CONSUMPTION OF PULSES AMONG URBAN AND RURAL CONSUMERS IN TANZANIA

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A DISSERTATION SUBMITTED IN A PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS OF SCIENCE IN AGRICULTURAL AND APPLIED ECONOMICS OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

2015

ABSTRACT

Pulses are the major source of income to farmers and nutrients to people and animals. Pulses also offer natural maintenance benefits in the soil. In spite of economic and nutritional importance its consumption is low and has been decreasing over time. This study investigated not only factors underlying pulses consumption but also its consumption pattern. Data used in the analysis were collected by the National Bureau of Statistics in 2010/11 which covered 21 regions in Tanzania mainland and five regions in Island (Unguja and Pemba). A total of 3846 households were interviewed of which 2583 were from rural and 1263 from urban areas. Results from non- parametric tests show variations in pulses consumption among comparison variables except in terms of marital status. Average intake was high in the middle expenditure group, while household heads aged from 16-30 years consume less than other consumers. A double hurdle model results revealed that household sizes and education levels of the decision makers residing in rural areas had significant effect on the decision to consume pulses while the extent of consumption was influenced by their education levels, household sizes, households' total expenditure, prices of pulses and meat. Household sizes, education levels and sex significantly affected decision to consume whereas age, education levels, household sizes and household's total expenditure influenced the extent of consumption in urban areas. In summary, participation in pulses' market was lower in rural than in urban areas. However, overall consumption was lower in urban than in rural areas, implying that the prospect for increasing its consumption is higher in urban than in rural areas. There is a need to devise strategies for promoting the consumption of pulses in both areas.

DECLARATION

I, Adelina Mfikwa, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution

_____ _____

Adelina Mfikwa Date

(MSc Candidate)

The above declaration is confirmed;

_____ _____

Prof. F. T. M. Kilima Date

(Supervisor)

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ACKNOWLEDGEMENTS

I wish to express my gratitude to a number of people who without their moral, financial, spiritual and intellectual guidance, I would not have come this far. Special thanks to my supervisor, Prof. F.T.M. Kilima for his tremendous support, tireless intellectual advice, precious time and encouragement which made this dissertation possible.

I thank CMAAE programme and BVCP for granting me tuition fees and research funds for my studies. I would also like to thank my employer, Bunda District Council for releasing me from work to pursue studies.

I am forever indebted to my family (my beloved mother Tumaini, my son Enock, my sister Dorothy, brothers Cuthbert and Emmanuel) who supported and prayed with me throughout the period of study. Thank you and God bless you abundantly.

Thanks to my fellow colleagues who kept encouraging me even at times when I felt there was no hope in this whole process coming to a conclusion.

Thank you Lord because I have come this far.

DEDICATION

I dedicate this work to my late father, Enock Eliah Mfikwa, and my mother, Tumaini Shem Mfikwa, who taught me the values of honesty, wisdom, perseverance and love for God and people. Thanks to God for, His grace keeps my father's soul in eternal peace and keeps on blessing my mother abundantly.

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LIST OF ABBREVIATIONS AND SYMBOLS

BVCP	Bean Value Chain Project
CMAAE	Collaborative Masters in Agricultural and Applied Economics
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Statistics
gm/day/person	Gram per day per person
IFPRI	International Food Policy Research Institute
NBS	National Bureau of Statistics
NNBS	Nigeria National Bureau of Statistics
OECD	Organisation for Economic Cooperation Development
PEM	Protein Energy Malnutrition
USAID	United States Agency for International Development
VIF	Variance Inflation Factor
WHO	World Health Organization

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Pulses are annual leguminous crops yielding from one to twelve grains or seeds of variable size, shape and colour within a pod; they are harvested for the dry grains (FAO, 1994). This term 'pulses' excludes the 'leguminous oil-seeds', such as soya beans, which are primarily processed for oil extraction and green beans and peas which are generally classified as green vegetables (FAO, 1994; Schneider, 2002).

Pulses play an important role in the nutritional and food security for a large number of people in developing countries. Pulses represent a major source of protein compared to other grains and minerals for people, livestock and it allows actors within the chain to earn income (FAO, 2005; Odendo *et al*., 2011). Moreover, pulses offer natural soil maintenance benefits through nitrogen-fixing, which improves yields of cereals through practices such as crop rotation and mixed cropping thereby reducing the application of nitrogenous fertilizers to support plant growth (Okereke *et al.*, 2006; IFPRI, 2010; Maredia, 2012).

Pulses have considerable adaptation to high temperatures and drought compared to other crops (Singh *et al*., 2009). The crop is a drought-tolerant and it grows in many semi-arid and drought prone areas (Mussa *et al*., 2012). There is evidence showing that about 1000kg/ha of dry grain has been produced in a Sahelian environment with only 181mm of rainfall (Hall and Patel, 1985).

1.2 Production and Consumption

Statistics show that the global production of pulses was about 63.1 million tons in 2009 and was significant in Asia, Americas, Africa and Europe with annual production capacity of about 28.6, 14.4, 12.1 and 6.2 million tons; respectively (FAOSTAT, 2014). India was the main producer with an average of 16.3 million tons which is about 33.6 % of the total world pulses production. In Africa, Nigeria was the leading producer of pulses with an average of 2.6 million tons that was about 5.3% of the world pulses production. Tanzania was ranked 12th among the pulses producing countries in the world. This production was equivalent to 1.5 million tons and was about 2.2% of the world pulses production (FAOSTAT, 2012). In Africa the consumption of pulses in 2009 was estimated to about 10.5 kg/year/person where in East Africa the consumption was approximately 15.4 kg/year/person (FAOSTAT, 2012). The consumption of pulses may be part of a healthy lifestyle that prevents weight gain and is suitable for diabetic patients since it is gluten free and has low glycaemic indexes (Rehman *et al*., 2014). Production and consumption data reveal that common beans, pigeon peas, chickpeas, cowpea, bambara nuts and peas are widely cultivated and consumed in Tanzania (Abate, 2011).

1.3 Economic Importance of Pulses

As for other crops pulses value chain involves many actors who assume different roles. The major roles in this value chain are production, value addition, sales, consumption of pulses and other products derived from pulses.

In terms of economic importance, sales of pulses enable farmers to earn income that is not only used to buy fertilizer and other inputs but also to supplement needs for cereals such as rice, maize and others which does not thrive in some areas. As farmers' income increases their ability to purchase other grains is enhanced leading to improved food

security situations (Odendo *et al*., 2011). Since the production and consumption allow people to derive multiple benefits, pulses are crucial in reducing poverty, increasing income, improving health and nutrition, addressing food insecurity problems among smallholder farmers and fixing nitrogen in soils (Okereke *et al*., 2006; Dilis and Trichopoulou, 2009; Akibode, 2011).

