ANALYSIS OF FACTORS INFLUENCING PRODUCERS, TRADERS AND CONSUMERS' INTAKE OF TRADITIONAL AFRICAN VEGETABLES: THE CASE STUDY OF ARUSHA REGION, TANZANIA

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Analysis of Factors Influencing Producers, Traders and Consumers' Intake of Traditional African Vegetables:

The Case Study of Arusha Region, Tanzania

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DECLARATION

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

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DEDICATION

I dedicate this work to my wife, Irene Johnson Kimambo for her tireless efforts, encouragement and support which ensure that I successful accomplish this task. Also, I would like to dedicate this work to our children, Zoe Johnson, Jason Johnson and Jaysen Johnson for allowing Dad to study.

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ABSTRACT

The contribution of Traditional African Vegetables (TAVs) to reduction of malnutrition, stunting and poor health among consumers in Sub-Saharan Africa cannot be overemphasized. This is due to high contents of vitamins, essential minerals and a source of dietary fiber. Although TAVs form a significant component of many families` diets in Tanzania, consumption is still below the amount recommend by WHO and FAO in most regions. This study identified traditional African vegetables with high nutritional potential and examined awareness of nutrition knowledge, factors that influence intake frequency of traditional African vegetables and attitudes of farmers, traders and consumers towards traditional vegetables. The study used data collected from 381 respondents through personal interviews using pre-tested questionnaires and focus group discussion. The study was conducted in Arumeru District, Arusha Region. The analysis was conducted using regression models. Generalized Poisson regression model was used to determine awareness of nutrition knowledge and factors influencing intake frequency of traditional African vegetables among farmers, traders and consumers. Descriptive and factor analysis methods were used to assess the attitudes of farmers, traders and consumers towards traditional African vegetables.

Descriptive statistics results showed that African nightshade was ranked high due to its nutritional potential based on the opinion of the respondents. The study found out that there was average awareness of nutrition knowledge for both farmers, traders and consumers. Results indicate that awareness of nutrition knowledge was highest in the famers category. Generalized Poisson regression results show that gender, number of years in schooling, age household size and farm size influence farmers' awareness of nutrition knowledge. The results also show that age, number of years in schooling, annual income, household size, interaction of age and annual income, and interaction of number of years in schooling and annual income influence traders' awareness of

nutrition knowledge whereas consumers' awareness of nutrition knowledge was influenced by age, numbers of years in schooling and occupation of the respondent. Also, generalized Poisson regression results show that age, annual income, household size, TAVs farm size and price of TAVs influence famers' intake frequency of traditional African Vegetables. Gender and medicinal properties influence traders' intake frequency whereas distance to the market, culture/ taboos, price of TAVs and TAVs weekly budget influence consumers' intake frequency of traditional African vegetables. Lastly, the results of the descriptive and factor analysis indicate that farmers' attitude towards consumption of traditional African vegetables was associated with health benefits, personal perception and taste. Traders' attitude towards consumption of traditional African vegetables was associated with health benefits, taste, time factor and personal perception whereas taste, health benefits, freshness and perception were associated with consumers' attitude. The implication of the findings is that consumption of traditional African vegetables can be enhanced by; (i) creating awareness of the benefits of consuming traditional vegetables using easy to understand approaches such as: (ii) educational materials on vegetable in schools and, campaigns and road show; (iii) development, documentation and promotion of recipes and cooking demonstrations.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONMYS

ACIAR: Australian Center for International Agriculture Research

AIC: Akaike Information Criterion

AVRDC: Asian Vegetable Research and Development Centre

ASDS: Agricultural Sector Development Strategy

BIC: Bayesian Information Criterion

FAO: Food and Agriculture Organization of United Nation

GDP: Gross Domestic Product

GPR: Generalized Poisson Regression

HODECT: Horticultural Development Council of Tanzania

IFPRI: International Food Policy Research Institute

KMO: Kaiser-Meyer-Olkin

NBS: National Bureau of Statistics - Tanzania

PCA: Principal Component Analysis

URT: United Republic of Tanzania

VINESA: Vegetables for Income and Nutrition in Eastern and Southern Africa

WHO: World Health Organization of United Nation

R&D: Research and Development

RUFORUM: Regional Universities Forum for Capacity Building in Agriculture

TAV: Traditional African Vegetables

CHAPTER 1

INTRODUCTION

1.1 Background of the study

Agriculture is the backbone of Tanzanian economy. This sector contributes over 45 percent of the country's Gross Domestic Product (GDP), employs over 70 percent of labor force, provides 65 percent of industrial raw materials and accounts for over 41 percent of its foreign exchange (URT, 2008; Sarris et al., 2006). Despite its significance to improving poor people's livelihoods, especially in rural areas as a source of income and food, agriculture sector continues to face a number of challenges such as heavy dependence on unreliable and irregular weather conditions, declining land productivity due to poor farming practices and use of outdated technology (Chauvin et al., 2012), inadequate infrastructure, lack of access to market and credit, and weak institutional support (Amani, 2005). These challenges have led to a decline in the performance of this critical sector of the national economy. For example, between 1985 and 1990 agricultural sector grew only by 3.5 percent while from 1990 to 1998 it grew by 3.3 percent (FAO, 2001). This sluggish performance has reduced the productivity and profitability of many farmers, especially the smallholder who depend on farming for their living.

Approximately 80 percent of the poor individuals in Tanzania reside in the rural areas where about 70 percent of the country's population lives (URT, 2001). Around 3.5 million farm families cultivate about 4.5 million hectares of arable land where crops yield only 20 percent to 40 percent of their potential (URT, 2008). This facts demonstrate that, agriculture is mainly in the hands of small-scale farmers majority of whom cultivate an average farm size of less than 1 to 3 hectares (Chauvin et al., 2012; Sarris et al., 2006) where small-scale farmers occupy almost 85 percent of

the cultivated area (Sarris et al., 2006). About 70 percent of all crops grown in Tanzania are cultivated by use of hand hoe, nearly 20 per cent by ox plough and only 10 percent by tractor drawn implements (Chauvin et al., 2012). The main foods crops produced using various forms of farm mechanization include maize, rice, wheat, sorghum, cassava and beans.

To increase productivity of agricultural sector in Tanzania, the government has introduced a number of policies and strategies. For example, in 2001, Agricultural Sector Development Strategy (ASDS) was introduced as a response to many economic challenges facing the country including stagnated growth of the agricultural sector (URT, 2008). The primary objective of ASDS was to create an enabling environment for improving profitability of the sector as a means of improving farm incomes and alleviating poverty in the medium and long-term basis. ASDs also set the framework for achieving the sector`s objectives and targets (MAFC, 2006). In addition, in 2008 the Ministry of Agriculture helped to establish the Horticultural Development Council of Tanzania (HODECT) whose main aim is to promote and coordinate the development of the horticultural sub-sector in Tanzania.

Horticulture crops provide higher productivity of 0.9 percent as compared to cereal crops of 0.7 percent (Chauvin et al., 2012). Cereal crops had been experiencing a continuous upward until a major drop came in the early 2000's. Horticulture crops sharply increased in the early 2000's as the Tanzanian horticulture industry expanded. Over the last three decades, increase in productivity has been occasioned by an increase in demand for horticultural products due to price fluctuations of major cash crops in the world market. This scenario has compelled small-scale farmers to look for alternative crops with better prices and more certain markets (URT, 2008). Currently, fruit and vegetable crops account for over 50 percent of all non-staple food production in the country (URT, 2008). In 2008, The Ministry of Agriculture reported that, approximately 1.2 million tons of

vegetables were produced with a value of Tshs. 600 billion (URT, 2008). However, out of 10.8 million hectares planted in the country, fruit, viniculture and vegetable crops, constitute less than 10 percent (URT, 2008) while vegetables crops took only 6 percent of arable land (Eaton et al., 2007). These figures demonstrate that, despite limited amount of land allocated to horticultural crops, the sub-sector have significant potential.

Due to rapid growth of Tanzanian economy and liberalization of export sector recently, there has been a sharp rise in fruit and vegetable production (Mwasha, 1998). In 1995/96, the top ten main vegetable crops in terms of yield were cabbage, tomato, onion, garden pea, amaranth, Chinese cabbage, eggplant, carrots, cauliflower and okra. Most of these vegetable crops are grown by small-scale farmers in rural areas (Keding et al., 2007). Thus horticultural crops have provided farmers with higher income per unit area especially for growers with small arable land.

Among vegetable crops, traditional African vegetables (TAVs) have gained popularity due to their role in providing vitamins and essential minerals in family diets for many years (Chweya & Eyzaguirre, 1999). The increase in production of TAVs has been promoted by lower usage of farm inputs as compared to global or exotic vegetables. For example, in 2007, about 78 percent of participants in one study were cultivating traditional African vegetables while 75 percent of these households had consumed traditional vegetables on the previous day (Keding et al., 2007). In 2004, about 56 percent of TAVs produced were consumed while nearly 17.2 percent of these were picked up from the wild (Weinberger and Msuya, 2004). Of all traditional African vegetables cultivated, almost 50 percent are sold in the markets and the remaining 50 percent are either consumed at home or given out as gifts (Keding et al., 2007). This shows the importance of TAVs and the need to increase their production, marketing and consumption.

However, in urban areas, TAVs are threatened with extinction due to high competition from global or exotic vegetables (Chweya & Eyzaguirre, 1999). Decline in production of TAVs has caused a decline in their consumption due to urbanization. This has forced many small farmers to grow global or exotic vegetable crops instead. Furthermore, there is little knowledge on production, preservation, usage and nutrition importance of TAVs since indigenous information is no longer passed from one generation to the next (Weinberger and Msuya, 2004). Neglecting TAVs is a lost opportunity since farmers, traders and consumers fail to benefit from these vegetables as they are better suited to local environments than global vegetables. Global vegetables refer vegetables that originate from outside of the continent. Other causes of decline of TAVs includes climate changes, changes in food consumption patterns, loss of vegetable habitats, decline of indigenous knowledge and unsupportive policies (Keding et al., 2007). Decline in use of TAVs in many household diets has led to prevalence of malnutrition and food insecurity and loss of income to small-scale farmers and traders.

1.2 Problem Statement

Consumers in many parts of the world derive a major portion of their diets from vegetables which play a significant role in human nutrition, especially as important sources of vitamins (C, A, B1, B6, B9, E), essential minerals, dietary fiber, and various phytochemicals (Liu et al., 2001). Traditional African vegetables (TAVs) such as amaranth, African nightshade and African eggplant contains more of these nutrients compared to global vegetables such as white cabbage (Weinberger and Msuya, 2004). Daily diet consumption of vegetables has been strongly associated with overall good health, improvement of gastrointestinal function, good vision, and reduced risk of some forms of cancer, and other chronic diseases (Goldberg, 2008). Women in particular can benefit from a diet with high vegetable content, particularly during later stages of pregnancy and in

lactation period (Ryder, 2011). However, consumptions of TAVs is low and varies widely with geographical region, nationality and local customs.

In Africa, vegetable consumption per capita has been reported by FAO/WFO (2009) to be below the minimum recommended intake of 400g per person per day. This situation has led to malnutrition and poor health in the region (Ojiewo et al. 2010). IFPRI (2001) forecasts that there will be an 18 percent increase in the number of malnourished children in Sub-Saharan Africa from the year 2001 to 2020. The decline in use of traditional African vegetables by many rural communities has resulted in poor diets and increased incidence of nutritional deficiency disorders (Odhav et al. 2007). In Tanzania, consumption of TAVs is also declining leading to high prevalence of malnutrition, stunted growth and general poor health.

In many regions of Tanzania, fruits and vegetable consumption per capita is below recommended intake of 400g per capita per day. However, there have been some improvement in intake in the recent years though this has not reached the recommended rate. For example, between the year 1993 and 2000, vegetable consumption grew from 107 to 113g per day (FAO, 1994). In 2007, vegetable consumption reached 200g per day for some high income consumers (Keding et al., 2007). However, for most medium and low-income consumers there is a big need to increase their vegetable consumption up to a recommended amount of 400g per day.

Among many other factors, consumption of TAVs depends highly upon the culture of the community in question (Maundu, 1997). In Tanzania, young generation do not consume traditional vegetables due to lack of systematic transmission of knowledge on their nutrition and health importance from one generation to the next (Keller, 2004). On the other hand, food habits and taboos influence intake of traditional vegetables demonstrating that, consumption of these vegetables depend on socio-economic characteristics (Yang and Keding, 2009). Therefore, there is a need to understand factors that are responsible for low intake of traditional African vegetables in Tanzania by producers, traders and consumers despite the crops being a rich supply of vitamins and essential minerals especially to women and children.

1.3 Objectives of the Study

1.3.1 Overall Objective

To evaluate the nutritional knowledge of vegetable producers, traders and consumers and determine factors that influence their intake of traditional African vegetables in Arumeru District, Arusha Region, Tanzania aiming at increasing consumption.

1.3.2 Specific objectives of the study

1. To identify traditional African vegetables varieties with high nutritional potential being grown in the study area
2. To determine the levels of awareness of nutrition knowledge and the factors influencing them among farmers, traders and consumers along selected vegetable value chains
3. To assess the socio-economic factors that influence frequencies of intake of traditional African vegetables along these value chains
4. To assess producers, traders and consumers' attitudes towards traditional vegetables.

1.4 Hypotheses *(H_o)*

The study will test the following hypotheses:

1. Traditional vegetables varieties with high nutritional potential do not grow in the study area;
2. Education and annual income jointly have no effect on the levels of awareness of nutrition knowledge among producers, retailers and consumers;
3. Age and annual income jointly have no effect on intake frequency of TAVs;
4. Producers, traders and consumers' attitude toward traditional vegetables do not have effect on their consumption.

1.5 Justification

The importance of traditional vegetables cannot be over-emphasized due to their nutritional and health benefits. This study focused on analyzing socio-economic factors that influence the intake of traditional African vegetables at household and community levels in Arumeru District, Arusha Region, Tanzania. An understanding on these factors could help to increase the consumption of vegetables and raise their demand thus pulling different produce and products from downstream end of vegetable value chains thereby creating more market opportunities, more employment and higher incomes to value chain players.

Secondly, findings of the study provide information on levels of nutritional knowledge possessed by producers, traders and consumers. Study findings will lead into a better understanding of which vegetables have high nutritional potential and which farmers should grow in the study region.

Finally, findings from this study help R&D organization such as research and teaching institutions, vegetable trader and producer associations, policy makers, extension service providers, government and non-governmental organizations to assess their activities their mode of operations

and ultimately influence the design and implementation of policies and strategies. It also helps these institutions to promote better use of research innovations.

1.6 Scope of the Study

This study identified vegetable varieties with high nutritional potential, evaluated the nutritional knowledge of vegetable producers, traders and consumers as well as analyze socio-economic factors that influence consumption of traditional African vegetables in Arumeru District, Arusha Region, Tanzania. The study was conducted under a four year, ACIAR[1] funded project called "Improving Income and Nutrition in Eastern and Southern Africa by Enhancing Vegetable-based Farming and Food Systems in Peri-urban Corridors (VINESA)" lead by AVRDC in Ethiopia, Malawi, Mozambique and Tanzania.

1.7 Organization of the Thesis

This thesis report is organized into five chapters. Chapter 1 constitutes the introduction, which focuses mainly on the background, statement of the problem, objectives, research questions and hypothesis, significance and the scope of the study. Review of the theoretical and empirical literature is presented in Chapter 2. Chapter 3 describes research methodology adopted in this study and includes a study design, description of the study area, data collection procedures and analytical techniques. Chapter 4 presents the results and discusses the study findings. Finally, summary of the major findings, conclusion and recommendation are presented in Chapter 5.

[1] Australian Center for International Agriculture Research

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Chapter Two is on review of literature that is related to the study topic as per the research objectives in Section 1.3.2. The chapter also shows the gaps in terms of theory and practice that this study hopes to contribute to in order to increase nutritional knowledge, intake of vegetables by households and communities as well as increase market access and income to small-scale farmers and traders.

The term vegetable is broadly defined as the edible portions of a plant (excluding fruit and seeds), such as the roots, tubers, stems and leaves (Maundu et al., 2009). Also AVRDC (1990) (pg. 447) define vegetable as "an edible, usually succulent plant or a portion of it which eaten with staples as main course or as supplementary food in its cooked or raw form". In Sub-Saharan Africa, vegetables species falls into two main groups of crops. The first group is global such as exotic vegetables that originated from outside of Africa while the second group include indigenous or traditional African vegetables commonly abbreviated as TAVs.

