to cook ( )

2 = Vegetable is easy to cook ( )

3 = Vegetable is medicinal ( )

4 = Vegetable can be combined with others ( )

5 = Vegetable can be prepared in many ways ( )

6 = Vegetable is considered nutritious ( )

7 = Vegetables` price is affordable ( )

8 = Vegetables are easy to dry and use during scarcity or drought ( )

6. (a) If you were to buy from the market, how many minutes would you take to get to the nearest market? ___minutes (*help with estimation if needed*)

(b) Would this distance discourage your consumption of traditional vegetables? [1 = Yes, 0 = No] If yes, how does it discourage you?

_____

Section 5: Household Membership in Groups

1. Are you a member of a social group or organization? (1=Yes 0=No)

2. Indicate in the table below the type of group/ organization

Type of group			Number of meetings per month	**Benefits**		
1= Business	2 = Farmer	3 = Self-help/ credit		0= None	1=education and training	2=credit
4= Merry-go-round Round	5= Women	6=Family/clan		3=labor sharing	4=market access	5=resource access (eg.water)
7= Saccos	8=Other (specify)					

Section 6: Attitude towards traditional vegetable consumption

(Tick appropriate, 5 = strongly agree, 4 = Agree, 3 = Not sure, 2 =Disagree, 1 = strongly disagree)

Items	**5**	**4**	**3**	**2**	**1**
While consumption of traditional vegetables is important for women and children, it is also important for men.					
Traditional vegetables are inferior foods that are good when one doesn`t have much money or food at home.					
Fresh traditional vegetables are likely to contain more nutrients than dried ones.					
Eating a variety of traditional vegetables each day probably gives you all the vitamins and minerals you need.					
It is important to choose a daily diet accompanied by traditional vegetables.					
Consumption of traditional vegetables improve eye sight and boost body immunity.					
Traditional vegetables are best consumed when fresh.					

Traditional vegetables takes more time to prepare.					
Traditional vegetables are not good to me.					
Traditional vegetables are tasteless and bitter					
I am willing to contribute my resources including my time to safeguard and preserve traditional vegetables for the next generation.					

Thanks you for your cooperation and be blessed

Appendix III: Analysis of Market Trends and Consumption of Indeginous Vegetables in Upper Eastern; Case Study (Meru And Tharaka Nithi Counties)

2. Traders' questionnaire for Traditional Vegetables

Name of Enumerator: _____ Questionnaire Number: _____

Date of Interview: _____ Start time: _____ Time to finish: _____

Location: _____ Name of Respondent: _____

Section 1: Demographic Characteristics of Respondent

Sex 1 = Male 2 = Female	Age in years	Marital Status *(codes below)*	Highest level of educatio n *(codes below)*	Number of years in school	Main Occupation *(see codes)*

Marital status 1=Monogamous Married, 2=Polygamous Married, 3=Single, 4=Separated, 5=Divorced,

6=Widow or Widower.

Education Level 1=None 2= Primary 3=Secondary 4=Middle-level college 5=University 6= others

(*Specify*) _____

Occupation 1=Agriculture 2=Casual labour 3=Formal Employment 4=Business 5=Informal employment 6=Agriculture and livestock 7= other (specify) _____

1. What is the size of income that your household had for the past 12 months? _____ Tshs.
2. What is the size of your household? …….
3. What ethnicity group do you belong to?

   = Tigania

   1( ) 2 = Tharaka ( ) 3 = chogoria ( ) 4 = Imenti ( )

   = Chuka

   4() 5 = others (*please specify*) _____

Section 2: Traditional vegetables business

1. What is the nature of your vegetable business? _____ [01= Full time, 02= Part time]
2. How long you have been trading in traditional vegetables? _____ years/months *(specify)*.
3. What main types of traditional vegetables that are you are engaged in? (*Rank by giving 12 for most traded going down to least*)

Traditional vegetables	**Rank**
1 = Cowpeas/ Nthoroko	
2 = Amaranth / Terere	
3 = African nightshade / ***Managu***	
4 = Spider flower / ***saga***	
5 = Sweet potatoes leaves	
6 = Cassava leaves / ***Makwacii***	

7 = Pumpkin leaves / ***Marenge***	
8 = Okra / ***Bamia***	
9 = Jute mallow / ***Mlenda***	
10 = Cowpea leaves / ***Majani ya kunde***	
11 = Watercress / ***Saladi***	
12 = Other (*Specify*)	