1.4 Problem Statement and Justification

Regardless of its nutritional and economic importance, the average consumption of pulses in Tanzania is 6.8gm/day/person which is generally below the FAO recommended level of 30gm/day/person. Besides, the consumption trend has been declining over time. This trend reflects changes in consumer preferences and failures by suppliers to align pulses attributes to consumer preferences (FAO, 2003). Moreover, children below five years, pregnant and lactating mothers are mostly affected by protein energy malnutrition. Also children are born with low birth weight due to high protein energy malnutrition in pregnant women (Mazengo *et al*., 1997; NBS, 2011). In an ideal world, pulses would be the best alternative for this group of consumers because they are richer in protein than any other grain and are cheaper than animal source protein (Akibode, 2011).

The focus of this study was to understand pulses consumption pattern for different categories of consumers, factors underlying its consumption and the spatial significance of these factors as a basis to inform policy about the prospect to increase the portion of pulses in Tanzanians' regular diet and improve health and earnings of chain actors. Furthermore the study reveals the demand pattern and locate where within consumers' category the demand for pulses is likely to be high. This information is critical for agribusiness and related firms contemplating to venture into food business.

1.5 Objectives

1.5.1 Overall objective

The overall objective of this study was to investigate factors influencing pulses consumption among urban and rural Tanzanians as an entry point to leverage pulses development and utilization initiatives in the country.

1.5.2 Specific objectives

i. To compare pulses consumption across consumers' categories.

ii. To analyse factors that influence consumption of pulses.

1.5.3 Hypothesis

i. Frequency and levels of pulses consumption is the same across consumers' categories.

ii. Socio economic factors have insignificant effect on pulses consumption.

1.5.4 List of Papers

i. Who consume more pulses? An Empirical Investigation from Tanzania.

ii. Factors influencing the consumption of pulses in rural and urban areas of Tanzania

1.5.5 Organization of the dissertation

This dissertation is organized into four chapters, the introduction is covered in chapter one. Chapter two presents the first paper titled "Who consume more Pulses? An empirical Investigation from Tanzania", chapter three presents the second paper titled "Factors influencing the consumption of pulses in rural and urban areas of Tanzania". Chapter four presents the extended conclusion and the implication of these findings.

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CHAPTER TWO

2.0 Who Consume More Pulses? An Empirical Investigation from Tanzania

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2.1 Abstract

This paper identifies differences in frequencies and levels of consumption among Tanzanian household consumers that consume pulses using cross sectional data. Non-parametric techniques encompassing Kruskal-Wallis H and Mann-Whitney U tests were performed to examine differences across consumers' categories. The Kruskal-Wallis H test was used to compare frequencies and levels of consumption across age groups, education levels, adult equivalent and income groups. Mann-Whitney U test was adopted to compare frequencies and levels of consumption between two independent groups of household consumers that were distinguished on the basis of sex (male vis-à-vis female), marital status (married vis-à-vis single) and location of households (rural vis-à-vis urban). Results show that male headed households eat more pulses and more frequently than female headed households whereas rural households consumed more pulses than urban households. There is a significant difference in frequencies of consumption between age groups, education level groups, expenditure groups and adult equivalent groups. Pair-wise comparison of levels of consumption revealed that households headed by people aged between 16-30 years consumed less pulses than all other groups of households' heads. In terms of levels of education, a significant difference was observed between households' head with and without primary education and training on practical skills where the former consumed pulses more frequently but less quantities than the latter. However, households

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headed by people with secondary education with some practical skills consumed less pulses than those with primary education and similar skills. Middle expenditure groups were found to consume more pulses than the lowest expenditure group. Households with less adult equivalents consumed less quantity of pulses and less frequently than household with more adult equivalents. The study recommends creating more awareness about the benefits (health, economic and environmental) of pulses among young headed households' and crafting and piloting initiatives encompassing varietal improvements to meet consumers' desired attributes for pulses (taste, appearance and other quality attributes).

Key words: *Pulses Consumption, Cross sectional Data, Kruskal-Wallis H Test, Mann-Whitney U Test*

2.2 Introduction

The economic importance of pulses in Tanzania, other African countries and elsewhere in the world is well documented in literature. In places where it is widely produced and consumed is an important source of income for farmers, traders as well as other chain actors (Odendo *et al*., 2011). Pulses are specifically important for poor people and vegetarians as they are cheaper sources of protein than meat, fish, milk and other animal products (Weliwita *et al*., 2003; Drewnowski and Specter, 2004). Nutritionists have established that pulses are among the low-fat, high-carbohydrate food products that are increasingly being recommended for a healthy life-style (Rizkalla, 2002; Sadler, 2004; Jukanti *et al*., 2012).

While common beans, pigeon peas, chickpeas, cowpea, bambara nuts and peas are widely cultivated in Tanzania, its average consumption is about 6.8gm/day/person which is generally below the FAO recommended level of 30gm/day/person (Leterme, 2002; NBS, 2010). Trends show that this level of consumption has been decreasing over time. Statistics show that per capita consumption of pulses decreased by 1.4% between 2000 and 2009 (FAOSTAT, 2014). This low and decreasing level of consumption could be attributed to factors such as changing diet behaviour, family structures along with consumers' income and lifestyle (Verbeke, 2005; Msangi and Rosegrant, 2012; Chongela *et al*., 2014). The food choice domain for ordinary people in Tanzania has traditionally included the main staples; especially cereal grain, roots and tubers, bananas, legume (beans and peas), nuts and vegetables. The consumption of other food products such as milk, meat, fish and fruits has generally been rare and low (Weliwita *et al.,* 2003; Ngasapa *et al.,* 2010).

Many analysts have attempted to identify factors underlying the consumption of specific food groups in Tanzania (Weliwita *et al.,* 2003; Kaliba, 2008; Muhihi *et al*., 2012). Others have compared food intake across space (Mafuru and Marsh 2003; Chongela *et al.,* 2014) or consumers' groups (Pauw and Thurlow, 2011). However, studies that have comprehensively assessed and delineated the choices of the varied food categories across different dimensions of consumers' profile (e.g. location wise; across age, sex, marital status, education level, and income groups) have generally been rare. This paper attempts to fill this knowledge gap as it tests whether quantities and frequencies of pulses consumption vary significantly across consumers' profile. The paper contributes to the on-going USAID funded research in East and Sothern Africa under the Bean Innovation Lab through identifying pulses consumption pattern. Also the study contributes new knowledge as it reveals the demand pattern for different categories of consumers and locate exactly where within the consumers' category the demand for pulses is likely to be high. This information is critical for agribusiness and related firms contemplating to venture into food business.

The paper is structured into five sections including this introduction. Section two offers a comprehensive literature review followed by a brief description of the methodology in section three. Section four presents and discusses the main findings while the last section summarizes the findings and implication of these findings.