2.2 Conceptual Framework of Traditional African Vegetable (TAV) Consumption

Consumption of traditional African vegetables could either be low or high depending on the perception held by consumers. The frequency consumption of TAVs has been low over the years, this is noted in various studies (Abukutsa-Onyango, 2007; Keller et al., 2006; Masayi & Netondo, 2012). It is noted that this outcome came from perception that TAVs are considered to be inferior in their taste and nutritional value compared to global vegetables such as cabbage and spinach. According to Vorster et al. (2007), there is a general impression that traditional vegetables are

‘poverty foods’ or ‘backward’ as assumption that might explain why youth are not readily inclined to these vegetables.

Consumption of TAVs is influenced by many other factors, including consumers` gender and age. For instance, men in general consume less of vegetables as compared to women (Kimiywe et al., 2007; Vorster et al., 2007). Studies have also indicated that youth show no interest in consuming traditional vegetables as they are viewed to be outdated. Limited methods of cooking traditional vegetables have made them less appealing to the young. Furthermore, preference of traditional vegetables species varies depending on the geographical location and cultural background (Kimiywe et al., 2007; Uusiku et al., 2010). The consumption pattern and preferences for traditional vegetables vary among households within different countries (Uusiku et al., 2010). Occupation is a major socio-economic factors that influence choice and consumption of traditional vegetables. It has been noted consumption of traditional vegetables is high among casual laborers and/ or unemployed people in comparison to those in full-time employment and businesses (Kimiywe et al., 2007). These authors note 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 of traditional vegetables. According to Vorster et al. (2007), those with low income levels consume traditional vegetables more than their wealthier counterparts.

Availability and accessibility of the traditional vegetables also determine their consumption. Acipa et al., (2013) found that consumption of traditional foods plants was limited to casual encounters, periods of famine and were used as supplements to major food crops. When available, traditional vegetables are preferred to global vegetables (Dweba & Mearns, 2011). Due to demographic and

socio-economic activities, many traditional vegetables are fast disappearing and genetic erosion is therefore taking place.

The term vegetable is broadly defined as the edible portions of a plant (excluding fruit and seeds), such as the roots, tubers, stems and leaves (Maundu et al., 2009). Also AVRDC (1990) (pg. 447) define vegetable as “an edible, usually succulent plant or a portion of it which eaten with staples as main course or as supplementary food in its cooked or raw form”. In Sub-Saharan Africa, vegetables species falls into two main groups of crops. The first group is global such as exotic vegetables that originated from outside of Africa while the second group include indigenous or traditional African vegetables commonly abbreviated as TAVs.

This study adopts the definition of traditional African vegetables from the United Nation Food and Agriculture Organization. According to the United Nations Food and Agriculture Organization (FAO, 1988), traditional vegetables are all categories of plants whose leaves, fruits or roots are acceptable and used as vegetables by urban and rural communities through custom, habit and tradition. Traditional African vegetables refers to those plants which originate on Africa, or those which have such a history of cultivation and domestication to African conditions. This study will pay more attention to three TAVs namely, African nightshade (*Solanum spp.*), amaranth (*Amaranthus spp.*) and African eggplant (*Solanum spp.*) due to their high market potential in the region (Keding et al., 2007) and nutritional contribution in the study area. For example, African eggplant has been adopted for commercial purposes in Tanzania, the produce is sold in supermarkets and also transported to distant urban markets in Dar-Es-Salaam.

On the other hand, global or exotic vegetables refer to species that were brought into the region of focus (in this case, Africa) from other parts of the world. Some researchers use terms like exotic or introduced species to refer to global species. Exotic vegetables are species which have been

used for a longtime and have become part and parcel of the culture of a society (Keller, 2004). Consumption of these TAVs vegetables by high income households is relatively high in the study area, the vast majority of medium and low income households are yet to reach the recommended rate of consumption. The diagram in Figure 2.1 reflects factors that influence the intake of traditional African vegetables in rural and urban households.

The diagram is a figurative representation of the interplay among the variables in this study. The variables were conceptualized as independent variables include; socio-economic drivers, consumers` attitudes, nutrition knowledge, availability of traditional African vegetables and how they influence the consumption of traditional African vegetables.

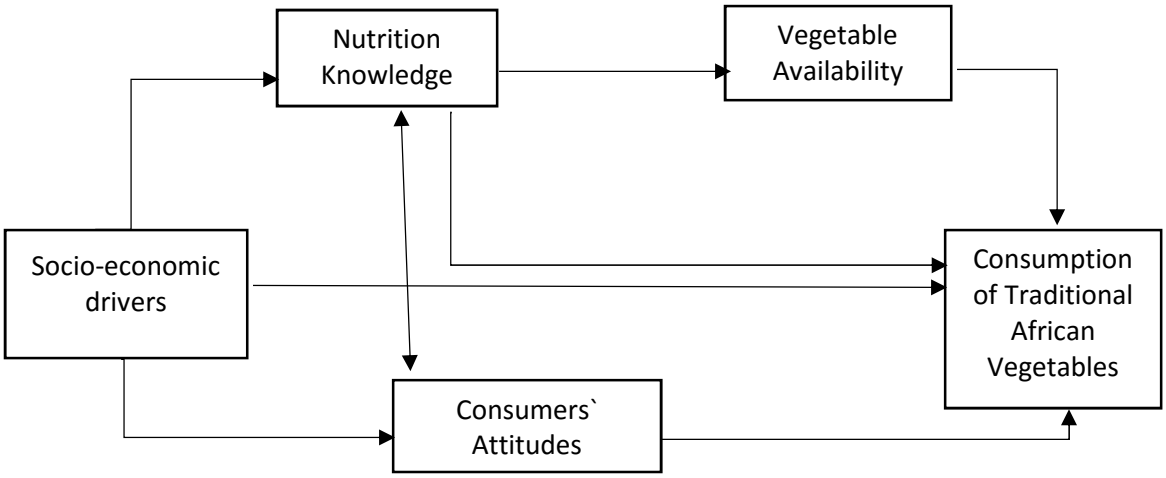

Figure 2.1 Conceptual Framework for the study

2.3 Vegetable Value Chains

The term supply chain is an internationally applied term and used to describe logistical and procedural activities involved in producing and delivering a finished product or services to customers and consumers (Feller et al., 2006). The prime objective of supply chain is efficiency.

In contrast to supply chain, value chain concept as business management tool was developed and made popular by Porter (1985).

Value chain can be defined as a framework for understanding how the flow of inputs and services come together, transform; how agriculture products moves physically from the producer to the final consumer; and how values is increasing along the chain (Webber & Labaste, 2009). On the other hand, Kaplinsky & Morris, (2001) (p. 46-47) defined value chain as "a range of activities which are required to bring products and services from conception, through different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to the final consumers and disposal after use". In balance, value chain concept in agriculture involves linkages of different players and their activities and interactions which add value to agri-food products and services for their customers and consumers. Value chain focuses mainly on value creation through innovation in products or processes and/or marketing. According to this view, features of agri-food value chain include mapping, coordination, governance, upgrading, meeting consumer demand and being competitive. In contrast, practitioners of the supply chain approach fail to look at what extent cost reduction and efficiencies actually add to value of the final product or services and how benefits are shared among different players in the chain.

Vegetable value chains in particular have important implications for food security, food safety and human nutrition (Keatinge et al., 2011) as well as for generation of income and from a nutritional point of view (Mithöfer & Waibel, 2011). However, studies on agri-food value chains on food and nutrition security and livelihood patterns along the whole value chain from producers to the consumers are few to a large extent. Similarly, food safety is an outcome of the entire value chain, influencing all actors from primary producers, middlemen and to final consumers (Asfaw, 2011).

Thus, there is a need to understand different players in the value chain, their perspectives on nutritional importance of vegetables and how this effects their level of intake of vegetables.

In Southern Africa, relatively few studies have been carried out on value chains (Lyatuu et al., 2009; Odhav et al., 2007). These studies have concentrated much on individual features of production systems, nutritional attributes, nature of marketing outlets and women involvement in the sector, but barely looked at the entire value chain. Assessment done in Kenya, Tanzania and Uganda to establish needs and opportunities for African vegetables in value addition and market linkages found out that research and development activities for African leafy vegetables are extremely limited (Maria and Marshal, 2011). Little work has been done in assessing the interaction of demand and supply factors that influence marketing efficiencies in vegetable value chains. No work that as found to have been carried out on how interactions of supply and demand of vegetables affects nutritional and health status of key players in the value chain (farmers, retailers and consumers) as well as that of individual households and communities.

2.4 Prior Studies on Nutrition Knowledge

Nutrition knowledge is defined as knowledge of nutrients (Worsley, 2002). This knowledge is applicable when a consumer learns how to utilize and benefit from the knowledge of nutrients they possess. The need of nutrition knowledge differs from one occupation to another and may also differ between different players in agri-food value chains. Nutritionist normally require a large amount of nutritional knowledge than other professionals while a nursing mother will have different nutrition knowledge needs from non-nursing mother. The interests of farmers to grow TAVs could be influenced by their knowledge of crops' nutrient contents while traders may sell these crops due to demand and supply forces at work in the market place. In general, some of the areas which concerns consumers include the energy content of food, amount of fat, sources of

vitamins and minerals, presence of phytochemicals, and links between food production and ecological sustainability (Worsley, 2002). It is a common assumption that, intake of nutritious vegetables is associated with the level of nutrition knowledge a consumer possesses.

Vegetable farmers and retailers may know certain guidelines or principles but fail to benefit from this knowledge due to lack of its application. Also, consumers may have access to healthy eating guidelines and recommendations but many may fail to follow these guidelines. Thus acquiring knowledge about certain things does not necessarily mean direct application of this knowledge.

Apparently, nutrition behavior involves two types of knowledge. These are declarative and procedural knowledge (Worsley, 2002). Declarative knowledge is knowledge about things and processes (Worsley, 2002). One's knowledgeable that vitamins are essential in one's diet or too much fat is not good in a diet does not assure compliance. On the other hand, procedural knowledge is the knowhow of how to do something. Eating nutrient vegetables is example of procedural knowledge. Many people may understand the need to reduce their energy intakes but may not know how to go about attaining it. Employing this knowledge to eating behaviors is the next step.

Some research revealed that nutritional knowledge indeed positively influences and alter subjects' choices. However, in some of these studies, nutrition knowledge alone was found not to be sufficient to affect the subjects' choices. According to Frazao and Allshouse (2003), interventions involving nutrition knowledge would most effectively influence consumers positively who do not have this specific knowledge. Study in Indonesia found that mothers who have better nutritional knowledge allocate a big share of their budgets to food, but larger portion of this budget goes to foods that are rich in micronutrients, comprising fruit and vegetables such as traditional vegetables (Block, 2002). Similarly study in Ghana found out that female headed household spent great percentages of their income on food (Donkoh et al., 2014).

Kolodinsky et al., (2007) on their study, knowledge of current dietary guidelines and food choice by college students: better eaters have higher knowledge of dietary guidance. Researchers found that increased knowledge of dietary guidelines was positively related to healthier eating practices among college students. The authors concluded that healthy eaters have a higher nutrition knowledge leading to good food choices which can promote reduction and maintenance of weight.

From a study by Kruger et al., (2002), physical inactivity was found to be the major determinant of obesity in black women in the North West province, South Africa: the THUSA study. Authors found that nutritional knowledge is an important factor in promoting healthier eating habits, and consequently, maintaining an appropriate body weight. People who are aware of the connection between poor nutrition and certain health conditions are more likely to follow a balanced diet.

Sharma et al. (2008) carried out a study on association between nutrition knowledge and eating behavior in predominantly Mexican American population on the Texas-Mexico border where the key variables for the study were the number of servings of food items consumed as dependent variable and knowledge of recommended servings of food items as independent variable. Using a used multiple logistic regression, this study found out that nutrition knowledge predicts eating behavior for all food groups except for fruits and vegetables. Also, the authors recommend that the role of cultural factors in eating behaviors required further research.

Geaney et al. (2015), also carried out a study in nutrition knowledge, diet quality and hypertension in a working population. The findings show that nutrition knowledge was positively associated with diet quality after adjustment for age, gender, health status, lifestyle and socio-demographic characteristics. Authors concluded that higher nutrition knowledge is associated with better diet quality and lower blood pressure. Ball et al. (2006) in a study on socio-economic inequalities in women's fruit and vegetable intakes: a multilevel study of individual social and environmental

mediators. This study concluded that nutrition promotion interventions should focus on enhancing nutrition knowledge and health considerations underlying food purchasing in order to promote healthy eating particularly among those of socio-economically disadvantaged. In other study, Turrell and Kavanagh (2006), found that nutrition knowledge was influenced by educational attainment which determine food purchasing behavior. The findings are in line with Peltzer (2002) in a study on relationship between nutrition knowledge and food choice among black students in South Africa. The author found that students with university education have high nutrition knowledge than secondary students. From these cases, it is evident that nutrition knowledge is important but alone it is not sufficient to change consumers` food habits.

2.5 Prior Studies on of intake of Traditional African Vegetables

Vegetable consumption pattern has dramatically changed in Sub-Saharan Africa as a result of urbanization (Rensburg *at al.*, 2007) and globalization which as has been observed to be a central force underlying current dietary shift (Chopra et al., 2002). However, urbanization and globalization undermine the use of TAVs due to high demand and supply of global vegetables.

In order to examine the determinants of production and consumption of traditional vegetables in a community, it is useful to begin with a review of the economic theory of household decisions. In the standard household model, households use their resources (labor, skills, land and equipment) to achieve the highest level of utility (satisfaction) possible. These decisions result in a certain level of disposable income, although this may not be the highest possible income since the household may choose to sacrifice some of its income to cater for more leisure or to save some of the income for future use. In practice, households that are near the margin of subsistence probably cannot afford much leisure or saving and are likely to be close to the maximum income level feasible with their resources and skills.

Consumption patterns are determined by the combination of three main factors: the income level, preferences of the household, and market prices. Preferences are in turn, affected by the composition of the household, its members` knowledge and education, habits and cultural norms, personal experience, in the case of food, the biological factors.

Increasing understanding of factors that influence consumption of traditional vegetables is of utmost importance. Study by Block et al. (1992) suggested that, variables such as gender, age, ethnicity, income level, educational level, perceived benefits and perceptions determine fruit and vegetables consumption. These factors can be further divided into socio-economic factors including age (Faber at al., 2010), education (Kimiywe et al., 2007), household income and gender (Keller et al., 2006), and institutional factors including availability of traditional vegetables in the formal markets (Mwangi & Kimathi, 2006), traditional vegetable production and research, and public perception factors including knowledge about traditional vegetables as obtained through research, as well as the extent of their consumption (Taruvinga & Nengovhela, 2015).

A study by Keller, (2004) on African nightshade, eggplant, Spiderflower et al.–production and consumption of traditional vegetables in Tanzania from the farmers point of view where the author found out that indigenous knowledge on how to cultivate and prepare traditional vegetables was disappearing. In addition, the study found out that there is no systematic and appropriate means to transfer knowledge from one generation to another. Vorster, (2007) studied the role and production of traditional leafy vegetables in three rural communities in South Africa where they found out that loss of indigenous knowledge influences less production and consumption of traditional vegetables. Hart and Vorster, (2006) shared similar sentiments on their study Indigenous knowledge on the South African landscape: potentials for agricultural development. These authors

found that indigenous knowledge affect consumption of traditional vegetables was due to urbanization, migrant labor and education.

In a study by Kimiywe et al., (2007) about utilization and medicinal value of indigenous leafy vegetables consumed in urban and peri-urban Nairobi where the authors noted that culture erosion and breakdown of traditional systems of plant resource management result in the loss of TAVs. Some of TAVs have become popular for use in a medication of various ailments. A study in South-west Nigeria indicate that twenty-four TAVs were found have been used as traditional medicine (Adebooye et al., 2003). Also a study by Abukutsa-Onyango, (2007) about seed production and support systems for traditional African vegetables in three communities in western Kenya, it was noted that traditional vegetables have medicinal values. Furthermore, a study by Kimiywe et al., (2007) found that some TAVs have been used to treat common illness such as malaria, diarrhea, anaemia, colds and coughs, skin infections, high blood pressure, diabetes and malnutrition. In Tanzania, a study by Keller, (2004) also revealed the medicinal properties of some TAVs.