4. Who are your main traditional vegetables customers at the market? (*Tick all that apply*)

1 = Home consumers	2 = Restaurants/ Hotels	3 = Retailers/Wholesalers	4 = Other (*specify*)

5. How much of traditional vegetables do you normally trade per week? _____ (bunches or kg.)

Section 3. Nutrition Knowledge

1. Understanding of nutrition terms

   a) Do you know what a balance diet is? ____ [1= Yes, 0 = No] If yes, explain

   _____

   b) Please, mention five groups of food that constitute a balance diet. [*Fruits, vegetables, grain, protein, dairy*]

   _____

   _____

2. Awareness of dietary recommendation

   Do you know the quantity of fruits and vegetable that one should consume per day? __ [1 = Yes, 0 = No]. If yes, how much_____. (*It should be 400gm/day/ person.*)

3. Knowledge of foods as a source of nutrients

   Is a balance diet important to your body? ___ [1 = Yes, 0 = No] If yes, mention the benefits of a balance diet. _____,_____,_____

4. Ability to apply nutrition information in choices.

   Do you consider nutrition status before you decide which traditional vegetables to trade in? [1 = Yes, 0 = No] If yes, can you explain briefly? _____

5. Awareness of diet-diseases associations

   Are you aware of nutritional disorders caused by lack of sufficient consumption of traditional vegetables? _____ [1 = Yes, 0 = No]

   If yes, please mention any three diseases related to lack of balance diets or essential nutrients.

Total Nutrition Knowledge scored: [_____]

Section 4. Consumption Frequency of Traditional African Vegetables

1. Do you consume traditional African vegetables in your household? ____ [1 = Yes, 0 = No]

   If "Yes", go to number 2b of this section; if No, answer number 2a then stop here.

2. (a) i) If you do not consume any of the traditional vegetables in your household, what other types of vegetables do you consume? _____

   ii) What is the reason for not consuming traditional vegetables? _____

iii) Did you use to consume traditional vegetables in the past? [1 = Yes, 0 = No] If yes, why, if no why

_____

iv) Would you want to consume traditional vegetables in the future? [1 = Yes, 0 = No] (b)Which of the following traditional vegetables did you consume in your household a week ago? (*please tick as appropriate*)

(Do not tick but place number for source: 1 = Purchased; 2 = Produced, 3 = Collected; 4 = gift; 5 = other)

Traditional African Vegetables	**Per Week**					**Source**
	Once or twice	3 or 4 times	5 or 6 times	More than 6 times	Never/ almost never	
1= Cowpeas / ***Nthoroko***						
2= Amaranth / ***terere***						
3= African nightshade / ***Managu***						
4= Spider plant / ***saga***						
5= Ethiopian Kale/ sarati						
6= Potatoes leaves						
7= Pumpkin / ***Marenge***						
8= Watercress / ***Saladi***						
= Others 9(*specify*)						

3. If you were to buy vegetables for use in your household, how much do you think you will spend per month? _____ kshs.

4. a) Does your culture have any taboos regarding the consumption of traditional vegetables? ___
   [1 = Yes, 0 = No]

   b) If Yes, which taboos/regulations? Please explain.
   _____

   c) Has this affected your consumption of traditional vegetables? ____
   [1=Yes, 0 = No]

5. What are the reasons for you to consume traditional vegetables? (*Tick as appropriate*)

   1 = Vegetable takes a short time to cook ( )

2 = Vegetable is easy to cook ( )

3 = Vegetable is medicinal ( )

4 = Vegetable can be combined with others ( )

5 = Vegetable can be prepared in many ways ( )

6 = Vegetable is considered nutritious ( )

7 = Vegetables` price is affordable ( )

8 = Vegetables are easy to dry and use during scarcity or drought ( )

6. (a) If you were to go to the market, how many minutes would you take from home to the nearest market? _____minutes (*help with estimation if needed*)

(b) Would this distance discourage you from consuming traditional vegetables? [1 = Yes, 0 = No] If yes, how would this distance discourage you?