2.3 Literature Review

2.3.1 Factors underlying food consumption

Many scholars support the view that consumers' social and cultural orientation (background, food habit and norms) create location-specific influences on food choices. Food products that people consume on a regular basis tend to be uniquely influenced by

their belief, traditions and taboos (Devine *et al*., 1999; Grunert *et al*., 2004; Puoane *et al*., 2006; Leung and Stanner, 2011). However some scholars argue that food choices could change over time as new food products are increasingly being imported and consumers in importing countries are tempted to try these products. It is important to note that there have been world-wide changes in food production, processing and distribution systems that have altered people's choice of shopping and eating places along with the food products they buy and eat (Mafuru and Marsh 2003; Weliwita *et al*., 2003; Zhang and Wang, 2003; Popkin *et al*., 2005).

Food choices in Africa seem to follow this conversional path as the proportions of traditional foods are increasingly being reduced from consumers' food basket partly because domestic food markets have opened up to allow importation. Some of the foods that are imported tend to be cheaper than the locally produced ones owing to high levels of inefficiency in production, processing and preparation in importing countries (Oniang *et al*., 2003). Moreover western food culture and life style seem to have influence food choices and consumption in many African countries (Mazengo *et al*., 1997; Puoane *et al.,* 2006). The type of contacts that individuals have with one another and access to media, especially through internet have been acknowledged to reshape choices that people make.

There are several other factors apart from the social factors that influence food choices. One of the main factors that influence this decision is the cost of food products within the food basket. Naturally, it is expected that any changes in food costs and/or income will change the quantity and types of food products within the consumer's basket (Kormawa *et al*., 2000; Nayga 2000; Drichoutis *et al*., 2005; Mitchell *et al*., 2009; Revoredo-Giha *et al*., 2011; Banterle *et al*., 2013). Some analysts have acknowledged that it is difficult to describe and ascertain the effect of consumer's state of mind and emotions but

there is a consensus that psychological factors that influence consumers' reasoning and emotions may induce unique and significant variation in food choices. Personal history related to upbringing and forced/imposed food choices during the early stages of growth could result in someone avoiding entirely some foods during late stages of growth (Sztainer *et al*., 1999; Makweba, 2009).

Nevertheless, physiological factors which encompass aspects such as the level of hunger and appetite as well as nutritional requirements of a consumer that are influenced by body size/type, age, level of activity, gender, health status and reaction to foods; have also been reported to influence food choices (Sztainer *et al*., 1999; Weliwita *et al*., 2003; Vu, 2008; Revoredo-Giha *et al*., 2011; Banterle *et al*., 2013).

Studies related to food demand in Tanzania have attempted to profile food demand across location (Weliwita *et al*., 2003; Kaliba, 2008; Chongela *et al*., 2014). However, literature suggest that food demand varies not only across location (e.g. rural versus urban) but also across other socio-economic variables such as age, education level, sex and income groups (Turrini *et al*., 2001; Pauw and Thurlow, 2011). Like other foods, the consumption of pulses is bound to vary across consumers' categories. Evidence suggests that adults consume more pulses than children (Lucier *et al*., 2000; Leterme and Carmenza Muũoz, 2002) though among adults, men because of their larger caloric intake they consume more quantities than women (Lucier *et al*., 2000; Labadarios *et al*., 2011). Some studies on consumer demand across income groups have discovered that the consumption of pulses is always higher among low income earners, especially those residing in rural areas (Schneider, 2002; Labadarios *et al*., 2011). Overall there is a consensus that rural households consume more food crops than urban households as a larger share comes from own production (Leterme and Carmenza Muũoz, 2002).

In practice many empirical studies rely on analysis of number and types of meals consumed, quantities of food consumed and food costs as well as household sizes to understand the differences in food consumption (Cialfa *et al.*, 1991; Turrini *et al*., 2001). This study upholds these approaches to better understand the profile of pulses consumers in Tanzania. Unlike many of the previous studies it goes beyond identification of factors underlying the consumption to pin-pointing where within the consumer groups the differences in consumption and levels of consumption lie. The study focuses on pulses because it has been identified as one of the important crops for reducing poverty and improving human health as well as soil fertility (Pauw and Thurlow, 2011; Maredia, 2012).

2.3.2 Pertinent issues in assessing differences in food consumption

The most common problem when observing differences among comparison variables is related to deciding whether they are attributable to differences in the populations or specific variables within the populations of interest (Adams *et al*., 2009). A variety of parametric and non-parametric tests have been proposed to be appropriate in overcoming this challenge (Adams *et al*., 2009).

Analysis of Variance (ANOVA)[2] is one of the potential parametric methods that can allow for the investigation of the effects of various variables envisaged influencing the consumption of pulses. However, this analysis can only be adopted when the sample of consumers is drawn from populations that are normally distributed with homoscedastic variance (Daniel, 1990).

[2]Analysis of variance (ANOVA) is a collection of statistical models (e.g. Multivariate Analysis of Variance (MANOVA) and Analysis of covariance (ANCOVA)) that are used to analyze the differences between group means and other properties such as variation within and between groups of interest. These models are only used when all necessary assumptions are satisfied.

However, other (non-parametric) methods such as Kruskal-Wallis H and Mann-Whitney U tests assume that the observations in each group came from populations with the same or different shapes of distribution (Kruskal and Wallis, 1952; Castellan, 1988; Adams *et al*., 2009; Gregory and Dale, 2009; Hecke, 2010; Milenovic, 2011).The Kruskal-Wallis H test is used to determine whether three or more independent groups are the same or different with respect to some observable attribute (Chan and Walmsley, 1997). This test is normally used when there are at least two independent groups that are different with respect to a variable of interest but cannot show where within the groups the differences lie. The Kruskal-Wallis H test is computed as:

$$H = \frac{12}{N(N+1)}\sum \frac{R^2{}_i}{n_i} 3(N+1) \quad \text{.....(1)}$$

Where:

H=Kruskal-Wallis H statistics

N=Sample size for all groups

n_i=Size of an independent sample within group i

R_i=Sum of the ranks for the i^{th} sample

To pin-point these differences its application is normally extended to Mann-Whitney U test that can determine which of the independent groups differ significantly from each other (Chan and Walmsley, 1997). This test is computed as:

$$U_1 = n_1 n_2 + \frac{n_1(n_1+1)}{2} - \sum R_1 \quad \text{.....(2)}$$

$$U_2 = n_1 n_2 + \frac{n_2(n_2+1)}{2} - \sum R_2 \quad \text{.....(3)}$$

Where:

n_1 and n_2 are the two sample sizes

$\sum R_1 and \sum R_2$ = Sum of ranks for samples 1 and 2, respectively

Unlike ANOVA which compares mean values between groups, Mann-Whitney U and Kruskal-Wallis H tests compare their mean ranks or median values conditional to the shape of their distributions. If the distributions are assumed to be of different shapes then the mean ranks are used instead of medians and vice-versa (Turrini *et al*., 2001; Olivares *et al*., 2004; Milenovic, 2011). When these requirements are violated the analysis might be incorrect or misleading (Fagerland and Sandvik, 2009; Milenovic, 2011). Overall, non-parametric test performs better than ANOVA when the data being analysed are not normally distributed (Hecke, 2010).