Another study by Puoane et al., (2006) on socio-cultural factors influencing food consumption patterns in the black African population in an urban township in South Africa where the authors found out that intake of meat was associated with a high socio-economic status while vegetables consumption was associated with a low socio-economic status. They also found that eating large portion of food is associated with affordability. Hall et al., (2009) concluded that prevalence of low fruit and vegetable intake tended to increase with age and decrease with household income level.

Stewart et al., (2003) on a study about: do income constraints inhibit spending on fruits and vegetables among low-income households where the authors found that low income households spend less on fruits and vegetables than other households, but they are not responsive to changes

in income. Also Hart et al., (2005) study on vegetable consumption pattern of households in selected areas of the old Rivers State in Nigeria indicates that factors influencing vegetable consumption were mainly culture and season while taste and nutrition knowledge influences were minor, these authors concluded that culture limits adequate consumption of traditional vegetables even when they are in abundance.

A study by Kimiywe et al., (2007) where the authors found that ethnic origin influence greatly consumption of TAVs and there was no significant relationship between household income and education level and choice or use of TAVs. Also, a study by Sani et al., (2014) about socio-economic factors influencing adoption of dual-purpose cowpea production technologies in Bichi Local Government area of Kano State, Nigeria where the results from the correlation analysis indicated that education level, size of household, farming experience, number of ruminants' owned, social participation and contact with extension officers were significantly related to technology adoption. Authors concluded that educational level, social participation and extension contacts were majorly socio-economic factors influencing adoption of the dual-purpose cowpea production technologies. Also authors recommend the need for improving in promoting these factors.

Another study by Mahlangu et al., (2014) on production and commercialization potential of Indigenous Leafy Vegetables: Case Study of Capricorn District in the Limpopo Province, South Africa. The authors used Stochastic Frontier Production Function to determine productivity and to assess socio-economic characteristics of producers of TAVs where authors found that amount of labor required, cost of hiring tractors service, land devoted to indigenous vegetables, gender, age, household size, farming experience, size of farm, hired labor, primary occupation and land ownership were significant socio-economic factors and production factors. Also, a study by

Mwaura et al., (2013) about traditional African vegetables and household wellbeing in Kenya: a disaggregation by gender where the authors found that income, primary occupation of the producer, distance to the market, access to extension services, access to technical support and distance to piped water were significant factors influencing production of traditional African vegetables by smallholder farmers.

2.6 Summary

This chapter looked at different bodies of literature on nutritional importance of traditional African vegetables; use of value chain concept to improve production, marketing and consumption of vegetables; socio-economic factors that influence intake of vegetables; and attributes that determine what products consumers buy, where and when. The gaps in theory and practice that this study contributed to have also been identified. The following chapter shows how data was collected and analyzed with a view to improve theory and practice as outlined in Chapter Two.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter presents the research design and methods used in this study. It starts with a brief description of how this research 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 Theoretical Framework

According to Creswell (2009), theories provide explanation for relationships between factors in research questions and hypotheses. In this view, it was very relevant to look as some theories that could be used to explain the consumption of traditional vegetables in the study area where an understanding of the economic theory of household decision making is very important. In the standard household model, households prefer to use their resources such as labor, skills and equipment to attain the highest level of satisfaction possible. According to Ruel et al. (2005), decision making is largely dependent on the income level of the household.

3.3 Determination of Nutrition Knowledge

Finding from this section helped to address Objective No. 2 of this study: “To determine levels of awareness of nutrition knowledge among farmers, traders and consumers”.

In order to determine the awareness of nutrition knowledge that farmers, traders and consumers possess, five scale were adopted from the study conducted by Parmenter & Wardle (1999) i) understanding of nutrition terms, ii) awareness of dietary recommendations, iii) knowledge of

foods as source of nutrients, iv) ability to apply information on choices and v) awareness of diet-disease associations. Awareness of nutrition knowledge was counted with the range of zero to five. Respondents were asked five question to assess their awareness of nutrition knowledge and then score from each response was added together. The respondents were asked whether or not they know each of the scales identified. Hence the dependent variable is the number of scale levels the respondent is knowledgeable of.

The number of scales known by the respondent were count dependent variable and therefore were analyzed using count data models. Count variable models are typically 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 were inappropriate (Hilbe, 2011; Long, 1997). Generalized Poisson regression (GPR) model was therefore adopted in this study.

3.4 Generalized Poisson Regression (GPR)

Initially, a generalization to the basic Poisson model was developed by Consul & Jain (1973) which was termed as generalized Poisson regression. According to Hilbe (2011) generalized Poisson regression has undergone numerous revision to generate other models such as the restricted generalized Poisson and three parameterizations of a hybrid generalized Poisson. Consul & Famoye (1992) have 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:

$$f(y;\lambda,\theta) = \theta\left(\theta + \lambda_i^{y_i}\right)^{y_i} \frac{e^{\left(-\theta-\lambda_i^{y_i}\right)}}{y_i!} \qquad \text{..... Eqn. 3.1}$$

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

$$\mathcal{L}(\mu,\alpha;y)=\sum_{i=1}^{n}\left\{y_i l\epsilon\ \left(\frac{\mu_i}{1+\alpha\mu_i}\right)+(y_i-1)l\epsilon\ (1+\alpha y_i)-\left[\frac{-\mu_i(1+\alpha y_i)}{1+\alpha\mu_i}\right]-l\epsilon\ \Gamma(y_i+1)\right\}$$ .....Eqn. 3.2

Or in terms of x as

$$\mathcal{L}(\beta,\alpha;y)=\sum_{i=1}^{n}\left\{y_i l\epsilon\ \left(\frac{e\ (x_i'\beta)}{1+\alpha\ (x_i')}\right)+(y_i-1)l\epsilon\ (1+\alpha y_i)-\left[\frac{e\ (x_i'\beta)(1+\alpha y_i)}{1+\alpha\ (x_i'\beta)}\right]-l\epsilon\ \Gamma(y_1+1)\right\}$$ .....Eqn. 3.3

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

x =covariate vectors of explanatory variables

β= linear predictor of random response variable

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

Scales of awareness of nutrition knowledge known (y) = f (logage, gender, education, logIncome, occupation, social capital) + e.

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

Age **-** is a continuous variable and was measured in years. It was expected to have effect on knowledge though the direction of influence may not be determined a priori due to effects from other factors. The older one gets, the more knowledgeable they are expected to be on issues such as health.

Gender of household head (gender) - this is a dummy variable measured as 1=male, 0=female. Men were generally expected to be more knowledgeable about their surroundings than their female counterparts. However, findings vary depending on how long respondents have been in a place and whether they have lived in an area for longer period of time.

Education of the household head - this is a human capital variable and was measured in terms of the number of years of formal education. Education level was expected to have a positive relationship with the awareness of nutrition knowledge. It was expected that respondents with more years of education will be more aware of nutrition knowledge provided by consuming traditional African vegetables.

Income – this variable forms part of the financial capital owned by a household from all possible income generation sources that they were engaged in including remittances. It was measured as total income earned from various sources in a year (July, 2014 - June, 2015). Income was hypothesized to positively influence the level of knowledge of nutrition one possess.

Type of occupation – is a categorical variable that refers to a person`s regular work or profession. It was expected that a respondent's type of occupation has positive influence on their awareness of nutrition knowledge. For example, consumers who are nutritionists by profession are expected to be more aware of nutrition knowledge. On the other hand, producers and traders who have been exposed to basic agriculture training and have long time experience in growing vegetables crops was expected to possess nutritional knowledge.

Group membership (social capital) - is a social capital variable and was measured as a dummy variable (1= group member, 0= Otherwise). For the purpose of this study, the group membership was a variable that took into consideration those groups that have a component of food related

concerns or activities such as training on food preservation and quality vegetable production. Thus it was expected that this variable will have an effect on nutrition knowledge of respondents.

3.5 Determination of Socio-economic Factors Influencing Intake of Vegetables

Findings from this section helped to address Objective No. 3 of this study: To assess socio-economic factors that influence frequencies of intake of traditional African vegetables.

There are several socio-economic factors that influence intake of traditional African vegetables. In this study, the model for frequency of intake was a number such as 0 times a week, 3 times a week etc. This approach uses standard poison and generalized Poisson regression model as explained in section 3.4 above.

Determinants of factors influencing vegetable intake

A number of variables that influence intake of vegetables among producers and consumers were identified and analyzed. These variables were classified for practical purposes into three broad sets namely: productive, demographic and socio-economic characteristics.

Productive set of variables were considered as those factors mainly related with the technological traits of the small-scale farmers surveyed, such as the use of tractor, use of inputs, hired labour or their land size. On the other hand, the “socio-economic” set of variables referred mainly to factors such as access to credit and technical assistance as well as respondent’s demographic characteristics such as the gender of the household head, age of the farmer and his level of education as well as social capital. These variables were defined as;

Age

Traditional vegetables consumption is assumed to be influenced by age. In South Africa, older people consume more of traditional vegetables as compared to younger people (Vorster et al., 2007). Age has been found to influence consumption of traditional vegetables (Rensburg at al., 2004). Similar study carried out in South Africa found that, TAVs producers were more than 60 years old (Pasquini et al, 2009). Thus, it was assumed that age has influence on intake of vegetables.

Education

Educated producers and consumers are able to process nutritional information in a better way and know the importance of consuming TAVs as compared to their non-educated counterparts. Illiteracy and ignorance of sound eating habits profoundly influence traditional African vegetable consumption. In a cross-sectional survey, Peltzer and Phaswana-Mafuya (2012) found out that education was closely associated with the amount of fruits and vegetables consumption. Generally, educated farmers, traders and consumers have high probability level in deciding to consume nutritious vegetables.

Taboos and cultural beliefs

Food taboos are common in almost all human communities. These taboos are presumed to play an important role in many populations of developing countries. The concept of food taboos 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, children

and elderly (Onuorah & Ayo, 2003). Surprisingly, food taboos are common even in educated members of different communities.

Cultural beliefs defines what a meal is both with respect to time and content (Onuorah & Ayo, 2003). Food habits play role in the existence of strong culture and tradition. Some of the largest variations in food choice decision are mainly due to limitations laid by cultures and traditions. For example, in some countries, tea is taken as part of the breakfast, while in other places it is taken during special event. In Tanzania, there are some tribes where it is assumed that vegetables consumption is mainly for women and children while men consume only meat.

Medicinal Properties

Traditional African vegetables are reported to have abilities to heal. Different vegetable crops have been cultivated for use as medicine for more than 2000 years (ShingJy et al., 2004). Their medicinal value has been evaluated in the treatment of painful conditions such as rheumatic diseases, headache and diabetic (Hounsome & Hounsome, 2011). Diets rich in antioxidants and micronutrients are recommended in fighting HIV/AIDS (Friis et al., 2002). Vegetables rich in micronutrients such as TAVs can improve nutrition and help to ease pains associated with HIV/AIDS condition.

In Tanzania, a study carried out in Muheza District found out that some traditional vegetables such as African spider flower (*Cleome gynandra*) is not popular as a vegetable but as medicine, specifically to treat ear illnesses (Keller, 2004). In Kongwa District of Tanzania, this author found out that Bitter Lettuce (*Launaea cornuta*) has the ability to treat measles as well as to treat hook worms, cure malaria and reduce stomach aches (Keller, 2004). Consumption of these vegetable crops helps to cure several diseases by boosting immune system and therefore human health.

Household Income

Income was considered to be one of the most significant factor that determines food consumption patterns of households in developing countries. Wong et al. (1984) examined a relationship between household income levels and food consumption in urban households of Mexico. These authors found out that as family income level increases, so was their consumption of high protein foods.

In sub- Saharan Africa, poor household consume more of traditional vegetables as compared to their wealthier counterparts (Rensburg & Averbeke, 2007). From another study in South Africa, it was perceive that, consumption of food such as samp (corn), beans, greens (i.e. traditional vegetables), and root plants is associated with poverty (Puoane et al., 2006). These findings suggest that consumption of traditional African vegetables is perceive to be a poor man diet was higher in the rural areas as compared to urban areas.

Gender

Gender was among many factors assumed to influence consumption of traditional vegetables in Africa (Rensburg & Venter, 2004). Female intake of traditional vegetables is important during pregnancy and lactation periods. During lactation, women are highly vulnerable to micronutrient deficiencies, a phenomenon that is prevalent in many developing countries. In Cameroon, it was found that there is a high involvement of women in TAVs marketing (Gockowski et al., 2003). This shows the importance of understanding the constraints faced by men and women, and boys and girls in a given community and how these affects the types and levels of vegetables they produce, market and consume.

3.6 Consumer Attitude toward Traditional vegetables

Findings from this section help to address Objective No. 4 of this study: To analyze attributes for traditional African vegetables that consumers would prefer and which could increase their consumption of these vegetables.

To analyze attributes for traditional African vegetables that consumers would prefer, two main approaches were used. These were descriptive and inferential statistics. Descriptive statistics used included summing up of the responses and obtaining a score or using percentage of respondents in a given Likert scale category (Shibia, 2010) or scale averages for the particular question responses (Dolisca et al., 2007; Rishi, 2007). The second method was principal component analysis (Leech et al., 2012). According to (Dolisca et al., 2007) some studies use a combination of descriptive statistics and inferential approaches.

In this study, a combination of descriptive and inferential statistics was used to examine attributes that consumers preferred. Descriptive statistics (percentages and mean scores) was used to analyze attributes that consumers prefer. On the other hand, factor analysis was used to identify latent dimensions underlying the different variables that measured attributes that consumers prefer. Responses to 11 5-point Likert-type scale items was subjected to a principal component factor analysis (PCA) with Varimax rotation. The factors were subjected to the Kaiser-Meyer-Olkin and Bartlett's test (KMO and Bartlett's test) to determine the sampling adequacy. According Leech et al. (2012), KMO measure was greater than 0.7 and is inadequate if is less than 0.5. KMO shows whether or not enough items are predicted by each factor. The above procedures were adopted for this study and used to analyse attributes that consumers preferred towards increasing intake of traditional African vegetables. The objective was to obtain fewer dimensions that reflected the

relationship among these inter-related variables. An Eigen-value greater than one rule was applied in identifying the number of factors.

3.7 Study Area

3.7.1 Study design and sampling

Location

This study was conducted in Arumeru District of Arusha Region in Tanzania. The study was a single-locational one as it based on one region and district. This study was conducted under a four year, ACIAR funded project called "Improving Income and Nutrition in Eastern and Southern Africa by Enhancing Vegetable-based Farming and Food Systems in Peri-urban Corridors (VINESA)" led by AVRDC-The World Vegetable Center in Ethiopia, Malawi, Mozambique and Tanzania. The study was undertaken for about five months from July to November, 2015.