_____

Section 5. Membership in Groups

1. Is anyone in this household a member of a group? [1=Yes 0=No]
2. Indicate in the table below the type of group

Type of group			Number of meetings per month	**Benefits**		
1 = Business	2 = Farmer	3 = Self-help/ credit		0= None	1=education and training	2=credit
4 = Merry-go-Round	5= Women	6=Family/clan		3=labor sharing	4=market access	5=resource access (eg.water)
7= Saccos	8=Other (specify)					

Section 6: Attitude towards traditional vegetable consumption

(Tick appropriate, 5 = strongly agree, 4 = Agree, 3 = Not sure, 2 =Disagree, 1 = strongly disagree)

Items	**5**	**4**	**3**	**2**	**1**
While consumption of traditional vegetables is important for women and children, it is also important for men.					
Traditional vegetables are inferior foods that are good when one doesn`t have much money or food at home.					
Fresh traditional vegetables are likely to contain more nutrients than dried ones.					
Eating a variety of traditional vegetables each day probably gives you all the vitamins and minerals you need.					
It is important to choose a daily diet accompanied by traditional vegetables.					
Consumption of traditional vegetables improve eye sight and boost body immunity.					
Traditional vegetables are best consumed when fresh.					
Traditional vegetables takes more time to prepare.					
Traditional vegetables are not good to me.					
Traditional vegetables are tasteless and bitter					

I am willing to contribute my resources including my time to safeguard and preserve traditional vegetables for the next generation.					

Thanks you for your cooperation and be bless

Appendix IV: Analysis of Market Trends and Consumptiono Indeginous Vegetables in Uppper Eastern; Case Study (Meru and Tharaka Nithi Counties)

3. Questionnaire for traditional African vegetables buyers/consumers

Name of Enumerator: _____ Questionnaire Number: _____

Date of Interview: _____ Start time: _____ Time to finish: _____

Location: _____ Name of Respondent: _____

Section 1: Demographic Characteristics of Respondent

Sex 1 = Male 2 = Female	Age in years	Marital Status *(codes below)*	Highest level of education *(codes below)*	Number of years in school	Main Occupation *(see codes)*

Marital status 1=Monogamous Married, 2=Polygamous Married, 3=Single, 4=Separated, 5=Divorced,

6=Widow or Widower

Education Level 1=None 2= Primary 3=Secondary 4=Middle-level college 5=University 6= others

(*Specify*)

_____

1=Agriculture 2=Casual labour 3=Formal Employment

Occupation 4=Business 5= Informal

Employment 6= Agriculture and livestock 7= other(*specify*) _____

1. What size of income did your household have for the past 12 months? _____Kshs.
2. What is the size of your household? …….
3. What ethnicity group do you belong to?

1

= Imenti ( ) 2 = Tharaka ( ) 3 = Tigania ( )4 = Chuka ( )

5 = others (*please specify*) _____

Section 2: Traditional African vegetables

1. Where do you usually buy traditional African vegetables from? *(Tick all that apply)*

1 = Town Market	2 = Street vendors	3 = Supermarkets	4 = Others (*specify*)

2. How often do you go to this market? (*Tick all that apply*)

1= Daily		2 = Weekly		3 = Monthly	

3. Are these vegetables for your home consumptions? ___ (1= Yes, 0 = No) If No, please explain _____

4. How much do you spend per week for purchase of these vegetables? _____ kshs.

5. What are the common types of traditional African vegetables do you normally buy from this market? (*Rank by giving 11 for most purchased going down to least)*

Traditional vegetables	**Rank**
1 = Ethiopian kale / ***sarati***	
2 = Amaranth/ ***Terere***	
3 = African nightshade / ***Managu***	
4 = Sweet potatoes leaves /makwacii	
5 = Okra / ***Bamia***	
6 = Cassava leaves /	
7 = Jute mallow / ***Mrenda***	
8 = Pumpkin leaves / ***Majani ya malenge***	
9 = Cowpea leaves / ***Majani ya kunde***	
10 = African spider flower / ***saga***	
11. = Watercress / saladi	

Section 3. Nutrition Knowledge

1. Understanding of nutrition terms

   a) Do you know what a balanced diet is? ____ [1= Yes, 0 = No] If yes, explain

   _____

b) Please, mention five groups of balance diet. [*Fruits, vegetables, grain, protein, dairy*]

_____

2. Awareness of dietary recommendation

   Do you know the quantity of fruits and vegetables that one has to consume per day? __ [1 = Yes, 0 = No]. If yes, how much_____. *(It should be 400gm/day/ person).*

3.Knowledge of foods as a source of nutrients

   is a balanced diet important to your body? ___ [1 = Yes, 0 = No] If yes, mention the benefits of a balanced diet.

   _____

4.Ability to apply nutrition information in choices.