2.5 Methodology

2.5.1 Data and data source

This study uses data collected by the National Bureau of Statistics (NBS) in 2010/11. The survey covered 21 regions in Tanzania mainland and five regions in Tanzania Zanzibar. A total of 3846 households were interviewed of which 2583 were randomly selected from rural and 1263 from urban areas.

2.5.2 Diagnostic tests

Data were tested to check for normality using Shapiro–Francia test and visual inspection of histograms. Results showed that the frequency and levels of consumption were not normally distributed for all groups that were compared. Levene test of homogeneity of variances in different comparison groups was also performed and results indicated that the variance was not homogenous. These formal tests for normality and homogeneity of

variance imply that the necessary assumptions were violated thus precluding the use of ANOVA.

Thus, differences in frequencies of consuming and quantities of pulses consumed were assessed using Kruskal–Wallis H and Mann-Whitney U tests. The null hypothesis (H_0) in Kruskal–Wallis H test stipulates that there are no differences in frequencies of consumption and quantities of pulses consumed among three or more independent groups of consumers whereas the null hypothesis in Mann-Whitney U test stipulates that there is no difference in these variables among two independent groups.

In this study Kruskal-Wallis H test was used to test whether there were differences in frequencies of consumption of pulses and the quantities that were consumed by different categories of consumers namely, age with four groups, education level (8 groups), adult equivalent (9 groups) and expenditure groups. Adult equivalent of the household consumers were adjusted according to mean caloric intake by age and sex of the household members. Expenditure groups in urban were divided into 3 groups; lowest expenditure group, middle expenditure group and high expenditure group. Following Kothari (2004) these groups were established as follows;

$$E = \frac{R}{N}$$

Where;

E = Class width

R = Range (maximum - minimum)

N = Number of groups

Kruskal-Wallis H test analysis was extended to Mann-Whitney U test to identify groups (pair-wise) that were different from each other. The Mann-Whitney U test was used to compare frequencies and levels of consumption for all binary variables included in the analysis. These variables were sex of households' heads (male vis-à-vis female), marital status of households' heads (married vis-à-vis single household heads) and location of households (rural vis-à-vis urban residence).

2.6 Results and Discussion

Details related to the profile of pulses consumers that were included in the sample are given in Table 1. This table shows that 67.2% of the households lived in rural areas and 32.8 % in urban areas. In terms of headship, 1983 of the households in the rural areas were headed by males and 600 households were headed by females while 912 of the households in urban areas were headed by males and 351 households were headed by females. The proportions of unmarried household heads in rural and urban areas were 76.8% and 64%, respectively. Mean age of household heads located in rural and urban areas were 47.6 and 42.7 years with standard deviations of 16.05 and 14.7, respectively. The means and standard deviations of other quantitative variables are also shown in this table.

Table 1: Statistics for important socio-economic variables in rural and urban areas

	Rural			Urban		
Variable name	**n**	**Mean**	**Standard deviation**	**n**	**Mean**	**Standard deviation**
Quantity of pulses consumed per month (Kg)	2583	5.6	7.60	1263	4.4	5.41
Age of main decision maker (years)	2583	47.6	16.05	1263	42.7	14.66
Adult-equivalents in the household	2583	4.5	2.61	1263	3.8	2.30
Number of years the main decision maker spent in school	2583	4.9	3.96	1263	7.2	4.52
Total household expenditure per month (TZS)	2583	217 538.2	168 309.62	1263	362 353.7	335 242.7
Binary variables						
Sex	**n**	**%**		**n**	**%**	
Male	1983	76.8		912	72.2	
Female	600	23.2		351	27.8	
Total	2583	100.0		1263	100.0	
Whether married						
Yes	599	23.2		455	36.0	
No	1984	76.8		808	64.0	
Total	2583	100.0		1263	100.0	

n = Number of household heads.
(%) = percentage of household head

Table 2 presents z-values, mean ranks and statistical significance for difference between variables that were compared using the Mann-Whitney U test. Results show statistical significant differences between sex and location implying that male headed households consumed pulses more frequently than female headed households. Similarly in terms of consumption there is evidence that male headed households consumed more pulses than female headed household ($p<0.05$). Also households in rural areas had higher levels of consumption compared to their counterparts in urban areas ($p< 0.01$). However there is no significant difference in terms frequency of consumption between rural and urban areas. These results are consistent with the findings of other researchers (Leterme and Carmenza Muũoz, 2002; NNBS, 2012).

Table 2: Mann-Whitney U Test for difference in frequencies and levels of pulses consumption

Comparison variable	Variable label	Frequency of consumption (days/week)				Quantity Consumed (kg/week)			
		n	Mean Rank	Sum of ranks	Mann-Whitney U(Z-value)	n	Mean Rank	Sum of ranks	Mann-Whitney U (Z-value)
Sex	Male	2168	1467.2	3 180 892.0	-3.82**	2168	1467.2	3 180 892.0	-3.820***
	Female	699	1331.0	930 386.0		699	1331.0	930 386.0	
Marital Status	Married	599	1306.1	782 380.5	-0.536	485	1051.3	509 872.0	-1.486
	Single	1984	1287.7	2 554 855.5		1548	1006.3	1 557 689.0	
Location	Rural	2583	1934.4	4 996 647.5	-0.884	1901	1507.7	2 866 195.5	-6.756***
	Urban	1263	1901.1	2 401 133.5		966	1288.9	1 245 082.5	

NB: *** means significant at p=0.01; ** means significant at p=0.05; means significant at p=0.1
n = Number of household heads

Results of Kruskal-Wallis H tests for three or more independent groups of consumers are presented in Table 3. This table reveals that there was a statistically significant difference in the frequency of pulses consumption between age groups ($p<0.01$), expenditure groups ($p<0.05$), education levels ($p<0.05$) and adult equivalent ($p<0.01$). In terms of quantities consumed differences were detected between age and expenditure groups, education levels and adult equivalent ($p<0.01$). However, Kruskal-Wallis H tests cannot tell which specific groups are statistically significant different from each other with respect to frequencies of consumption and the actual quantities consumed. Thus, it was necessary to perform Mann-Whitney U test to determine groups that were different as per results in Table 4. To ease presentation and interpretation of the results the findings are grouped according to the comparison variables.