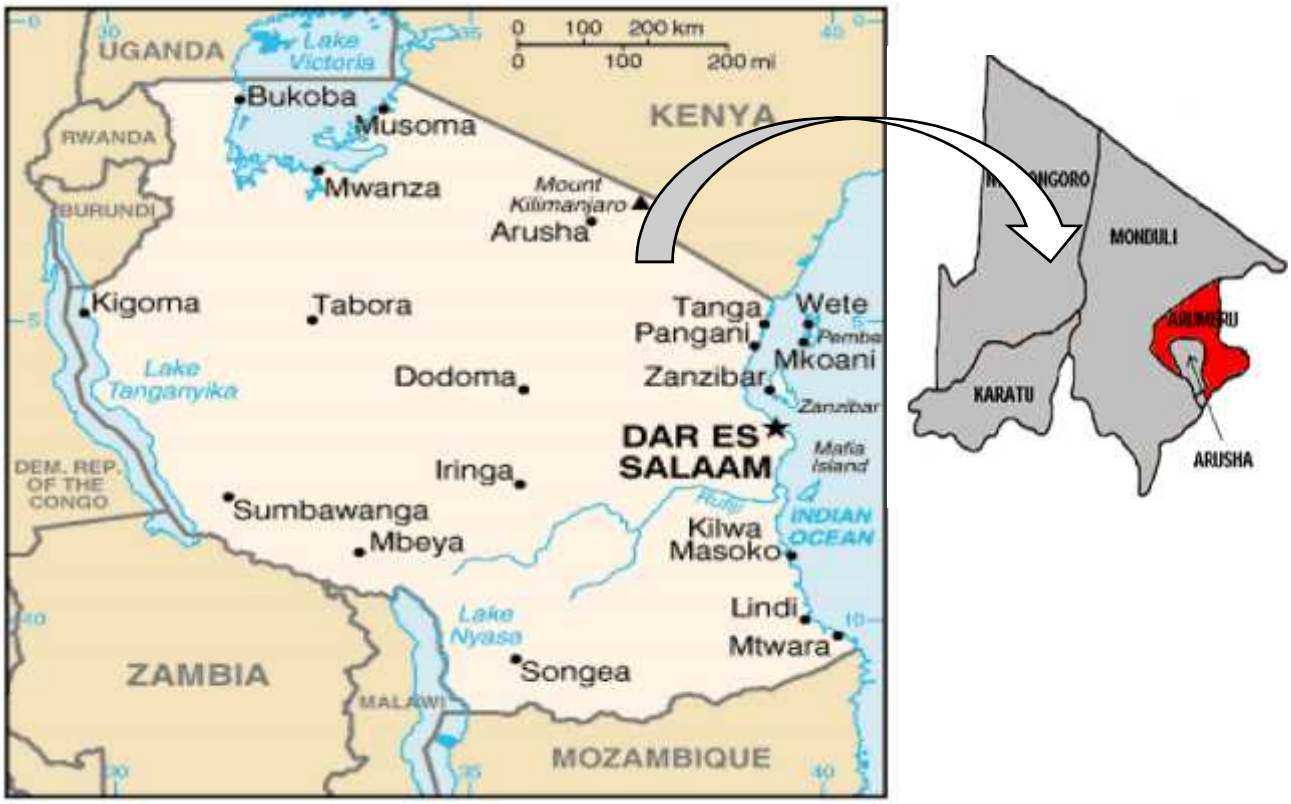

Figure 3.1 Tanzania map, showing Arusha Region and study area Arumeru

Arumeru District is one of the five districts in Arusha Region of Tanzania. It is bordered to the north and west by the Monduli District, to the east by the Kilimanjaro Region and to the south by the Arusha District and the Monduli District. The district lies between longitudes 36.5^{o} to 37.5^{o} east and latitudes 3.5^{o} to 3.7^{o} south of the Equator (Kaihura & Stocking, 2003). Mount Meru which is the second highest mountain in Tanzania with the height of 45931.8 meters above the sea level, is situated in the northern part of the District. Arumeru District has an area of 2966 square kilometers which is about 3.6% of the area of Arusha Region with a total area of 82424 square kilometers. Administratively, the district is divided into 6 divisions, 37 wards and 133 villages. It is composed of three major ethnic groups which are the more sedentary, the Wameru and Waarusha and the pastoralist Maasai.

Arumeru District has the largest number of households in the region and it has the second highest percentages of households involved in smallholder agriculture in the region. Most smallholders are involved in crop and / sea weed farming, followed by livestock keeping and herding. The most important livelihood activity for smallholder households in Arumeru District is crop and/ sea weed farming followed by livestock keeping and herding.

Arumeru District has the highest literacy rate of 88.6 percent among smallholder households, a fact that is reflected by the district's highest level of school attendance in Arusha Region (NBS, 2008). However, the literacy rate for the heads of household is moderate among the districts in the region. The utilized land area per household in Arumeru District is more or less the same with that in other areas, as there are almost no variations in land area utilized per household across districts. According to National Sample Census of Agriculture 2007/ 2008, the district has the first largest

planted area in the region, and the second largest planted area per household with average of 0.9 hectare.

Arumeru district is popular for maize production in the region with a planted area of over 32,830 hectares though the planted area per household is the second lowest in the Arusha region. The district has the largest planted area of paddy in Arusha region with 272 hectares under rice crop. However, it has the lowest area of 435 hectare planted with other cereals (sorghum and wheat). As for the production of roots and tubers, the district is third in Irish potatoes (74 hectare), and fourth in sweet potatoes by 2.2 percent of the total land planted with sweet potatoes in Arusha region.

Vegetable production is an important activity in Arumeru District. It has the largest planted area with tomatoes which accounts for 79 percent of tomatoes grown in the region, and cabbage (13 percent of the cabbage planted area), though there is no large quantity production of onion reported in the district. Arumeru is one of the two districts where traditional cash crops (e.g. tobacco) are grown in high quantities, and having the largest tobacco planted area in the district of 92.7 percent. The district has a large number of households selling crops and for those households who did not sell, the main reason for not selling is insufficient production. There is only little access to credit in the district to both male and female farmers from commercial institutions. However, the main source of farm credit for most farmers is from families, friends, relatives or community banks. Others sources of credit include private sources, non-religious organizations, NGOs, and saving and credit societies including village-based merry-go-rounds or "*kibati*" in Swahili language.

Research Design

The study adopted cross sectional survey in studying particular phenomenon at a particular time due to time savings. This type of survey also accommodates a large sample in a study (Bryman,

2012; Saunders et al., 2011). This design also maintains a high level of confidentiality, it is convenient and enables data to be collected faster, questions to be asked in a personal in an interview or impersonal through a questionnaire about issues which cannot be observed easily. It also gives the researcher an opportunity to get an accurate response to issues as well as test theories on social relationship at both the individual and group level (Kothari, 2004).

For the survey, semi-structured questionnaire was followed by several focus group discussions for three key categories of players in a value chain, namely vegetable farmers, traders and consumers. As recommended by Kaplowitz & Hoehn (2001), focus groups discussions and individual interviews were used in this study to complement each other.

This study design was most appropriate as it allow collection and analysis of both qualitative and quantitative data. On quantitative approach, the study uses a closed-ended sections of the questionnaire to collect data on the socio-economic factors that influence consumption of traditional African vegetables. On the qualitative side, the study used the open-ended sections of the questionnaire to collect data on the same parameters such as how socio-economic factors influence consumption of traditional African vegetables.

In this study, the survey was conducted in two parts. Firstly, a questionnaire was administered to collect information from vegetable producers, traders and consumers on production, marketing and consumption traditional African vegetables. Secondly, focus group discussions for vegetable producers, traders and consumers was conducted to discuss in more depth specific topics of interest coming out of the questionnaire.

Target Population

The study targeted small-scale farmers, traders and consumers of vegetables within Arumeru District, Arusha Region. According to Arusha Region Agriculture Sample Census of 2007/2008, Arumeru District has a population of about 49,292 small-scale farmers (NBS, 2008). This constituted the study population from which study sample was derived.

Sample Size and Sampling Techniques

This section describes the sample size and sample selection used in the study.

Sample Size

Respondents of the study were drawn from the larger population of vegetable producers, traders and consumers, especially the areas where VINESA project is being implemented. The researcher used a sample size of 381 respondents selected among the households in Arumeru District. See Table 3.1 for details.

In the context of this study, the formula of Fisher et al. (1983) and Daniel (1987) was used to determine the sample size as shown below:

$$S \quad s \quad (S\ ) = \frac{Z^2 \times p \times (1-p)}{c^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Eqn. 3.4}$$

Where:

Z= Standard normal deviation set at 1.96 corresponding to 95 confidence level

p = Percentage of target population estimated to have a particular characteristic (50% = 0.5)

c= Degree of accuracy desired set at 0.05

Given Z= 1.96, p= 0.5 and c=0.05 (±5)

$$S \ = \frac{1.9^{\ 2} \times 0.5 \times (1-0.5)}{0.0^{\ 2}}$$, hence sample size (ss) = 384

Then, adjustment basing on the finite population:

$$N \quad S \ = \frac{S}{1+\frac{S\ -1}{p}}$$ Where: ss = sample size, pp = population of Arumeru District.

$$N \quad S \ = \frac{3}{1+\frac{3\ -1}{4}} = 381$$

Therefore, sample size for this study was 381 respondents.

Table 3.1 Sample size distribution for the study

Category	Producers	Traders	Consumers	Total
Sample size	63	65	262	381

Sampling Techniques

The study utilized two sampling techniques. Randomly sampling was used for producers and, purposive sampling technique was employed due to unavailable list of consumers and traders in the study area. In this study, vegetable producers, traders and consumers in Arumeru District were selected due to their involvement in the traditional vegetable.

3.7.2 Data Collection and Variables

Research Instruments

Selection of tools was guided by the nature of data collected, the time available for the researcher as well as the objectives of the study. This study used three types of questionnaires to collect data from different respondents: one set was administered to producers, second set to traders and last set to consumers. These questionnaires were used to solicit information on the view, opinion and perception of consumers, producers and traders on nutrient dense vegetables since a questionnaire was a suitable tool in a survey research (Oso & Onen, 2008).

Pretesting

According to Mugenda & Mugenda (2003), a pre-test of a 10 percent of the total sample size having homogenous characteristics was suitable for a pilot study. For this study 38 respondents (8

producers, 8 traders and 22 consumers) from Arumeru District were interviewed during the pilot study.

Questions were precise and concise to enhance the validity of the instrument. The researcher sought permission from the appropriate village leaders, who were gatekeepers in each location before conducting focus group discussions. Pilot testing offered a researcher an opportunity to revise data collection tools, look for errors in a tool, and scan the environment for factors that might confound the results.

The researcher obtained consent from respondents after explaining the overall objective of the study. An assurance of confidentiality and anonymity of the information gathered from the respondents was given before each interview or group discussion.

Descriptive Statistics

Findings on descriptive statistics helped to address Objective No. 1 of this study: “To identify traditional African vegetables varieties with high nutritional potential being grown in the study area”. Descriptive statistics were used to identify vegetables with high nutritional potential being produced, marketed and consumed in Arumeru District. Descriptive statistics such as means, variance and standard deviation were used.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

This chapter presents the results of the various analytical approaches and their discussions. Implications of findings from sampled farmers, traders and consumers on traditional African vegetables are also given.

4.1 Socio-economic Characteristics

Table 4.1 shows the descriptive statistics of the socio-economic characteristics of study respondents. Descriptive analysis helped one to understand whether the demographic characteristics of a respondent influenced participation in production, marketing and consumption of traditional African vegetable.

The survey results demonstrated that of the majority of the farmers' interviewed 57% were males and 43% of the farmers were females. On the other hand, majority of traders` interviewed 97% were females while 3% were males. These results indicated that there are many women involved in the trade of traditional African vegetables (TAVs) as compared to men. In street vendors' stalls as well as formal markets, female traders were more than male traders. The results also showed that out of 262 consumers` interviewed during the survey, 74% were females and 26% were males. In many African countries, it is traditionally believed that women should be responsible to sell and buy food, so this result presents a true picture of the real scenario.

Further, descriptive statistics showed that the majority of 91% small-scale farmers interviewed who produced TAVs had primary school education while only a few had middle-level college (0.8%) and university (1.14%). About 89% of traders had attained primary school education, while 76% of consumers had attained primary school education. Out of traders and consumer's category,

no respondent had middle-level college and university education. Generally, most of the three categories of respondents (farmers, traders and consumers) had an average level of education.

Table 4.1 Socio-economic Characteristics of the sample

Demographic Characteristics	Consumer(*262*)	Farmers*(63)*	Traders*(65)*
Gender (%)			
Female	73.66	42.86	96.92
Male	26.34	57.14	3.08
Marital status of respondent (%)			
Married	81.68	92.07	85.16
Single	13.36	6.35	9.23
Separated	0.76	1.59	3.08
Divorced	0.76	-	1.54
Widow or widower	3.44	-	-
Age of respondent (mean)	39.65	40.17	38.15
Household size (count) mean	3.923	4.2	4.338
TAVs Farm size (acres) mean	-	0.61	-
Awareness of nutrition knowledge (count) mean	2.755	2.854	2.769
Ethnicity group (%)			
Meru	45.42	36.51	41.54
Maasai	3.05	3.17	-
Arusha	20.23	34.92	13.85
Chagga	20.61	15.87	21.54
Others (Sukuma, Nyakyusa, Iraqw, Pare)	10.69	9.52	23.07
Main Occupation (%)			
Agriculture	62.60	74.60	9.23
Casual labor	3.05	-	-
Formal employment	14.50	-	-
Business	7.25	4.76	90.77
Agriculture and livestock	12.60	20.64	-
Number of years of schooling (mean)	**6.95**	**7.13**	**7.14**
Level of education (%)			
No formal education	8.78	1.59	3.08
Primary	75.57	90.48	89.23
Secondary	13.74	7.94	7.69
Middle-level college	0.76	-	-
University	1.14	-	-
Annual household income (Tshs) (mean)	1,411,663	1,263,651	1,634,692
Amount spent to purchase TAVs per week (mean)	6,328.63	7,647.62	9,143.10
Years in TAVs business (mean)	-	-	8.3
Distance to nearest market (minutes) mean	28.393	52.403	51
Intake frequency (count) mean	1.214	1.06	1.415

Moreover, the results showed that mean age of farmers was 40 years. These results showed that most of the vegetables farmers in the study area had experience in farming practices and quality of production. However, there is a need to promote youth involvement in agriculture particularly TAVs. This trend raises a concerned that if young people do not get involved in growing TAVs, this might lead to food scarcity in future particularly for TAVs. Mean age of traders was 38 years while their mean period of involvement in TAVs business was 8 years. This showed that traders had long experience in trading TAVs. Consumers` mean age was about 40 years. These results could be taken to imply that consumer knew exactly what to purchase and of what quality. The results indicated that the mean age for both three categories was almost the same.

On respondent's occupation, results showed that majority of famers practiced farming as their main occupation (75%), traders practiced business as main occupation (91%) and consumers` main occupation was farming (63%). Generally, farmers derived the greatest proportion of their income from farming activities, traders derived the greatest proportion of their income from trading in TVAs while most consumers derived their income from farming activities.

Descriptive result indicated that majority of farmers (37%), traders (42%) and consumers (45%) came from Meru ethnic group. This study found that Maasai ethnic group did not trade in TAVs while only few of them grew and consumed TAVs at 3% and 3%, respectively. Further, these results showed that the mean yearly income for traders was Tshs 1,634,692/=, which stood out to be higher than for farmers (Tshs 1,263,651) and for consumers (Tshs 1,411,663). Many traders sold TAVs and other global vegetables and fruits, a practice that could explain why they had higher annual income. Traders had higher annual income from trading traditional African vegetables as compared to farmers and consumers.

Furthermore, farmers obtained TAVs from their farms whereas traders obtained TAVs from their business. In this study, it was assumed that if farmers and trader had to buy TAVs, they did so from the nearest market. The results indicated that the mean amount spent per week to purchase TAVs differed between respondents. In this case, traders spent Tshs 9,100 per week on TAVs which is higher than what consumers spent and farmers at Tshs 6,300 and Tshs 7,650 per week respectively. These figures for farmers and traders were derived from an assumption that if they were to purchase TAVs varieties from nearest market.

4.2 Traditional African vegetables varieties with high nutritional potential

Table 4.2 show common traditional African vegetables being grown in the study area. The results showed that in the study area African nightshade is grown by many farmers (81%) followed by Amaranths (65%), Ethiopian mustard (52%), African eggplant (49%), sweet potatoes' leaves (11%) and spider plant (5%). One of the respondent reported during the interview that,

> *"spider plant variety was cultivated by the least number of farmers as it was considered to be wild; spider plant grows mostly during raining season. Famers had no tendency of keeping spider plant seeds"*.

Table 4.2 Common Traditional African Vegetables grown in the study area last season

Botanical Name	English name	Swahili name	No. farmers	%
Solanum spp.	African eggplant	Ngogwe	31	49.21
Amaranthus spp.	Amaranths	Mchicha	41	65.08
Solanum spp.	African nightshade	Mnavu	51	80.95
Cleome gynandra	Spider plant	Mgagani	03	4.76
Brassica carinata	Ethiopian mustard	Loshuu	33	52.38
	Sweet potato leaves	Tembele	07	11.11

Table 4.3 show the area in acres under TAVs in the study villages. The result of the survey showed that in the three villages selected for this study, Manyire village had a mean of 0.8 acre under

TAVs, Bangata had mean of 0.5 acre while Embaseny had mean of about 0.5 acre. In general, Manyire farmers dedicated huge area to grow TAVs compared to Embaseny and Bangata farmers. Embaseny and Bangata villages are located at the slopes of Mountain Meru where many farmers are still growing coffee. Farmers from Bangata Village, grow both TAVs and global vegetables. Many farmers engaged in global vegetables whereas few grow TAVs. During focus group discussion, participants said that, *"the demand for global vegetables is high in the organized market such as supermarkets and big hotels"*.