   Do you consider nutrition status before you buy traditional vegetables? [1 = Yes, 0 = No] If yes, can you explain a bit?

   _____

5. Awareness of diet-diseases associations

   Are you aware of nutritional disorders caused by lack of sufficient consumption of traditional vegetables? _____ [1 = Yes, 0 = No]

   If yes, please mention any three diseases related to lack of balance diets/ nutrients.

   _____

Total Nutrition Knowledge scored: [_____]

Section 4. Consumption Frequency of Traditional African Vegetables

1. Do you consume traditional African vegetables in your household? ____ [1 = Yes, 0 = No]

   If "Yes", go to number 2b of this section; if No, answer number 2a then stop.

2. (a) i) If you do not consume any of the traditional vegetables in your household, what other types of vegetables do you consume?

_____

_____

ii) What are your reasons for not consuming traditional vegetables?

_____

iii) Did you use to consume traditional vegetables in the past? [1 = Yes, 0 = No] If yes, why, if no why

---

Would you want to consume traditional vegetables in the future? [1 = Yes, 0 = No]

(b) Which of the following traditional vegetables did you consume in your household a week ago?

(Do not tick but place number for source: 1 = Purchased; 2 = Produced, 3 = Collected; 4 = gift; 5 = other)

Traditional African Vegetables	**Per Week**					**Source**
	Once or twice	3 or 4 times	5 or 6 times	More than 6 times	Never/ almost never	
1= Ethiopian kale / ***Sarati***						
2= Amaranth / ***Terere***						
3= African nightshade / ***Managu***						
4= Spider plant / ***Saga***						
5= Ethiopian mustard / ***Sarati***						
6= Potatoes leaves / ***Mathungu***						
7= Pumpkin / ***Marenge***						
8= Watercress / ***Saladi***						
9= Others (*specify*)						

3. a) Does your culture have any taboos regarding the consumption of traditional vegetables? ___

[1 = Yes, 0 = No]

b) If Yes, which taboos/regulations? Please explain.

_____

c) Has this affected your consumption of traditional vegetables? … [1=Yes, 0 = No]

4. What are reasons for you to consume traditional vegetables? (*Tick as appropriate*)

1 = Vegetable takes a short time to cook ( )

2 = Vegetable is easy to cook ( )

3 = Vegetable is medicinal ( )

4 = Vegetable can be combined with others ( )

5 = Vegetable can be prepared in many ways ( )

6 = Vegetable is considered nutritious ( )

7 = Vegetables` price is affordable ( )

8 = Vegetables are easy to dry and use during scarcity or drought ( )

5. (a) How many minutes do you take to get to the nearest market? _____minutes (*help with estimation if needed*)

(b) Does this distance discourage your consumption of traditional vegetables? [1 = Yes, 0 = No] If yes, how does it discourage you?

_____

Section 5: Membership in Groups

1. Do you belong to a group? ____ (1=Yes 0=No)
2. Indicate in the table below the type of group/ organization

Type of group			Number of meetings per month	**Benefits**		
1 = Business	2 = Farmer	3 = Self-help/ credit		0= None	1=education and training	2=credit
4 = Merry-go-round	5= Women	6=Family/clan		3=labor sharing	4=market access	5=resource acce (eg.water)
7= Saccos	8=Other (specify)					

Section 6. Attitude towards traditional vegetable consumption

(Tick appropriate, 5 = strongly agree, 4 = Agree, 3 = Not sure, 2 =Disagree, 1 = strongly disagree)

Items	**5**	**4**	**3**	**2**	**1**
While consumption of traditional vegetables is important for women and children, it is also important to men.					
Traditional vegetables are inferior foods that are good when one doesn`t have much money or food at home.					
Fresh traditional vegetables are likely to contain more nutrients than dried ones.					
Eating a variety of traditional vegetables each day probably gives you all					

the vitamins and minerals you need.					
It is important to choose a daily diet accompanying with traditional vegetables.					
Consumption of traditional vegetables improve eye sight and boost body immunity.					
Traditional vegetables are best consumed when fresh.					
Traditional vegetables take more time to prepare.					
Traditional vegetables are not good to me.					
Traditional vegetables are tasteless and bitter					
I am willing to contribute my resources including my time to safeguard and preserve traditional vegetables for the next generation.					

Thanks you for your cooperation and be blessed

Appendix V: A Screen plot having the Farmers Eigenvalues Vs Factor number