Table 3: Kruskal-Wallis Test for difference in frequencies and levels of pulses consumption

		Frequency of Consumption (days/week)			Quantity Consumed (Kg/week)		
Comparison variable	**Variable label**	**n**	**Mean Rank**	**Kruskal-Wallis Test**	**n**	**Mean Rank**	**Kruskal-Wallis Test**
Age group	16-30 years	458	1104.4	15.199***	458	1104.4	125.71***
	31-45 years	1093	1384.9		1093	1384.9	
	46-60 years	767	1600.9		767	1600.9	
	Above 60	549	1573.6		549	1573.6	
Education level	Either completed adult or primary education	5	2156.7	15.57**	4	1640.9	45.32***
	Completed primary education or this level with training on practical skills and pre-form one	2256	1944.8		1741	1472.5	
	Completed secondary education or this level with some training on practical skills	440	1960.3		331	1179.6	
	Completed O-level education or this level with some training on special skills(certificate)	84	2132.5		66	1397.2	
	Completed A-level education or this level with some training on special skills	31	1964.6		26	1237.2	
	With diploma	37	2101.8		31	1158.3	
	Completed university education and above	42	2068.5		35	1298.4	
	Neither completed pre-primary education nor pre-primary education	951	1821.6		633	1492.7	
Expenditure group	Lowest expenditure group	3714	1912.9	10.47**	2754	1415.6	35.43***
	Middle expenditure group	117	2198.1		99	1887.9	
	High expenditure group	15	2397.1		14	1854.4	
Adult equivalent	less than 5	2617	1850.5	39.71***	1885	1266.4	253.03***
	5 to less than 10	1134	2080.3		906	1721.7	
	10 to less than 15	83	1993.8		65	2098.4	
	15 to less than 20	10	2424.2		9	2454.3	
	25 to less than 30	1	3522.0		1	2835.0	
	40 to less than 45	1	2640.5		1	2862.0	

NB: *** means significant at p<0.01; ** means significant at p<0.05; means significant at p<0.1.

2.6.1 Differences within age groups

Results in Table 4 show a difference in frequency of pulses consumption between household heads aged between 16-30 years and 46-60 where the latter consumed pulses more frequently than the former ($p<0.01$). In terms of levels of consumption there were differences across all age groups compared ($p<0.01$) except for one pair (households aged 46-60 vis-à-vis those above 60 years). Overall, the quantity consumed increased with age up to 45 years and decreased thereafter. Above 45 years we expect that the household size is reduced as older children will have their own families and moved from their parents.

2.6.2 Differences across education levels

When education levels were compared, household heads who completed primary education or this level with additional training on practical skills and pre-form one showed significant difference in both frequencies and levels of pulses consumption against those who neither completed pre-primary education nor pre-primary education. The first group consumes pulses more frequently than the second but the second consumed more pulses than the first group. Besides those who completed primary education or this level with additional training on practical skills and pre-form one consumed more pulses than the ones who completed secondary education or this level with some additional training on practical skills. We expected a significant difference between lower levels and high levels of education as high educated household heads are thought to be more conscious of health benefits of pulses thus consuming more quantities and more frequently.

2.6.3 Differences within expenditure groups

Results show that the middle expenditure group consumed pulses more frequently than the lowest expenditure group; likewise they consumed more pulses than the low income

group. These results are not consistent with other empirical studies which found that the lowest expenditure group consumed more pulses than the middle expenditure group. Literature reveals that many of lowest expenditure group are small holder farmers who tend to be net sellers after harvesting. This is the period when they exhaust their food reserves and their limited purchasing power can only allow them to purchase less compared to middle expenditure group whose income can allow to smooth consumption.

2.6.4 Differences in adult equivalent

The analysis revealed that households with less than five adult equivalents consumed less quantity of pulses and less frequently than household with 5 to 10 adult equivalent. Moreover, households with less than five along with those with 5 to 10 adult equivalent consumed less pulses than households with adult equivalents above their own levels. These findings imply that large households are more likely to rely on cheaper sources of protein such as pulses than small households; provided they have the same level of income.

Table 4: Mann-Whitney U test as Post Estimation after Kruskal-Wallis Test

Comparison variable	Variable label	Frequency of consumption			Quantity Consumed		
		n	Mean Rank	Mann-Whitney U (Z-value)	n	Mean Rank	Mann-Whitney U (Z-value)
Age group	16-30	638	765.4	-3.84***	458	483.7	-9.98***
	46-60	1003	856.4		767	690.2	
	16-30				458	665.2	-6.38***
	31-45				1093	822.4	
	16-30				458	414.5	-9.00***
	Above 60				549	578.7	
	31-45				1093	784.5	-4.50***
	Above 60				549	895.1	
	31-45				1093	871.9	-5.69***
	46-60				767	1014.4	
Education level	Completed primary education or this level with training on practical skills and pre-form one	2256	1634.6	-2.92**	331	415.4	-5.48***
	Neither completed pre-primary education nor pre-primary education	951	1531.4		633	517.6	
	Completed primary education or this level with training on practical skills and pre-form one				1741	1070.5	-5.99***
	Completed secondary education or this level with some training on practical skills				331	857.9	
Expenditure group	Lowest expenditure group	3714	1907.3	-2.77***	2754	1410.7	-5.63***
	Middle expenditure group	117	2191.4		99	1880.8	
Adult equivalent	less than 5	2617	1808.2	-5.89***	1885	1251.7	-13.79***
	5 to less than 10	1134	2032.5		906	1696.3	
	less than 5				1885	956.8	-7.98***
	10 to less than 15				65	1517.3	
	less than 5				1885	943.9	-4.17***
	15 to less than 20				9	1696.8	
	5 to less than 10				906	477.0	-3.75***
	10 to less than 15				65	611.0	
	5 to less than 10				906	455.4	-2.99***
	15 to less than 20				9	718.7	

NB: *** means significant at p<0.01; ** means significant at p<0.05; means significant at p<0.1.
Only statistically significant results are presented.

2.7 Conclusion and Policy Implication

In conclusion, results from this study show that frequency and levels of consuming pulses vary among comparison variables except with respect to marital status of the household heads. Average intake of pulses was high in the middle expenditure group compared to other two groups. Higher income groups seem to consume low quantities of pulses as they can opt for other sources protein, while lower expenditure groups who are net sellers and at the same time are net buyers in subsequent periods cannot afford. Middle expenditure groups can smooth their consumption.

It is apparent that households that are headed by young (below 30 years) tend to consume less pulse compared to others. According to age structure about 46% of the Tanzanians households' heads are 18-30[3] years, 28% are 31-45 years, 14% are 46-60 and 11% are above 60 (http://www.nbs.go.tz). In view of this high proportion of young households' heads, there is a need to create more awareness about the benefits (health, economic and environmental) of pulses to this consumer group. It is worthy attempting to increase consumption to the FAO recommended level of (30gm/day/person). Other initiatives encompassing varietal improvements geared to meet consumers' desired attributes for pulses (taste, appearance and other quality attributes) are important pursuing. Hence the hypotheses one was rejected as frequencies and levels of consumption were not the same across consumers' categories.

2.8 Acknowledgements

The authors gratefully acknowledge funding from Feed the Future Innovation Lab for Collaborative Research on Grain Legumes through a project titled "Enhancing Value Chain Performance through Improved Understanding of Consumer Behavior and

[3]By Law marriage is illegal below 18 years.

Decision-making." Legume Innovation Lab Project: SO2.2. However, the authors take full responsibility for all errors and other shortcomings of this paper.