Table 4.3 Area under Traditional African vegetables cultivation

Standard Measure of the Sample	Manyire (acre)	Embaseny (acre)	Bangata (acre)
Minimum	0.250	0.250	0.250
Maximum	3.000	2.000	1.000
Mean	0.802	0.475	0.531
Standard deviation	0.687	0.411	0.247

Table 4.4 show the mean TAVs varieties with high nutritional potential cultivated in the study area based on the opinion of respondents. A list of different species of TAVs were given to respondents to tick which one they believe to have high nutritional potential. The result of the survey showed that, in Manyire village, African eggplant had high nutritional potential followed by Amaranth, African nightshade, Ethiopian mustard, others (watercress, pumpkin and sweet potatoes leaves) and spider plant with percentage of 81.82, 59.09, 45.45, 18.18, 18.18, and 13.64, respectively.

The results also showed that, in Embaseny village, African nightshade stood out in terms of nutritional potential followed by Amaranths, Ethiopian mustard, African eggplant, others (watercress, pumpkin and sweet potato leaves) and spider plant with percentage of 100, 73.33, 66.67, 16.67, 3.33, 0.00, respectively.

Table 4.4 Traditional African vegetables varieties with high nutritional potential

Variety	Location			Overall Ranking
	Manyire (%)	Embaseny (%)	Bangata (%)	
African eggplant	81.82	16.67	37.5	4
Amaranths	59.09	73.33	50.0	2
African nightshade	45.45	100.00	100.00	1
Spider plant	13.64	0.00	0.00	6
Ethiopian mustard	18.18	66.67	62.50	3
Others (Watercress, Pumpkin, Sweet potato leaves, etc.)	18.18	3.33	0.00	5

In Bangata village, based on respondents` opinion, descriptive statistics showed that African nightshade stood out in terms of nutritional potential followed by Ethiopian mustard, Amaranths, African eggplant and others such as watercress, pumpkin and sweet potatoes.

Moreover, in the study area, the survey showed that African nightshade variety was considered to have high nutritional potential in Embaseny and Bangata villages. In all three villages, African nightshade was ranked as number one among traditional vegetables with high nutritional potential being cultivated by the respondents.

4.3 Determine the awareness of nutrition knowledge

Figure 4.1 presents the mean awareness of nutrition knowledge among farmers, traders and consumers of traditional African vegetables. Awareness of nutrition knowledge Awareness of nutrition knowledge was highest among farmers (*mean= 2.86*), consumers (*mean = 2.76*) and lowest among traders (*mean=2.27*). Farmers grew TAVs due to their awareness of nutrition knowledge which was accessed from social groups. Consumers scored high in awareness of nutrition knowledge compared to traders. Traders engaged in TAVs business mainly for profit.

Figure 4.1 Mean Nutrition Knowledge of Farmers, Traders and Consumers

4.4 Factors influencing farmers, traders and consumer's awareness of nutrition knowledge

This section presents factors influencing awareness of nutrition knowledge in the three categories of respondents; farmers, traders and consumers of traditional African vegetables. This was initially analysed using standard Poisson regression model and later generalized Poisson model due to the presence of under-dispersion because farmers`, traders` and consumers` awareness of nutrition knowledge follows a count data.

Farmers' Model

The mean deviance and the Pearson chi-square ratio (the Pearson chi-square value divided by its degree of freedom) were used to assess the degree of fit of the standard Poisson model. The estimated Deviance and Pearson ratios are shown below:

Deviance/df = 30.81093633/52 = 0.59

Pearson/df = 25.95179108/52 = 0.49

From these results, both ratios were significantly smaller than 1 indicating that there is evidence of under-dispersion. Hence the standard Poisson model did not fit the data well. Consequently, the discussion below (Table 4.5) is based on the results of generalized Poisson model. Table 4.6 show comparison between standard Poisson and generalized Poisson as to fit, lower values of either Akaike Information Criterion (AIC) or Bayesian Information Criterion (BIC) indicate a better fit. Generalized Poisson model was a better fit for the data.

Table 4.5 Factors which influence farmers' awareness of nutrition knowledge

	Standard Poisson		**Generalized Poisson**	
Dependent variable = Number of Nutrition knowledge known	**IRR**	**P-values**	**IRR**	**P-values**
Gender	1.219	0.091*	1.182	0.099*
Log of Years in schooling	2.330	0.000***	2.389	0.000***
Log of Age	2.687	0.027***	3.108	0.014***
Occupation	1.028	0.382	1.016	0.534
Log of Income	1.018	0.780	1.011	0.835
Group membership	1.028	0.309	1.055	0.620
Log of Household size	0.725	0.062*	0.717	0.046**
TAVs farm size	1.158	0.040**	1.139	0.072*
Constant	0.084	0.044	0.079	0.024
Number of observations	61		61	
Wald chi2(8)	38.16		33.21	
Prob>chi2	0.0000		0.0001	
Pseudo R2	0.0304		0.0660	

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

Table 4.6 Akaike's and Bayesian Information Criterion

Model	Obs.	ll(null)	ll(model)	df	AIC	BIC
Standard Poisson	61	-104.4171	-101.2473	9	220.4946	239.4925
Generalized Poisson	61	-97.95632	-91.49381	10	202.9876	224.0964

As hypothesized, education and income of the household jointly have no effect on the awareness of nutrition knowledge among farmers. The results of Wald test (combined effect of education and income), however, found education and income have a joint statistically significant effect on the awareness of nutrition knowledge. The joint test yielded a P-value of 0.0004. The null hypothesis that education and income jointly do not influence awareness of nutrition knowledge was therefore

rejected at 5% level of significance. From the model results, it has been shown that farmers' awareness of nutrition was influenced positively by gender of the respondent, number of years in schooling, age of the respondent, household size and TAVs farm size. However, annual income, occupation and group membership did not statistically influence the awareness of nutrition knowledge of the respondent.

Gender of the respondent significantly influence (P-value <0.1) their awareness of nutrition knowledge. This implies that, gender of the respondent increase the expected awareness of nutrition knowledge by some 18%. Male respondents are more likely to have higher awareness of nutrition knowledge as compared to their female counterparts. This could be because TAVs were mainly produced for commercial purposes.

Furthermore, years in schooling influence significantly (P-value<0.001) awareness of nutrition knowledge. The more years spent in school by the respondent the more likely to be more aware of nutrition knowledge as compared to the ones who spent fewer years. This finding shows that education plays an important role on awareness of nutrition knowledge. The less educated farmers are likely to associate with lack of awareness of nutrition knowledge. This may mean less educated farmers are not well informed of the benefits they could possibly accrue from possessing awareness of nutrition knowledge. However, household income of the respondents did not significantly influence on their awareness of nutrition knowledge.

On the other hand, awareness of nutrition awareness of nutrition knowledge was positively influenced by the age of the respondent (P-value<0.01). For each additional of one year, incidence rate for awareness of nutrition knowledge would be expected to change by factor of 3.108, while holding all other variables in the model constant. This finding means that the older one gets, the

more knowledgeable in nutrition one likely to become. On other hand, younger farmers had little or no awareness of nutrition knowledge.

The study findings reveal that awareness of nutrition knowledge was influenced by household size (P-value<0.05). This imply that, increase the size of household, incidence rate for awareness of nutrition knowledge would be expected to change by a factor of 0.717, while holding all other variables in the model constant. Large household size could access vital information on traditional vegetables. Also, farm size (P-value<0.1) allocated for growing TAVs influence awareness of nutrition knowledge of the respondent. This indicate that additional of one acre will increase awareness of nutrition knowledge by nearly 14%. Famers who decided to allocate big area to grow TAVs were influenced by their awareness of nutrition knowledge.

The model shows that famers` awareness of nutrition knowledge was significantly influenced by the gender of the respondent, number of years spent in school, age of the respondent, household size and plot farm TAVs size under TAVs. These independent variables are statistically significantly at 95 percent confidence interval as shown by P-values. However, farmers` awareness of nutrition knowledge was not significantly influenced by respondent's annual income, occupation and group membership or social capital.

Traders Model

The mean deviance and the Pearson chi-square ratio (the Pearson chi-square value divided by its degree of freedom) were used to assess the degree of fit of the standard Poisson model. The estimated Deviance and Pearson ratios are shown below:

Deviance/df = 40.79479437/53 = 0.76

Pearson/df = 30.81113652/53 = 0.58

From these results, both ratios are significantly smaller than 1 indicating that there is evidence of under-dispersion. Hence the standard Poisson model did not fit the data well. Consequently, the discussion below (Table 4.7) is based on the results of generalized Poisson model. Table 4.8 show comparison between standard Poisson and generalized Poisson model as to fit, lower values of either Akaike Information Criterion (AIC) or Bayesian Information Criterion (BIC) indicate a better fit. Generalized Poisson model was a better fit for the data.

Table 4.7 Factors which influence traders' awareness of nutrition knowledge

	Standard Poisson		**Generalized Poisson**	
Dependent variable = Number of Nutrition knowledge known	**IRR**	**P-values**	**IRR**	**P-values**
Gender	1.051	0.708	1.134	0.423
Log of Years in schooling	0.0000134	0.018***	3.67e-06	0.005***
Log of Age	4.54e-06	0.058**	1.60e-06	0.020**
Occupation	1.012	0.818	1.027	0.578
Log of Income	0.064	0.020**	0.046	0.005***
Group membership	1.056	0.662	1.090	0.398
Log of Household size	0.059	0.141	0.065	0.071*
Log Age &Log Income	2.113	0.082*	2.305	0.027**
Log Yrs. in school & Log Income	2.271	0.016*	2.477	0.005***
Log Age & Ln HH size	5.223	0.204	5.024	0.109
Constant	1.89e+18	0.011	1.15e+20	0.003
Number of observations	64		64	
Wald chi2(10)	18.86		19.07	
Prob>chi2	0.0421		0.0394	
Pseudo R2	0.0186		0.0398	

, ** 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
Standard Poisson	64	-110.4389	-108.3874	11	238.7749	262.5226
Generalized Poisson	64	-104.1484	-100.0033	12	224.0065	249.9131

As hypothesized, education and income of the household jointly have no effect on the awareness of nutrition knowledge among traders. The results of Wald test (combined effect of education and income), however, found education and income to have a joint statistically significant effect on the awareness of nutrition knowledge. The joint test yielded a P-value of

0.0157. The null hypothesis that education and income jointly do not influence awareness of nutrition knowledge was therefore rejected at 5% level of significance. From the model results (Table 4.7), it has been shown that awareness of nutrition knowledge of traders was influenced positively by age of the respondent, number of years in schooling, annual income, household size, interaction of age and annual income, and interaction of years in schooling and annual income of the respondent. However, gender, occupation and group membership of the respondent did not significantly influence traders' awareness of nutrition knowledge.

Age of the respondent significantly influenced (P-value <0.05) awareness of nutrition knowledge. This implies that, increasing age of the respondent by one year the expected awareness of nutrition knowledge will change by a factor of 1.60e-06. The findings also showed that, years in schooling influence significantly (P-value<0.01) awareness of nutrition knowledge. The more years spent in school by the respondent the more likely that trader will be more aware of nutrition knowledge as compared to the ones spent fewer years. This show that education plays an important role on increasing awareness of nutrition knowledge. The less educated traders are likely to associate with lack awareness of nutrition knowledge. This may mean less educated traders are not well informed of the benefits they could possibly accrue from possessing awareness of nutrition knowledge. The study findings reveal that awareness of nutrition knowledge was influenced by household size (P-value<0.1). This implies that, with increase in the size of household, incidence rate for awareness of nutrition knowledge would be expected to change by a factor of 0.065, while holding all other variables in the model constant.

Interaction between age and annual income (P-value<0.05) significantly influence awareness of nutrition knowledge. This implied that there was an association nutrition knowledge and if respondent was older and wealthier. The results of the study showed that interaction between

number of years in schooling and annual income (P-value<0.001) of the respondent had significant influence on respondent's awareness of nutrition knowledge. This finding showed that there is a relationship between number of years in schooling and annual income, and awareness of nutrition knowledge of the respondent.

On the other hand, awareness of nutrition knowledge is positively influenced by annual income of the respondent (P-value<0.01). Each additional income of 1Tshs, incidence rate for awareness of nutrition knowledge changed by a factor of 0.046. Wealthier traders are able to quickly obtain nutrition information and other information because they have the ability to move and attend meetings and other interactions that may be important to help them acquire nutrition knowledge than their less wealthy traders.

The model also showed that traders` awareness of nutrition knowledge is significantly influenced by age of the respondent, number of years spent in school, household size, annual income and interaction between age and annual income, and interaction of number of years spent in school and annual income of the respondent. Few independent variables were statistically significantly at 95 percent confidence interval as shown by p-values. However, traders` awareness of nutrition knowledge was not significantly influenced by gender, occupation and group membership of the respondent.

Consumers' Model

The mean deviance and the Pearson chi-square ratio (the Pearson chi-square value divided by its degree of freedom) were used to assess the degree of fit of the standard Poisson model. The estimated Deviance and Pearson ratios are shown below:

Deviance/df = 123.8073647/231 = 0.54

Pearson/df = 107.9043492/231 = 0.47

From these results, both ratios are significantly smaller than 1 indicating that there is evidence of under-dispersion. Hence the standard Poisson model did not fit the data well. Consequently, the discussion below (Table 4.9) is based on the results of generalized Poisson model. Table 4.10 show comparison between standard Poisson and generalized Poisson model as to fit, lower values of either Akaike Information Criterion (AIC) or Bayesian Information Criterion (BIC) indicate a better fit. Generalized Poisson model was a better fit for the data.

Table 4.9 Factor which influence consumers' awareness of nutrition knowledge

	Standard Poisson		**Generalized Poisson**	
Dependent variable = Number of Nutrition knowledge known	**IRR**	**P-values**	**IRR**	**P-values**
Gender	1.039	0.543	1.041	0.460
Log of Years in schooling	1.414	0.002***	1.365	0.002***
Log of Age	1.239	0.261	1.276	0.064*
Log of Household size	1.041	0.648	1.03	0.726
Occupation	1.011	0.462	1.020	0.081*
Log of Income	1.004	0.902	0.994	0.825
Group membership	1.083	0.134	1.065	0.189
Constant	0.805	0.738	0.944	0.916
Number of observations	239		239	
Wald chi2(10)	17.11		19.73	
Prob>chi2	0.0167		0.0062	
Pseudo R2	0.0072		0.0184	

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

Table 4.10 Akaike's and Bayesian Information Criterion

Model	Obs.	ll(null)	ll(model)	df	AIC	BIC
Standard Poisson	239	-402.2397	-399.3466	8	814.6933	842.505
Generalized Poisson	239	-372.4379	-365.601	9	749.202	780.4902

As hypothesized, education and income of the household jointly have no effect on the awareness knowledge among consumers. The results of Wald test (combined effect of education and income) however found education and income have a joint statistically significant effect on the awareness of nutrition knowledge. The joint test yielded a P-value of 0.0069. The null hypothesis that education of nutrition and income jointly do not influence awareness of nutrition knowledge was

therefore rejected at 5% level of significance. From the model results, it has been shown that consumers` awareness of nutrition knowledge was influenced positively by the age of respondent, number of years in schooling and occupation of the respondent. However, gender, household size, group membership and income of the respondent did not statistically influence consumers' awareness of nutrition knowledge.

Age of the respondent significantly influenced (P-value <0.1) respondent's awareness of nutrition knowledge. This implies that, each additional year of age to respondent increase the expected awareness of nutrition knowledge by some 28%. This indicate that older TAVs' consumers were more knowledgeable in nutritional importance of these vegetables than younger consumers.

Furthermore, years in schooling influenced significantly (P-value<0.001) respondent's awareness of nutrition knowledge. Each additional year respondent spent in school was associated with an estimated 37% increase in their nutrition knowledge. Thus the more the years spent in school by a respondent the more likely that the consumer will be more aware of nutrition knowledge as compared to the ones spent fewer years. This finding shows that education plays an important role on awareness of nutrition knowledge. The less educated consumers are likely to associate with lack of awareness of nutrition knowledge. This may mean less educated consumers are not well informed of the benefits they could possibly accrue from possessing nutrition knowledge.

Occupation of the respondent had significant influence (P-value<0.1) on respondent's awareness of nutrition knowledge. Occupation of the respondent increased by some 2% the expected number of awareness of nutrition knowledge. This implies that respondent who had occupation were associated with increase of awareness of nutrition knowledge.

The model showed that consumers` awareness of nutrition knowledge was significantly influenced by age of respondent, number of years spent in school, and occupation of the respondent. Few independent variables were statistically significant at 95 and 90 percent confidence interval as shown by p-values. However, consumers` awareness of nutrition knowledge was not significantly influenced by age of respondent.

Furthermore, the more the number of years spent in school by the respondent the more the likelihood that the consumer will be more aware of nutrition knowledge as compared to the ones who spent fewer years in school. On the other hand, awareness of nutrition knowledge is positively influenced by the consumers` occupation. Age of the consumer influenced significantly respondent's awareness of nutrition knowledge. The results of the study also showed that annual income, gender, household size and group membership of the respondent did not significantly influence their awareness of nutrition knowledge.

4.5 Socio-economic factors that influence intake frequency of TAVs

This section presents the socio-economic factors that influenced the intake frequency of traditional African vegetables among three categories of respondents namely; farmers, traders and consumers. These factors were analysed first using standard Poisson model and later using generalized Poisson regression due to the presence of under-dispersion.

Farmers Model

The mean deviance and the Pearson chi-square ratio (the Pearson chi-square value divided by its degree of freedom) were used to assess the degree of fit of the standard Poisson model. The estimated Deviance and Pearson ratios are shown below:

Deviance/df = 20.34730709/48 = 0.42

Pearson/df = 16.16006631/48 = 0.34

From these results, both ratios are significantly smaller than 1 indicating that there is evidence of under-dispersion. Hence the standard Poisson model did not fit the study data well. Consequently, the discussion below (Table 4.11) is based on the results of generalized Poisson model. Table 4.12 shows comparison between standard Poisson and generalized Poisson model as to fit, lower values of either Akaike Information Criterion (AIC) or Bayesian Information Criterion (BIC) indicate a better fit. Generalized Poisson model was a better fit for the data.

As hypothesized, age and annual income of the household jointly have no effect on the intake frequency of TAVs. The results of Wald test (combined effect of age of respondent and household income), however, found the age of the respondent and household income to have a joint statistically significant effect on the intake frequency of TAVs. The joint test yielded a P-value of 0.0035. The null hypothesis that age of the respondent and household income jointly do not influence intake frequency of TAVs was therefore rejected at 5% level of significance.

From the model results, it was shown that intake frequency of farmers is influenced positively by their age, annual household income, household size, TAVs farm size and market price of TAVs. However, gender, number of years in schooling, occupation, distance to the market, culture/taboos, medicinal value and weekly TAVs purchase budget did not significantly influence their intake frequency of these vegetables.

Age of the respondent significantly influenced (P-value <0.05) their intake frequency of TAVs. This implies that, each additional year of age of the respondent increased the expected intake frequency of TAVs by a factor of 2.098. These results indicated that older respondents are likely to consume more TAVs' than younger respondents.

Table 4.11 Factors that influence farmers' intake frequency

Dependent variable = Intake frequency	Standard Poisson IRR	Standard Poisson P-values	Generalized Poisson IRR	Generalized Poisson P-values
Gender	0.956	0.713	0.886	0.434
Log of Years in schooling	1.329	0.465	1.221	0.654
Log of Age	1.679	0.046**	2.098	0.035**
Occupation	1.023	0.384	0.979	0.568
Log of Income	0.879	0.076*	0.771	0.001***
Log of household size	0.459	0.001***	0.359	0.001***
Log of farm size	1.077	0.410	1.253	0.034**
Log of distance to Mkt	0.950	0.437	0.888	0.123
Culture/taboos	1.010	0.950	1.016	0.935
Medicinal value	1.029	0.875	1.029	0.903
Price of TAVs	1.336	0.027**	1.406	0.016***
Log of TAVs Weekly spent	1.063	0.658	1.131	0.248
Constant	0.974	0.986	3.297	0.523
Number of observations	61		61	
Wald chi2(11)	22.11		40.95	
Prob>chi2	0.0363		0.0000	
Pseudo R2	0.0288		0.1739	

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

Table 4.12 Akaike's and Bayesian Information Criterion

Model	Obs.	ll(null)	ll(model)	df	AIC	BIC
Standard Poisson	61	-69.30718	-67.31347	13	160.6269	188.0683
Generalized Poisson	61	-61.0714	-50.44855	14	128.8971	158.4493

Furthermore, annual household income influenced significantly (P-value<0.01) the intake frequency of TAVs. With each additional increase of 1Tshs. in respondent's income, the incidence rate ration for intake frequency would be expected to change by a factor of 0.771 while holding all other variables in the model constant. These results showed that household income played a vital role on the intake frequency of TAVs.

Household size significantly influence (P-value<0.01) intake frequency of TAVs. If the size of the household increase by one individual, incidence rate ratio for intake frequency of TAVs would be expected to change by a factor of 0.359, while holding all other variables in the model constant. The bigger the household size the higher the consumption of TAVs. On the other hand,

the smaller the size of the household the lower intake frequency of TAVs. This implies that additional of one member in the household more intake of TAVs.

Farm size allocated for TAVs significantly influenced (P-value<0.05) the intake frequency of TAVs. Farm size was associated with an estimated 25% increase in the intake frequency. Thus in the study area, intake frequency of TAVs was positively related to farm size allocated to TAVs.

Intake frequency of TAVs was positively influenced by price of TAVs (P-value<0.01). Price of TAVs was associated with an estimated 41% increase in the intake frequency. This indicate that in the study area respondents consumed frequently TAVs due to its affordability.

The model showed that farmers` intake frequency of TAVs was significantly influenced by age of the respondent, annual household income, household size, farm size and price of TAVs. These independent variables were statistically significantly at 95 percent confidence interval as shown by p-values. However, farmers` intake frequency was not significantly influenced by gender, number of years in schooling, occupation, distance to the market, culture/taboos, medicinal value and weekly TAVs purchase budget.

Traders' Model

The mean deviance and the Pearson chi-square ratio (the Pearson chi-square value divided by its degree of freedom) were used to assess the degree of fit of the standard Poisson model. The estimated Deviance and Pearson ratios are shown below:

Deviance/df = 16.1268195/53 = 0.304

Pearson/df = 14.35957168/53 = 0.271

From these results, both ratios are significantly smaller than 1 indicating that there is evidence of under-dispersion. Hence the standard Poisson model did not fit the study data well. Consequently, the discussion below (Table 4.13) is based on the results of generalized Poisson model. Table 4.14

show comparison between standard Poisson and generalized Poisson model as to fit, lower values of either Akaike Information Criterion (AIC) or Bayesian Information Criterion (BIC) indicate a better fit. Generalized Poisson model was a better fit for the data.

As hypothesized, age and annual income of the household jointly had no effect on the intake frequency of TAVs. The results of Wald test (combined effect of age of respondent and household income), however, found age of the respondent and their household income had joint statistically significant effect on the respondents' intake frequency of TAVs. The joint test yielded a P-value of 0.032. The null hypothesis that age of the respondent and household income jointly do not influence intake frequency of TAVs was therefore rejected at 5% level of significance.

Table 4.13 Factors which influence traders' intake frequency

	Standard Poisson		**Generalized Poisson**	
Dependent variable = Intake frequency	**IRR**	**P-values**	**IRR**	**P-values**
Gender	1.588	0.000***	2.726	0.000***
Log of Years in schooling	0.855	0.665	0.698	0.468
Log of Age	0.682	0.237	0.827	0.551
Occupation	0.959	0.485	0.927	0.227
Log of Income	1.069	0.326	1.067	0.365
Log of household size	1.429	0.200	1.342	0.302
Log of distance to Mkt	0.973	0.599	0.969	0.530
Culture/taboos	Omitted		Omitted	
Medicinal value	1.291	0.096*	1.268	0.091*
Price of TAVs	1.022	0.871	1.134	0.391
Log of TAVs Weekly spent	1.049	0.510	1.068	0.336
Constant	0.492	0.723	0.129	0.249
Number of observations	64		64	
Wald chi2(10)	29.29		25.63	
Prob>chi2	0.0011		0.0043	
Pseudo R2	0.0140		0.0921	

, ** 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
Standard Poisson	64	-79.53566	-78.41972	11	178.8394	202.5872
Generalized Poisson	64	-66.85267	-60.69816	12	145.3963	171.3029

From the model, the results showed that intake frequency of TAVs for traders was influenced positively by gender of the respondent and medicinal properties. However, the number of years in schooling, age, distance to nearest market, annual income, occupation, price of TAVs and TAVs weekly purchase budget did not significantly influence the intake frequency.

Gender of the respondent significantly influenced (P-value <0.01) the intake frequency of TAVs. This implies that, gender of the respondent increased the expected incidence rate ratio for intake frequency changed by a factor of 2.726 while holding all other variables in the model constant. Female respondents were more likely to have higher intake frequency as compared to their male counterparts. This implies that female gender consumes TAVs more frequently than male counterparts do.

Intake frequency of TAVs was positively influenced by medicinal value (P-value<0.1). The incidence rate ratio for intake frequency changed by a factor of 1.268 or increased by 27% when respondent consumed TAVs for medicinal purposes. Thus, in the study area respondents consumed frequently TAVs as medicine due to its ability to heal diseases.

The model showed that traders` intake frequency of TAVs was significantly influenced by gender of the respondent and medicinal properties. These independent variables were statistically significantly at 95 percent confidence interval as shown by P-values. However, traders` intake frequency was not significantly influenced by number of years in school, age, occupation, annual income, household size, distance to the nearest market, price of TAVs and TAVs weekly purchase budget.

Consumers' Model

The mean deviance and the Pearson chi-square ratio (the Pearson chi-square value divided by its degree of freedom) were used to assess the degree of fit of the standard Poisson model. The estimated Deviance and Pearson ratios are shown below:

Deviance/df = 58.08657017/227 = 0.25

Pearson/df = 48.33728332/227 = 0.21

From these results, both ratios are significantly smaller than 1 indicating that there is evidence of under-dispersion. Hence the standard Poisson model did not fit the data well. Consequently, the discussion below (Table 4.15) is based on the results of generalized Poisson model. Table 4.16 show comparison between standard Poisson and generalized Poisson model as to fit, lower values of either Akaike Information Criterion (AIC) or Bayesian Information Criterion (BIC) indicate a better fit. Generalized Poisson model was a better fit for the data.

Table 4.15 Factors which influence consumers' intake frequency

	Standard Poisson		**Generalized Poisson**	
Dependent variable = Intake frequency	**IRR**	**P-values**	**IRR**	**P-values**
Gender	1.057	0.349	1.100	0.154
Log of Years in schooling	1.180	0.211	1.179	0.226
Log of Age	1.079	0.356	1.156	0.123
Occupation	0.986	0.356	0.977	0.159
Log of Income	1.021	0.544	1.028	0.439
Log of household size	1.054	0.513	1.092	0.369
Log of distance to Mkt	0.932	0.038**	0.929	0.012**
Culture/taboos	0.884	0.000***	0.746	0.047**
Medicinal value	1.018	0.786	1.080	0.276
Price of TAVs	1.191	0.002***	1.213	0.002***
Log of TAVs Weekly spent	1.156	0.000***	1.177	0.000***
Constant	0.139	0.006	0.064	0.001
Number of observations	239		239	
Wald chi2(11)	56.37		73.85	
Prob>chi2	0.0000		0.0000	
Pseudo R2	0.0161		0.1154	

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

Table 4.16 Akaike's and Bayesian Information Criterion

Model	Obs.	ll(null)	ll(model)	df	AIC	BIC
Standard Poisson	239	-279.6684	-275.1778	12	574.3556	616.0731
Generalized Poisson	239	-234.7561	-207.6537	13	441.3073	486.5014

As hypothesized, age and annual income of the household jointly have no effect on the intake frequency of TAVs. The results of Wald test (combined effect of age of respondent and annual household income), however, found age of the respondent and household income have a joint statistically significant effect on the intake frequency of TAVs. The joint test yielded a P-value of 0.024. The null hypothesis that age of the respondent and household income jointly do not influence intake frequency of TAVs was therefore rejected at 5% level of significance.

From the model results, it was seen that consumers` intake frequency was influenced positively by distance to the nearest market, culture/taboos, price of TAVs and TAVs weekly purchase budget. However, age, gender of the respondent, number of years in schooling, occupation, annual household income, household size and medicinal value did not statistically influence consumers' nutrition knowledge.

Distance to the nearest market negatively significant influence (P-value<0.05) intake frequency of TAVs. The closer the market to the consumers, the incidence rate ratio for frequently intake of TAVs will change by a factor of 0.929, while holding all other variables in the model constant. Thus more time was taken going to the market, in turn decreased the intake frequency of TAVs by 7%.

The amount spent weekly to purchase TAVs positively influenced (P-value<0.01) intake frequency of TAVs. Thus each additional expenditure of 1Tshs in the purchase of TAVs was associated with an estimated 18% increase of the intake frequency. More money resources set aside to buy TAVs it is an indication for increasing intake. The results also show that price of

TAVs (P-value<0.01) positively influence intake of TAVs. Price of TAVs was affordable to consumers and consumption increase by 21%. This imply that price of TAVs determine intake frequency in the study area. Intake frequency of TAVs negatively influenced (P-value<0.05) by culture/taboos of the respondent. Culture/ taboos decrease frequently intake of TAVs by some 25%. This implies that the more respondents retain their culture and food taboos the less consumption of TAVs.

The model showed that consumers` intake frequency of TAVs was significantly influenced by distance to the nearest market, culture/taboos, TAVs weekly purchase budget and price of TAVs. Independent variables were statistically significantly at 95 percent confidence interval as shown by p-values. However, consumers` intake frequency of TAVs was not significantly influenced by age, gender, number of years in schooling, occupation, medicinal value and household size of the respondent.

4.6 Attitude towards consumption of traditional African vegetables

Farmers

The results of the analysis of responses to the statement are as shown in Table 4.17. The results show 28.6% and 71.4% of the farmers` respondent agreed and strongly agreed respectively that consumption of traditional African vegetables was important to women and children as well as to men and 41.3% and 58.73% agreed and strongly agreed respectively that intake could improve eyesight and boost body immunity.

These results further showed that, 85% of respondents believed that fresh TAVs contain more nutrients than dried ones and almost 94% of the respondents agreed that TAVs are best consumed when fresh. About 98% of the respondents positively agreed that it was important to

choose daily diet accompanied with TAVs while 84% of the respondents agreed that consuming TAVs variety each day provides the required vitamins and minerals.

About 33.3% and 50.8% of the respondents disagreed and strongly disagreed respectively that TAVs were inferior foods or poverty food while 47.6% and 38.1% of the respondents disagreed and strongly disagreed, respectively, that TAVs take time to prepare. Also the results showed that 31.8% and 57.4% of the respondent disagreed and strongly disagreed respectively that TAVs being not good for them. About 30.2% and 23.8% disagreed and strongly disagreed, respectively, that TAVs were tasteless and bitter while almost 45% of the respondent agreed and strongly agreed. African nightshade and spider plants were mentioned during focus group discussion to be tasteless and bitter if they are not mixed with other TAVs varieties such as amaranth. However, more than 96% of the respondents were committed and willing to use their own resources especially time to safeguard and preserve TAVs for the coming generation by continuing growing as well as consuming them.