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CHAPTER THREE

3.0 Factors Influencing the Consumption of Pulses in Rural and Urban Areas of Tanzania

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3.1 Abstract

Pulses are important sources of some dietary protein and energy, especially for the vegetarian population. Despite its nutritional and economic importance, its consumption trend in Tanzania has been decreasing over time while factors underlying this change are not well established. This study investigated factors underlying decision to consume pulses and level consumption to inform policy and chain actors about ideal means to address the challenge. A two-step model following the double hurdle specification was adopted to identify factors underlying the decision to consume pulses and its extent of consumption. Model results revealed that household sizes and education levels of the decision makers residing in rural areas had significant effect on the decision to consume pulses while the extent of consumption was influenced by their education levels, household sizes, households' total expenditure on food and non-food as well as prices of pulses and meat.

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Household sizes, levels of education and sex of the main decision makers were found to have significant effects on the decision to consume pulses whereas the age and education levels, household sizes and household's total expenditure were the main factors that influenced the extent of consumption in urban areas. In summary, the model showed that decision to consume pulses was lower in rural than that in urban areas. However, the overall consumption was lower in urban than that in rural areas, implying that the prospect for increasing its consumption is higher in urban than that in rural areas. To increase the market share of pulses, traders should devise effective strategies to tap into the growing demand for pulses in urban areas. This strategy should be founded on thorough understanding of desired attributes of these products and purchasing power of different consumer groups.

Key words: *Pulses consumption, urban and rural areas, Tanzania, double hurdle Model*

3.2 Introduction

The production and consumption of pulses[4] are important in maintaining food security and reducing poverty as these crops have high potential to increase earnings of farmers and traders. Consumers, especially poor people and vegetarians in urban and rural areas, derive proteins from pulses that are normally cheaper sources of these macro-nutrients than meat, fish, milk and other animal products (Akinbode, 2011). The consumption of pulses may be part of a healthy lifestyle that prevents abnormal weight gain and reduces the risk of diseases that are associated with uptake of foodstuffs that are rich in carbohydrates, cholesterol and fats (Curran, 2012).

While pulses are widely consumed, the consumption is normally higher in places where the majority are vegetarians or animal protein is scarce and expensive for ordinary people (Weliwita *et al*., 2003). Production and consumption data reveal that common beans, pigeon peas, chickpeas, cowpea, bambara nuts and peas are widely cultivated and consumed in Tanzania as human food (Abate, 2011). Despite its nutritional and economic importance, the consumption of pulse in Tanzania is generally below the FAO recommended level. The average per capita consumption in 2007 was only 6.8 gm/day/person while the recommended intake is at least 30 gm/day (Leterme, 2002; NBS, 2010). Moreover, the consumption trend has been declining over time. Statistics show that between 2000 and 2009 per capita consumption decreased by 1.4% and the decrease was almost two folds (3.5%) after two years (FAOSTAT, 2014). This trend reflects changes in consumer preferences[5] and failures by suppliers to align pulses attributes to consumer preferences (FAO, 2003).

[4]Pulses is a general term for legumes (crop with a pod)such as dry peas, dry beans, lentils and chick .
[5] Literature that associates changing diet behaviour with changes in family structures along with increased proportion of middle income earners and lifestyle exist (Verbeke, 2005; Msangi and Rosegrant, 2012; Chongela *et al*., 2014)

Moreover, data show that Tanzanian children below five years of age, pregnant and lactating mothers are mostly affected by protein-energy malnutrition (PEM) or protein-calorie malnutrition. Survey results show that about 9 to 21% of children are born with low birth weight mainly due to high PEM in pregnant women (Mazengo *et al*., 1997; NBS, 2011). Ideally, pulses would be the best alternatives for this group of consumers because they are richer in protein than any other grain and are cheaper than animal source protein.

There have been several interventions to address challenges related to low productivity and utilization of pulses in Tanzania, but these initiatives have largely been tailored to improve agronomic performance (e.g. through breeding) as well as processing and preservation. Many of the previous studies in Tanzania have mainly focused on improving agronomic practices or addressing specific production and marketing constraints (Mussa *et al*., 2012; Hella *et al*., 2013; Nyoki and Ndakidemi, 2013). This focus has not been effective in generating appropriate knowledge to address unique consumers' demand or preferences for pulses, overcome value chain constraints and improve actors' welfare. Thus, entrepreneurs engaged in the pulses production and marketing have inadequate knowledge about factors underlying the consumption of this commodity to devise appropriate production and marketing strategies. The focus of this study was to understand factors underlying the consumption of pulses in Tanzania and the spatial significance of these factors as a basis to inform policy about the prospect to increase the portion of pulses in Tanzanians' regular diet and improve health and earnings of chain actors. The aim of this paper was to identify factors influencing the decision to consume and extent of pulses consumption as an entry point to leverage pulses development and utilization initiatives in Tanzania.

3.3 Literature Review

3.3.1 Consumer Behaviour

The consumer behaviour theory assumes that a consumer is a rational economic agent and aims at attaining the highest possible satisfaction derived not only from the good itself but also from its attribute (Lancaster, 1966). Empirical studies have established that consumer behaviour is mainly influenced by socio-economic and demographic factors such as education level, knowledge on nutrition and age along with sex of the main decision maker (Leterme, 2002; Reddy, 2004; Mitchell *et al*, 2009). Other factors hypothesized to influence this decision making are households' earnings and size; product attributes (e.g. taste, quality and safety) as well its own price and price of substitutes (Salama, 1995; Mmakola *et al*., 1997; Kormawa *et al*., 2000; Nayga, 2000; Schneider, 2002; Drichoutis *et al*., 2005; Begum *et al.,* 2010; Revoredo-Giha *et al*., 2011; Banterle *et al*., 2013). Moreover, food availability, parental influence on eating (including culture and religion of the family), beliefs and preferences may also influence food choices (Sztainer *et al.,* 1999). Also spatial variation of people's life style along with differences in their earnings can shape their food consumption behaviour (Vu, 2008).

Most of the contemporary and recent studies on food consumption in Tanzania have attempted to associate food consumption with several parameters of the potential consumers. Some of these studies have assessed the variation in the composition of foodstuffs consumed by people in different age groups across locations such as rural and urban (e.g. Mazengo *et al*., 1997). Abdulai and Aubert (2004) have assessed the role of income and other socioeconomic characteristics on calorie demand. However a commodity-specific focus to identify spatial differences in the consumption of such commodity has so far not been reported.

While factors underlying food choices and intake are well documented in economic literature, there is evidence suggesting that there could be marked spatial differences in consumers' response to changes in these factors. One important distinction of this nature is between consumers in urban and rural areas. It has been established that differences in household characteristics such as ownership of assets, food habits, household's size and access to resources, markets and vital support services can potentially lead to differences in their living standards and reactions to changes in economic variables (Garret and Ruel, 1999; Minot *et al*., 2006; Bopape and Myers, 2007; Vu, 2008; Rout, 2009; Tafere *et al*., 2010).