Table 4.17 Farmers Attitude towards TAVs Consumption

Attitudinal views/Dimensions	Percent of households within the response				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Consumption of TAVs important to women, children and men	0	0	0	28.57	71.43
TAVs are inferior foods, poverty food	50.79	33.33	1.59	7.94	6.35
Fresh TAVs contain more nutrients than dried ones	1.59	1.59	11.11	42.86	42.86
Intake of TAVs each day gives vitamins and minerals needed	0	3.17	12.70	39.68	44.44
Important to choose daily diet with TAVs	0	0	1.59	57.14	41.27
Eating TAVs improve eyesight and boost immunity	0	0	7.94	33.33	58.73

TAVs are best consumed when fresh	0	1.59	4.76	41.27	52.38
TAVs takes more time to prepare	38.10	47.62	0	6.35	7.94
TAVs are not good to me	57.41	31.75	0	3.17	7.94
TAVs are tasteless and bitter	23.81	30.16	1.59	38.10	6.35
Committed to preserve TAVs for next generation	0	0	3.17	47.62	49.21

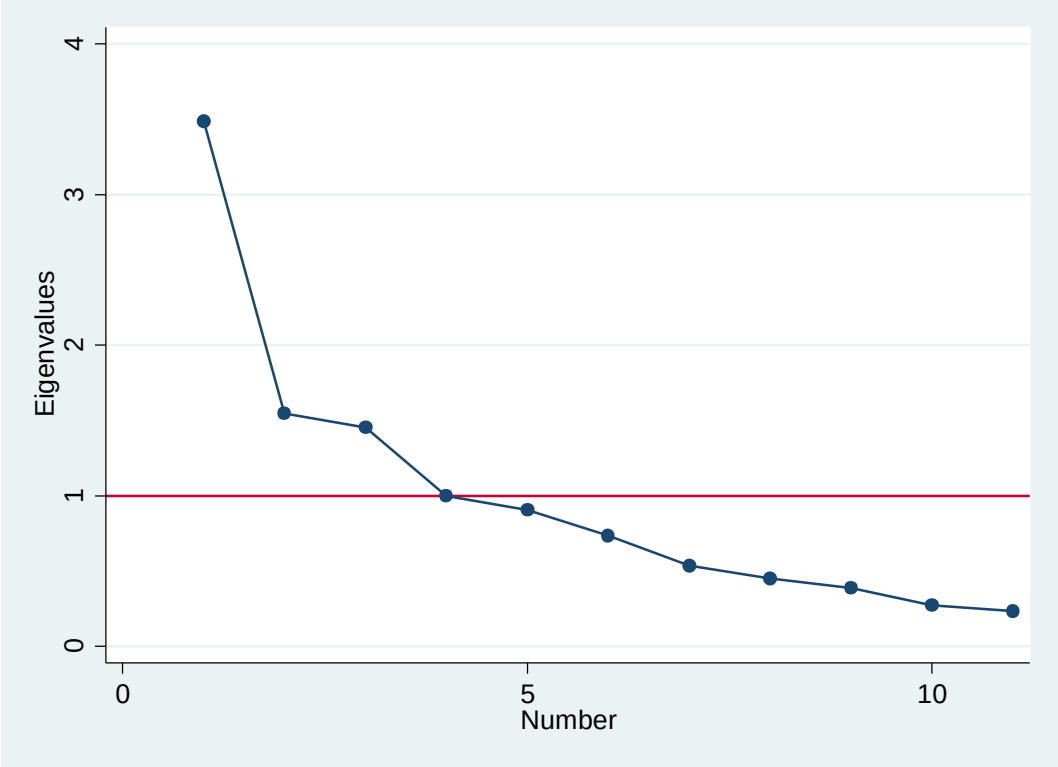

Figure 4.2 Farmers Eigenvalue Vs Factor number

The variables that had large loadings on the same factors were grouped together. Factor loadings value of 0.50 and above is normally considered good and significant (George & Mallery, 2003). Figure 4.2 marks the usual cutoff for retaining principal components, and again emphasize the less importance of components 4 through 11. For farmers, only three factors were retained for further analysis. The analysis produced a solution with three factors that accounted for 58.95% of the total explained variance as shown in Table 4.18.

Table 4.18 Results of Exploratory factor analysis

Factor and item description	Factor loading	% Variance explained
Factor 1: Health benefits		31.44
Consumption of TAVs is important to women, children and men	0.530	
Fresh TAVs contain more nutrients than dried ones	0.574	
Intake of TAVs variety each day guarantee vitamins and minerals required	0.872	
It is important to choose diet accompanied with TAVs	0.753	
Consumption of TAVs improve eyesight and boost body immunity	0.572	
TAVs are best consumed when fresh	0.733	
I am willing to preserve TAVs for the next generation	0.716	
Factor 2: Personal perception		13.79
TAVs are not good to me	0.633	
Factor 3: Personal taste		13.72
TAVs are tasteless and bitter	0.895	

The Kaiser's overall measure of sampling adequacy obtained was 0.694, which borders on the recommended threshold of 0.7 suggesting that the data is appropriate for factor analysis. Seven attitude variables concerning importance and conservation of TAVs were loaded on Factor 1 with the cross-correlation coefficients of 0.530, 0.574, 0.872, 0.753, 0.572, 0.733 and 0.716, respectively. This factor accounted for 31.4% of the total variance and was termed ‘health benefits’ because these variables mainly involve importance of consumption as well as conservation by local farmers. Higher scores and positive responses on this factor revealed a general understanding for significance of consumption TAVs as well as safeguarding these varieties for the next generation.

Factor 2 had cross-correlation coefficients of 0.633 where it was then labeled ‘personal perception’ due to TAVs varieties appear not good to consumers. Factor 2 accounted for 13.79% of the total variance.

One attribute (namely, personal taste) was loaded on Factor 3 with cross-correlation coefficient of 0.895. This attribute focused on taste issues. Hence Factor 3 was termed ‘personal taste’. It accounted for 12.71% of the total variance. The cumulative percent of variance for all the factors explained was 58.95%.

Traders

The results of the analysis of responses to the statement are as shown in Table 4.19. The results show 12.3% and 86.2% of the traders` respondent agreed and strongly agreed, respectively, that consumption of traditional African vegetables to be important to women and children as well as to men and, 24.6% and 69.2% positively agreed and strongly, respectively, that intake improve eyesight and boost body immunity.

Results showed that 92.3% of respondents believe fresh TAVs contain more nutrients than dried ones. About 35.4% and 63.1% agreed and strongly agreed respectively that TAVs were best consumed when fresh. About 43.1% and 49.2% of the respondents agreed and strongly agreed respectively that it was important to choose daily diet accompanied with TAVs and 91% said consuming TAVs variety each day provides vitamins and minerals required.

About 33.9% and 61.5% of the respondents disagreed and strongly disagreed respectively that traditional African vegetables were inferior foods or poverty food. About 50.8% and 35.4% of the respondents disagreed and strongly disagreed, respectively, that TAVs take time to prepare. Also the results showed 40% and 49.2% of the respondent disagreed and strongly disagreed,

respectively, that TAVs were not good to them. About 18.5% and 38.5% disagreed and strongly disagreed, respectively, that TAVs to be tasteless and bitter while only 43.08% of the respondent agreed and strongly agreed. African nightshade and spider plants were mentioned during focus group discussion to be tasteless and bitter if they are not mixed with other TAVs varieties. However, 100% of the respondents were committed and willing to use their own resources especially time to safeguard and preserve TAVs for the coming generation by continuing growing as well as consuming them.

Table 4.19 Traders Attitude toward TAVs Consumption

Attitudinal views/Dimensions	Percent of households within the response				
	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Consumption of TAVs important to women, children and men	0	1.54	0	12.31	86.15
TAVs are inferior foods, poverty food	61.54	33.85	3.08	0	1.54
Fresh TAVs contain more nutrients than dried ones	1.54	1.54	4.62	36.92	55.38
Intake of TAVs each day gives vitamins and minerals needed	0	1.54	7.69	43.08	47.69
Important to choose daily diet with TAVs	3.08	1.54	3.08	43.08	49.23
Eating TAVs improve eyesight and boost immunity	0	1.54	4.62	24.62	69.23
TAVs are best consumed when fresh	0	0	1.54	35.38	63.08
TAVs takes more time to prepare	35.38	50.77	0	3.08	10.77
TAVs are not good to me	49.23	40	0	0	10.77
TAVs are tasteless and bitter	38.46	18.46	0	0	43.08
Committed to preserve TAVs for next generation	0	0	0	36.92	63.08

Figure 4.3 marks the usual cut off for retaining principal components, and again emphasize the unimportance of components 5 through 11. For traders, only four factors were retained for further analysis. Factor loadings value of 0.50 and above is normally considered good and significant (George & Mallery, 2003). The analysis produced a solution with five factors that accounted for 74.47% of the total explained variance as shown in Table 4.20.

The Kaiser's overall measure of sampling adequacy obtained was 0.695, which borders on the recommended threshold of 0.7 (George & Mallery, 2003) suggesting that the data is appropriate for factor analysis. Five attitude variables concerning importance of consuming TAVs varieties were loaded on Factor 1 with the cross-correlation coefficients of 0.835, 0.915, 0.721, 0.872, and 0.838, respectively. This factor accounted for 32.38% of the total variance and was termed ‘Health benefits’ because these variables focused mainly on important of consuming TAVs by local traders. Higher scores and positive responses on this factor revealed a general understanding for significance of consumption and intake frequency of traditional African vegetables.

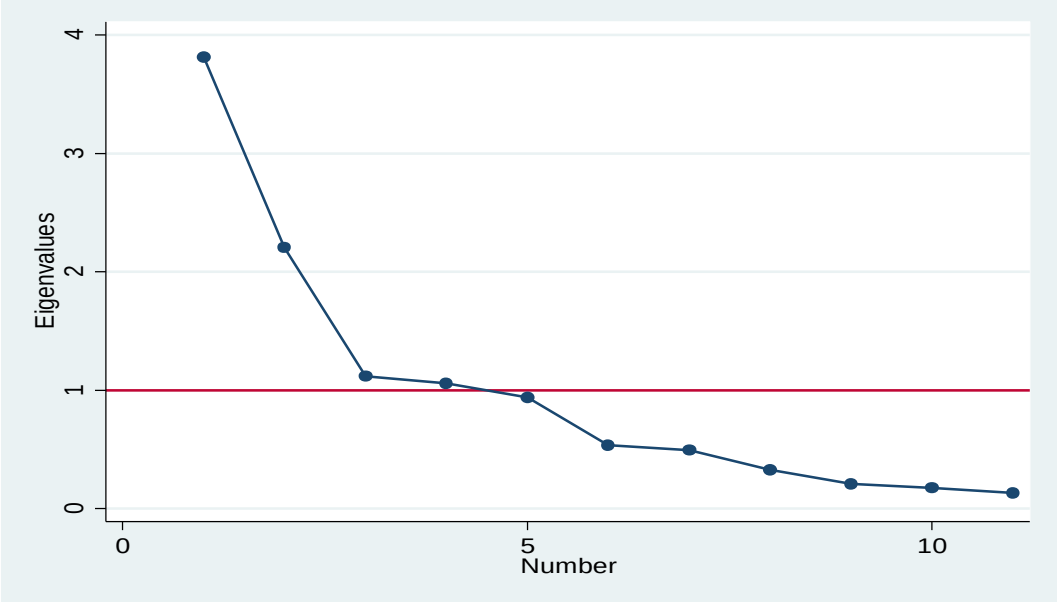

Figure 4.3 Traders Eigenvalue Vs Factor number

Factor 2 had cross-correlation coefficients of 0.664 and 0.879. Because these variable focus mainly at taste toward TAVs varieties. Factor 2 was then labeled ‘personal taste’ and accounted for 20.78% of the total variance. Higher scores and positive responses on this factor revealed a general opinion that it was important to consider how TAVs varieties taste.

Table 4.20 Results of exploratory factor analysis

Factor and item description	Factor loading	% variance explained
Factor 1: Health Benefits		32.38
Fresh TAVs contain more nutrients than dried ones	0.835	
Intake of TAVs variety each day guarantee vitamins and minerals required	0.915	
It is important to choose diet accompanied with TAVs	0.721	
Consumption of TAVs improve eyesight and boost body immunity	0.872	
TAVs are best consumed when fresh	0.838	
Factor 2: Personal taste		20.78
TAVs are inferior foods (poverty food)	0.664	
TAVs are tasteless and bitter	0.879	
Factor 3: Time factor		10.84
TAVs takes more time in preparation	0.941	
Factor 4: Personal perception		10.48
TAVs are not good to me	0.956	

Only one attribute (namely, TAVs preparation time) were loaded on Factor 3 with cross-correlation coefficients of 0.941. This attributes focused on time to prepare TAVs. Hence Factor 3 was termed ‘time factor’. Peri-urban consumers normally have no time to prepare TAVs, but

usually traders prepare them and sell to them already prepared and ready for cooking. This was not the case with rural consumers. Time factor accounted for 10.84% of the total variance.

Factor 4 had cross correlation coefficient of 0.956 and this variable was labeled 'personal perception' and it accounted for 10.48% of the total variance. There is a negative perception towards TAVs that they are generally not good. It has been in the communities for years. Negative perceptions toward TAVs normally hinder intake frequency. The cumulative percent of variance for all the factors explained was 74.47%. About 25.53% of the factors were not explained.

Consumers

The results of the analysis of responses to the statement are as shown in Table 4.21. The results show 27.9% and 69.9%% of the consumers` respondent agreed and strongly agreed, respectively, that consumption of traditional African vegetables were important to women and children as well as to men and, 24.4% and 70.6%% agreed and strongly agreed, respectively, that intake of TAVs improved eyesight and boosted body immunity.

Results showed that 82.1% of the respondents believed that fresh TAVs contain more nutrients than dried ones and, 45% and 52.7% agreed and strongly agreed, respectively, that TAVs were best consumed when fresh. About 51.9% and 44.7% of the respondents agreed and strongly agreed, respectively, that it was important to choose daily diet accompanied with TAVs and 90.07% said consuming TAVs variety each day provides vitamins and minerals requirement.

About 39.7% and 52.7% of the respondents disagreed and strongly disagreed respectively that traditional African vegetables were inferior foods or poverty food. About 53.8% and 34.7% of the respondents disagreed and strongly disagreed, respectively, that TAVs take time to prepare. Also the results showed that 45.4% and 46.6% of the respondent disagreed and strongly disagreed,

respectively, that TAVs were not good for them. About 29.8% and 30.5% disagreed and strongly disagreed, respectively, that TAVs to be tasteless and bitter while only 37.4% of the respondent were positively. African nightshade and spider plants were mentioned during focus group discussion to be tasteless and bitter if not mixed with other TAVs varieties such as amaranths and cowpea leaves. However, nearly 100% of the respondents were committed and willing to use their own resources especially time to safeguard and preserve TAVs for the coming generation by continuing growing as well as consuming them.

Table 4.21 Consumers Attitude towards TAVs Consumption

Attitudinal views/Dimensions	Percent of households within the response				
	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Consumption of TAVs important to women, children and men	0.76	0.76	0.76	27.86	69.85
TAVs are inferior foods, poverty food	52.67	39.69	2.29	2.29	3.05
Fresh TAVs contain more nutrients than dried ones	1.53	4.58	11.83	41.98	40.08
Intake of TAVs each day gives vitamins and minerals needed	0.38	0.38	9.16	45.80	44.27
Important to choose daily diet with TAVs	0.76	0.38	2.29	51.91	44.66
Eating TAVs improve eyesight and boost immunity	0.38	1.15	3.44	24.43	70.61
TAVs are best consumed when fresh	0.76	1.15	0.38	45.04	52.67
TAVs takes more time to prepare	34.73	53.82	0	6.49	4.96
TAVs are not good to me	46.56	45.42	0	0.38	7.63
TAVs are tasteless and bitter	29.77	30.53	2.29	33.97	3.44
Committed to preserve TAVs for next generation	0.38	1.15	0	40.23	58.24

Figure 4.4 marks the usual cut off for retaining principal components, and again emphasize the unimportance of components 5 through 11. For consumers, only four factors were retained for further analysis.

The analysis produced a solution with five factors that accounted for 68.30% of the total explained variance as shown in Table 4.22. The Kaiser's overall measure of sampling adequacy obtained was 0.667, which suggest that the data is appropriate for factor analysis. Four attitude variables concerning taste of TAVs varieties was loaded on Factor 1 with the cross-correlation coefficients of 0.460, 0.514, 0.790 and 0.783, respectively.

This factor was termed ‘Taste’ of TAVs varieties because these variables involved taste of TAVs by local consumers, and also taste loads higher in this factor compared to other statements. Higher scores and positive responses on this factor revealed a general opinion that it was important to consider how TAVs varieties taste.