Consumers in rural areas of Tanzania are mainly smallholder farmers who tend to be net sellers during the harvest and net buyers in subsequent periods (Jayne *et al*., 2006; Ivanic and Martin, 2008; Mghenyi *et al*., 2011; Jayne, 2012). Thus, their decision whether to consume own-produced or purchased food must be conditioned on their unique economic considerations and the overall food production and prices. Moreover, a majority of both rural and urban population are poor consumers whose expenditure on food exceeds 50% of their disposal income (Poulton *et al.*, 2006). The overall food intake for this group of consumers may decrease significantly if prices of food rise sharply.

Literature also shows that the consumption of pulses might be higher in rural than in urban areas owing to low incomes that limit the consumption of expensive sources of proteins and geographical constraints (e.g. poor infrastructure and access to crucial support services) that limit exchanges and favour consumption of locally produced foods (Leterme and Carmenza Muũoz, 2002; Schneider, 2002). Thus, low-income consumers including farmers who are producers and consumers at the same time are likely to consume more pulses than those with greater income like those with professional /white

collar jobs (Lucier *et al*., 2000; Bentley and Griffiths, 2003; Mitchell *et al*., 2009). In additional to the spatial differences in the consumption of pulses there are other differences that should be recognized.

Previous studies have established that adults between the ages of 18 and 59 tend to be the main consumers of pulses, especially beans whereas children tend to eat fewer pulses than adults (Lucier *et al*., 2000; Leterme and Carmenza Muũoz, 2002). Some studies argue that younger males tend to consume more beans arguably due to their larger caloric intake requirement, and this consumption tends to be fairly stable for male than female consumers at old age (Lucier *et al*., 2000; Leterme and Carmenza Muũoz, 2002).

Literatures also reveal that the consumption of pulses is particularly high when the decision maker is female and married (Folayan and Bifarin, 2013). There is evidence suggesting that larger households require more food than smaller households. Thus, the consumption of pulses is expected to rise with adult equivalents (Rehman *et al*., 2014).

With respect to education level, there is evidence to support that uneducated people tend to consume less pulses than those who are educated implying that higher education of the main decision makers, can significantly increase the consumption of pulses (Reddy, 2004; Mitchell *et al*., 2009). The effect of price of a normal/ordinary good on the consumption is to increase it when it falls and vice-versa. Where substitution is possible, the consumption falls as the prices of substitutes rise (Andreyeva *et al*., 2010; Tucker, 2014).

Therefore, an accurate analysis of determinants of food consumption is needed to account for the all potential differences in consumer behaviour. Unlike other papers that focused on specific consumer attributes (e.g. food intake vis-à-vis age or sex only) this paper

recognizes all the attributes that are discussed in this section. These attributes are accounted for in the empirical model. Note that other approaches that have been adopted to associate food consumption with consumers' socio-economic variables are also discussed.

3.3.2 Modelling Food Consumption

Several studies have analysed the relationship between socio-economic factors and food consumption. Some of the studies adopted censored regression following Tobin (1958) specification to estimate the relationship (Cox *et al*., 1984; Fabiosa, 2008; Lawrence, 2010). However, this modelling approach has been criticized as it reduces the consumption to a one step process implying that variables and parameters that determine the probability of consumption also determine in the same way the level of consumption (Wooldridge, 2009; Brent *et al*., 2010; Yimer, 2011; Akinbode and Dipeolu, 2012). Furthermore, its estimation requires the error term to follow a normal distribution with a constant variance, which in many applications, seems to be unrealistic. It is important to note that this assumption may not apply when cross-sectional data are used. Literatures show that when the assumption is relaxed the maximum likelihood estimators will be inconsistent (Arabmazard and Schmidt 1982; Newman *et al.*, 2003; Aristei and Pieroni, 2008).

Other studies have adopted the Heckman model to control for self-selection bias because some potential consumers may not consume the product at all. The Heckman model entails two estimation steps: the first estimates the probability of observing positive outcome i.e. the decision to consume or not equation; while the second estimates the level of consumption conditional on observing positive values of consumption (Dow and Norton, 2003; Moon *et al*., 2005; Ayo *et al*., 2012; Bedeke, 2012; Oni and

Fashogbon, 2012). The Heckman model suffers from two practical problems: Firstly, the probability of having a well-identified selection model is influenced by its functional form (Cameron and Trivedi, 2010). Secondly, the model is sensitive to violations of the homoscedasticity and normality assumptions of the error terms. When these assumptions are relaxed the estimates are biased and inconsistent (Silva and Tenreyro, 2006).

Other analysts have improved the Tobit model by relaxing the assumption of equivalence between zero demand and a corner solution. These models accommodate consumer's zero value of purchase as an outcome of a decision. Several models that differentiate true corner solutions (e.g., zero consumption) and zero expenditure resulting from infrequent purchase have been used to estimate food demand (Yen and Huang, 1996; Angulo *et al*., 2001). Empirical evidence reveals that these models can be estimated jointly when the decisions on whether to purchase a food item and how much to purchase are made at the same time. The models can also be estimated sequentially, especially when consumer's decision on whether to purchase a product affects the quantity purchased and not vice-versa. Special forms of sequential models that are known as dominance models have been applied when the two decisions are independent of each other (Joesch and Hiedemann, 2002; Smith, 2003; Martínez-Espiñeira, 2006). Separate models could be estimated when the decisions on whether and how much to purchase are independent of each other. In summary different approaches could be adopted to estimate these models based on the assumptions made with respect to the market participation and consumption decisions. However, many of the previous studies on food demand support the view that these decisions are independent and should be modelled separately (Gould, 1992; Jones, 1992; Smith, 2002; Moffatt, 2005).

Therefore, a robust model is the one that explicitly incorporates the participation decisions in an equation that is separate from consumption intensity decision. This model is known as a double hurdle model and it allows consumers to make participation and consumption decisions independently (Cragg, 1971; Akinbode and Dipeolu, 2012). These two decisions are separated because the participation decision might be influenced by factors other than those captured in the consumption decision. The first-hurdle differentiates between users and non-users where zero values are assigned for non-users only. It is important to note that there might be zero values in the second hurdle. These values may be a result of abstinence, misreporting and infrequency of purchases (Yen, 2005). Thus these values are not only affected by the participation decision but also by consumption decision implying that potential consumers may have zero expenditure (Aristei and Pieroni, 2008).

3.4 Methodology

3.4.1 Test for mean difference

A preliminary test involving all quantitative regressors hypothesized to influence the consumption of pulses was performed to test for mean differences between consumers in urban and rural areas. These differences were evaluated further using a bivariate model that tested whether the extent of market participation and consumption of pulses varied across these locations.