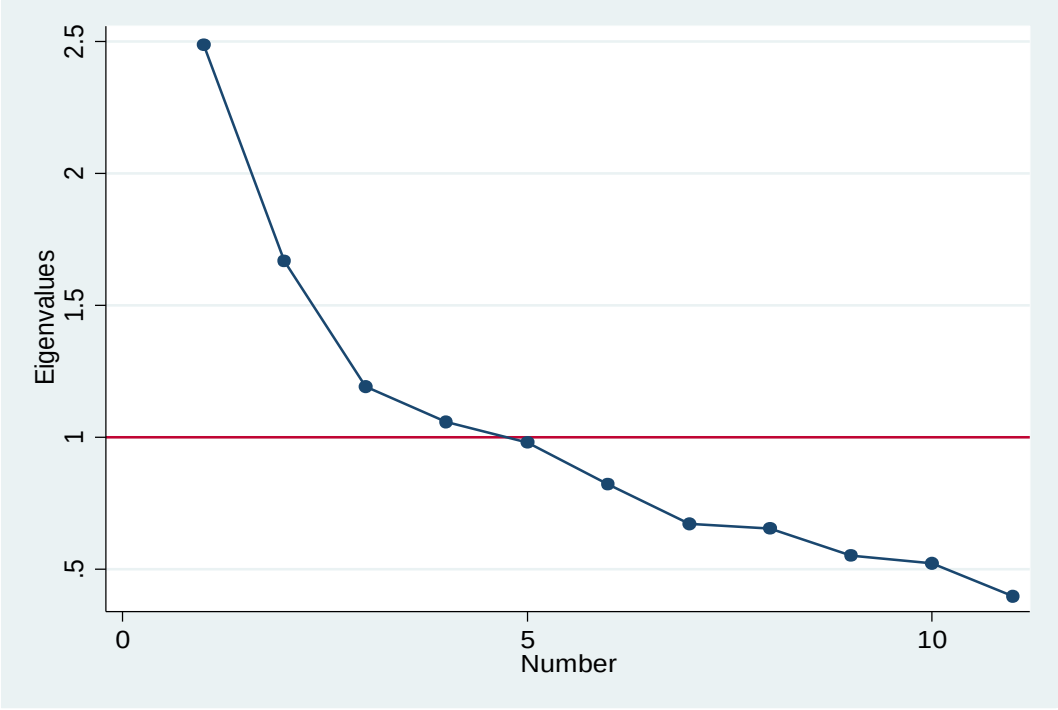

Figure 4.4 Consumers Eigenvalues Vs Factor Number

The “Health” factor had cross-correlation coefficients of 0.740, 0.772, and 0.410, respectively. These statements focused mainly on health benefits. This factor account for 15.31% of the total variance. Consumers were persuaded that TAVs had medicinal properties and hence were important for promoting human health. In the study area, African eggplant has been used as treatment for blood pressure, African nightshade for increasing blood while jute mallow was also used for stomach ulcers as well as a cure for pains of the joints. This implies that the health benefits in these TAVs influence their consumption positively.

Table 4.22 Results of exploratory factor analysis

Factor and item description	Factor loading	% variance explained
Factor 1: Taste		18.55
TAVs are inferior foods (poverty food)	0.460	
It is important to choose diet accompanied with TAVs	0.514	
TAVs are tasteless and bitter	0.790	
Willing to preserve TAVs for the next generation	0.783	
Factor 2: Health		15.31
Consumption of TAVs is important to women, children and men	0.740	
Consumption of TAVs improves eyesight and boosts immunity	0.772	
TAVs takes more time to prepare	0.410	
Factor 3: Freshness		14.36
TAVs are best consumed when fresh	0.640	
Fresh TAVs contain more nutrients than dried ones	0.646	
Eating a variety of TAVs each day guarantee vitamins	0.450	
Factor 4: Perception		10.00
TAVs are not good to me	0.899	

The “Freshness” factor had three attributes loaded and had cross-correlation coefficients of 0.646, 0.640, 0.450 respectively These attributes focused on the importance of consuming fresh TAVs. Hence Factor 3 was termed ‘Freshness’ of TAVs. This factor accounted for 14.36% of the total variance. In the study area, dried vegetables are not commonly found compared to other areas in Tanzania due to the fact that Arumeru Districts receives rain almost throughout the year. This indicated that, fresh TAVs were preferred to dried ones.

The “Perception” factor had cross correlation coefficient of 0.899. This statement was labelled ‘Perception’ and accounted for 10.0% of the total variance. There is a negative perception towards TAVs particularly associated with men that these vegetables are not good for them. It has been in the communities for years. Negative perceptions toward TAVs hinder their consumption. The cumulative percent of variance for all the four factors (Taste, Health, Freshness, Perception) explained was 58.22%.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

Malnutrition is one of the most serious health problems in the world, with enormous human and economic costs. Among others, it includes insufficient intake of micronutrient as well as excessive intake of calories through imbalanced consumption of fats and sugars. Concerns about the health status of individuals have stimulated scholars and research organisations to study the reasons for low intake and factors that could up stage intake of traditional African vegetables.

This study evaluated traditional African vegetables with high nutritional potential being produced. It determined nutrition knowledge; socio-economic factors that influence intake frequency, and attitudes of farmers, traders and consumers towards these vegetable varieties. Descriptive statistics were used to identify traditional African vegetables with high potential being cultivated in Arumeru District. Regression techniques were used to determine nutrition knowledge among farmers, traders and consumers, and the socio-economic factors influencing intake frequency of TAVs. This study used a generalized Poisson regression (GPR) model to determine nutrition knowledge and socio-economic factors that influence intake frequency of TAVs. The study utilized descriptive analysis and exploratory factor analysis to assess the attitudes towards TAVs among farmers, traders and consumers. The data used was collected through personal interviews using pre-tested questionnaires from 381 respondents in Arumeru District. The area was purposively selected due to its high involvement in the production, marketing and consumption of traditional African vegetables as well as good environmental weather that support growing of these varieties.

The study found out that traditional African vegetables varieties with high nutritional potential being cultivated include African nightshade, Amaranths, Ethiopian mustard and African eggplant based upon respondents' opinions. The study also established the factors that influence farmers' nutrition knowledge included gender of respondent, education of the respondent, age of the respondent, household size and size of TAVs farm owned by a farmer. The study specifically found out that household income on its own did not have a significant effect on nutrition knowledge and this may have been due to the low household income of households as compared to traders and consumers in the area. However, education was found to have a significant effect on farmers' nutrition knowledge. Education and income jointly had a significant effect on farmers' overall nutrition knowledge. Thus, the null hypothesis that education and income jointly have no effect on farmers' nutrition knowledge was rejected. The study concluded that income and education of the respondent significantly impacted the expected number of nutrition knowledge known by a farmer.

The study finding found that the factors influencing traders' nutrition knowledge included education of the respondent, age of the respondent, household income, household size, interaction of age and household income, and interaction of education and annual household income of the respondent. Education and income jointly had a significant effect on traders' nutrition knowledge. Therefore, the null hypothesis that education and income jointly have no effect on traders' nutrition knowledge was rejected. The study concluded that income and education of the respondent significantly impacted the expected number of nutrition knowledge known by a trader.

The study found out that the factors influencing consumers' nutrition knowledge include education, age and occupation of the respondent. The study specifically found that household income on its own did not have a significant effect. However, education was found to have a

significant effect on nutrition knowledge. Education and income jointly had a significant effect on consumers' nutrition knowledge. The null hypothesis that education and income jointly have no effect on consumers' nutrition knowledge was therefore rejected. The study concluded that income and education of the respondent significantly impacted on the expected number of nutrition knowledge known by a consumer.

The study found out that the factors explaining farmers' intake frequency of TAVs included the age of the respondent, household income, household size, farm size and price of TAVs. The null hypothesis that age and household income jointly does not influence intake frequency of TAVs was thus rejected. The study concluded age of the respondent and household income had a significant role in determining farmers' intake frequency of TAVs.

The factors explaining traders' intake frequency of TAVs include gender of the respondent and medicinal value of TAVs. However, age of the respondent and household income on its own, did not influence intake of TAVs. The null hypothesis that age and household income jointly does not influence intake frequency of TAVs was rejected. The study concluded that age of the respondent and household income have a significant role in determining traders' intake frequency of TAVs.

The study also found out that the factors explaining consumers' intake frequency of TAVs include distance to the market, culture/ taboos, price of TAVs and weekly budget to purchase TAVs. However, age of the respondent and household income on its own, did not influence intake of TAVs. The null hypothesis that age and household income jointly does not influence intake frequency of TAVs was thus rejected. The study concluded that age of the respondent and household income had a significant role in determining consumers' intake frequency of TAVs.

Lastly, this study found out that the attitude of farmers toward consumption of TAVs was associated with health benefits, personal perception and personal taste. This finding revealed that farmers consumed TAVs primarily for personal health purpose. Also, the study found out that the attitudes of traders toward consumption of TAVs was associated with health benefits, personal taste, time factor and personal perceptions. However, attitude of consumers toward consumption of TAVs was mainly influenced by taste, health, freshness and perception. Thus, it was concluded that farmers, traders and consumers' attitude toward traditional African vegetables had some effect on their consumption.

5.2 Conclusions

The study findings indicate that the majority of the respondents have low level of education. The low level of education has implications on various fronts including collecting, analyzing and understanding information relating to consumption. In general, education was found to influence farmers, traders and consumers' nutrition knowledge in spite of being low. Other strategies for educating respondents on importance of consuming traditional African vegetables may include promotion awareness campaigns such as distribution of educational materials on topics such as nursery establishment, management of pests and diseases, reduction of post-harvest loses, vegetables-based recipes, and how to target and supply vegetables to high value markets.

Gender was found to have a significant influence on farmers' nutrition knowledge but it was not so for traders and consumers. The majority of the respondents were mainly male by gender. This may have contributed to the statistical significance of nutrition knowledge. In the majority of the rural communities, women are not usually vocal especially on questions related to family. To reach out to the females who are in such areas, policies that target women participation should be encouraged. The male spouses can be encouraged to attend such forums to allay any fears they

may have. Also alternative approaches can be run with men involvement to provide support and security to women.

The majority of respondents in Arumeru District relied on farming as their main occupation. To minimize this dependence, there is need to invest in sensitization and training forum on commodity value chains which could boost income.

5.3 Recommendation

Investment in both formal and informal education of respondents in the study area. Formal education raises awareness of benefits of nutrition knowledge while the informal education can greatly change respondents' intake frequency as well as attitude toward traditional African vegetables. This could result in repeat purchase of vegetables for consumers who don't buy TAVs, leading to increased sales and revenue to both farmers and traders thus improving their health status as well as economic welfare.

Traders may need to incorporate nutritional messages in their promotion strategies to communicate the nutritional and health benefits obtained from consumption of TAVs to their customers. Creation of awareness on nutritional benefits of TAVs could increase consumers' nutrition knowledge. This could in turn influence consumers' attitude toward TAVs from negative to positive, which could then stimulate an increase in demand and supply of these vegetables.

The development, documentation and promotion of recipes would be an important tool in promoting traditional African vegetable varieties among people who may not know how to cook these species but are willing to try them. This is because many people may have access to TAVs but have no knowledge about how they should be prepared, cooked and served. Improving taste in vegetable varieties that have a bitter taste could also be an important practice. Vegetables such as

African nightshade, cowpeas leave and spider plants are very bitter and unpalatable to many consumers. In an effort to lessen the bitterness people boil the vegetables, wash and throw away the water thereby losing valuable water-soluble nutrients.

Socio-cultural motivation for the people to feel proud about their traditional African vegetables instead of global ones as well as attracting young people to consume them. Communities should be helped to rediscover the cultural value of cultivating and consuming TAVs by according special prestige to such traditions. This can be done using special community gatherings in which farmers are encouraged to show case varieties of TAVs cultivation and their culinary skills and experience. This can be up scaled by the Ministry of Agriculture, Livestock and Fisheries in collaboration with AVRDC-ESA by using Saba Saba and Nane Nane exhibitions as well as carrying out more research in relation to traditional African vegetables.

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ANNEXE 1: FARMERS QUESTIONNAIRE

ANALYSIS OF FACTORS INFLUENCING PRODUCERS AND CONSUMERS' INTAKE OF TRADITIONAL AFRICAN VEGETABLES:

THE CASE STUDY OF ARUSHA REGION, TANZANIA

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 labour 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? _____ Tshs.
2. What is the size of your household? …….
3. What ethnicity group do you belong to?
   1 = Meru ( ) 2 = Maasai ( ) 3 = Arusha [Waarusha] ( ) 4 = Chagga ( )

   5 = Pare ( ) 6 = Others (*please specify*) _____

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= African eggplants / ***Ngogwe***		2= Amaranths / ***Mchicha***		3= African nightshade/ ***Mnavu***		4 = African spider plant / ***Mgagani***		5 = Ethiopian Mustard / ***Loshuu***		6 = Others (*specify*)	_____ _____ _____

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

1= African eggplants / ***Ngogwe***		2= Amaranths/ ***Mchicha***		3= African nightshade/ ***Mnavu***		4 = spider plant/ ***Mgagani***		5 = Ethiopian mustard / Loshuu		6 = Other (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 = Commercial	2 = Family consumption	3 = Contract with traders`	4 = Both 1 and 2	5 = Others (*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 _____
   (b) Please, mention five groups of foods 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 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 Vegetables	**Per Week**					**Source**
	Once or twice	3 or 4 times	5 or 6 times	More than 6 times	Never/ almost never	
1 = African eggplant / ***Ngogwe***						
2 = Amaranth / ***Mchicha***						
3 = African nightshade / **Mnavu**						
4 = Spider plant / **Mgagani**						
5 = Ethiopian mustard / **Loshuu**						
6 = Potatoes leaves / ***Tembele***						
7 = Watercress/ ***Saladi***						
8 = Pumpkin / ***maboga***						
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? _____Tshs.
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	5= Women	6=Family/clan		3=labor sharing	4=market access	5=resource acces (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

ANNEX 2: TRADERS QUESTIONNAIRE

ANALYSIS OF FACTORS INFLUENCING PRODUCERS AND CONSUMERS' INTAKE OF TRADITIONAL AFRICAN VEGETABLES:

THE CASE STUDY OF ARUSHA REGION, TANZANIA

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 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 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?
   1 = Meru ( ) 2 = Maasai ( ) 3 = Arusha [Waarusha] ( ) 4 = Chagga ( )
   4 = Pare ( ) 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 = African eggplant / ***Ngogwe***	
2 = Amaranth / ***Mchicha***	
3 = African nightshade / ***Mnavu***	
4 = Spider flower / ***Mgagani***	
5 = Sweet potatoes leaves / ***Tembele***	
6 = Cassava leaves / ***Kisamvu mhogo***	
7 = Pumpkin leaves / ***Majani ya maboga***	
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 = H/H 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 = African eggplant / ***Ngogwe***						
2 = Amaranth / ***Mchicha***						
3 = African nightshade / ***Mnavu***						
4 = Spider plant / ***Mgagani***						
5 = Ethiopian mustard / ***Loshuu***						
6 = Potatoes leaves / ***Tembele***						
7 = Pumpkin / ***Maboga***						
8 = Watercress / ***Saladi***						
9 = Others (*specify*)						

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

ANNEX 3: CONSUMERS QUESTIONNAIRE

ANALYSIS OF FACTORS INFLUENCING PRODUCERS AND CONSUMERS' INTAKE OF TRADITIONAL AFRICAN VEGETABLES:

THE CASE STUDY OF ARUSHA REGION, TANZANIA

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*) _____

Occupation 1=Agriculture 2=Casual labour 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? _____Tshs.
2. What is the size of your household? …….
3. What ethnicity group do you belong to?
   1 = Meru ( ) 2 = Maasai ( ) 3 = Arusha [Waarusha] ( ) 4 = Chagga ( )
   4 = Pare ( ) 5 = others (*please specify*) _____

Section 2: Traditional African vegetable

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? _____ Tshs.
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 = African eggplant / ***Ngogwe***	
2 = Amaranth/ ***Mchicha***	
3 = African nightshade / ***Mnavu***	
4 = Sweet potatoes leaves / ***Tembele***	
5 = Okra / ***Bamia***	
6 = Cassava leaves / ***Kisamvu***	

7 = Jute mallow / ***Mlenda***	
8 = Pumpkin leaves / ***Majani ya maboga***	
9 = Cowpea leaves / ***Majani ya kunde***	
10 = African spider flower / ***Mgagani***	
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 _____
   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 = African eggplant / ***Ngogwe***						
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5 = Ethiopian mustard / ***Loshuu***						
6 = Potatoes leaves / ***Tembele***						
7 = Pumpkin / ***Maboga***						
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 reason 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	4=market	

7= SACCoS	8=Other (specify)			sharing	access	5=resource acces (eg.water)

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!