3.4.2 Estimation of decision and extent of pulses consumption

In the context of this study the double-hurdle model is used to identify factors underlying decision and extent of pulses consumption among rural and urban consumers. The assumption underlying the use of this model is that households make separate decisions on whether to consume the pulses and how much to consume. This decision making process is mathematically described as:

$$Y_i = \begin{cases} Y^* \text{ if } Y^* > 0 \text{ and } D_i > 0 \\ 0 \quad \text{Otherwise} \end{cases} \quad \text{.....(1)}$$

Where

$$Y^* = X_i\beta + \varepsilon_i \text{.....(2)}$$

$$D_i = Z_i\phi + \mu_i \quad \text{.....(3)}$$

In equation (1) Y_i is the actual/observed consumption of pulses while Y^* is a latent variable representing optimal level of pulse consumption; D_i is the zero-one discrete decision on whether to consume or not. This specification allows a vector of explanatory variables (X_i) to impact on the positive observations. Note that Z_i is a vector of variables hypothesized to influence market participation. Both Y^* and D_i must simultaneously be greater than zero to observe positive Y_i with the zeros indicating either optimal consumption decisions (corner solutions) or discrete decisions.

Yimer (2011) and William (2009) reveal that the log likelihood function (L) corresponding to equation (1) is computed as:

$$L = \prod_0 \left[1 - \theta\left(\frac{X'_i\beta_1}{\sigma}\right)\right] \prod_1 \left[1 - \theta\left(\frac{X'_{1i}\beta_1}{\sigma}\right)\right] \frac{1}{\sigma}\phi\left(\frac{Y_{21} - X'_{2i}\beta_2}{\sigma}\right) \text{.....(4)}$$

Empirically, the two decisions described in equation 2 involved the quantities of pulses consumed as a function of age, sex, marital status and education level of the main decision maker, household size, price of pulses, weighted price of meat, weighted price of fish and total expenditure as a proxy variable for household's earnings. Equation 3 involved all variables that were included in the second equation except the prices and total expenditure. Two separate double-hurdle models were estimated to compare and contrast the consumption of pulses in urban and rural areas.

Multicollinearity and heteroscedasticity are common problems in cross-sectional data. Thus independent variables were tested for multicollinearity and heteroscedasticity using variance inflation factors (VIFs) and Breusch Pagan tests prior to the estimation (Green, 2000). Results revealed that there was no multicollinearity problem. However, heteroscedasticity problem was detected, but necessary specification adjustments were made in the STATA software to produce consistent parameter estimates. Moreover, post estimation procedures were performed to compute expected values and probabilities that are needed to gauge the extent of market participation and pulses consumption as per details in Annex 1 (Burke, 2009).

3.5 Data

The data used in this study are secondary data collected by the National Bureau of Statistics (NBS) in 2010/11. The survey covered 21 regions in Tanzania Mainland and five regions in the Island (Unguja and Pemba). A total of 3846 households were interviewed of which 2583 were randomly selected from rural and 1263 from urban areas. The survey solicited detailed information from the household rather than households' heads to allow a comprehensive assessment of households' consumption taking into account their socio-economic characteristics. A brief description of variables that were fitted in the double hurdle model is provided in Table 5.

Table 5: Description of variables

Role in the model	Variable name	Description	Type and value labels	Anticipated impact on the dependent variable
Dependent variable	Pulses Q	Quantity of pulses consumed (Kg/per month)	Continuous	NA
Independent variables	Age	Age of the household head (years)	Continuous	Positive
	Sex	Sex of household head	Binary Male=0 Female=1	Negative or positive
	Household size	Size of the household(adult equivalent)	Continuous	Positive
	Education	Education level of household's head	Continuous	Positive
	Marital	Marital status of household's head	Binary 0=Married 1=Single	Positive
	$Price_1$	Price of pulses	Continuous	Negative
	$Price_2$	Weighted price of fish	Continuous	Positive
	$Price_3$	Weighted price meat	Continuous	Positive
	Expenditure	Total household expenditure as a proxy variable of household's earnings	Continuous	Positive/negative

NA = not applicable

3.6 Results and Discussion

A preliminary assessment of the sampled households shows that 67.2% of the households lived in rural areas and 32.8 % in urban areas. In terms of headship, 1983 of the households in the rural areas were headed by males and 600 households were headed by females while 912 of the households in urban areas were headed by males and the remaining (351 households) were headed by females. According to Tables 6 and 7, the proportion of unmarried people in both rural and urban areas was higher than those who were married. The mean age of household heads located in rural and urban areas were 47.6 and 42.7 years with standard deviations of 16.05 and 14.7, respectively. Further

analysis of the survey data revealed that the literacy[6] rate of household heads was 69.1% in rural areas and 87.8% in urban areas. The national average adult literate rate is estimated to be 73% (NBS, 2013). Overall, people in urban areas have better education than people in rural areas. Other important variables that characterize the sample are presented in Tables 6 and 7.

Table 6: Statistics for important socio-economic variables in rural areas

Variable name	n	Minimum	Maximum	Mean	Standard deviation
Continuous variables					
Quantity of pulses consumed per month (Kg)	2583	0.0	112.0	5.6	7.6
Age of main decision maker (years)	2583	16.0	105.0	47.6	16.1
Adult-equivalents in the household	2583	0.7	42.2	4.5	2.6
Number of years the main decision maker spent in school	2583	0.0	21.0	4.9	3.9
Total household expenditure per month (TZS)	2583	10 050.8	1 591 026.8	217 538.2	168 309.6
Pulses price (TZS/Kg)	2583	347.1	3393.0	1367.9	221.8
Weighted price of meat (TZS/Kg)	2583	600.0	9000.0	3763.9	773.6
Weighted price of fish (TZS/Kg)	2583	142.9	14 705.9	2668.3	1329.3
Binary variables					
Whether consumed pulses	n	%			
No	683	26.4			
Yes	1900	73.6			
Total	2583	100.0			
Sex					
Male	1983	76.8			
Female	600	23.2			
Total	2583	100			
Whether married					
Yes	599	23.2			
No	1984	76.8			
Total	2583	100.0			

n = Number of household heads.
(%) = percentage of household head

[6]Literacy is the ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying contexts (Kirsch and Jungeblut, 1986)

Table 7: Statistics for important socio-economic variables in urban areas

Variable name	n	Minimum	Maximum	Mean	Standard deviation
Continuous variables					
Quantity of pulses consumed per month (Kg)	1263	0.0	84.0	4.4	5.4
Age of main decision maker (years)	1263	16.0	99.0	42.7	14.7
Adult-equivalents in the household	1263	0.7	18.4	3.8	2.3
Number of years the main decision maker spent in school	1263	0.0	21.0	7.2	4.5
Total household expenditure per month (TZS)	1263	10 045.0	4 789 759.0	362 353.7	335 242.7
Pulses price (TZS/Kg)	1263	405.1	3746.0	1476.8	242.7
Weighted price of meat (TZS/Kg)	1263	400.0	8500.0	4274.8	765.9
Weighted price of fish (TZS/Kg)	1263	300.0	15 000.0	3268.2	1524.9
Binary variables					
Whether consumed pulses	n	%			
No	297	23.5			
Yes	966	76.5			
Total	1263	100.0			
Sex					
Male	912	72.2			
Female	351	27.8			
Total	1263	100.0			
Whether married					
Yes	455	36.0			
No	808	64.0			
Total	1263	100.0			

n = Number of household heads.
(%) = percentage of household head

According to results presented in Tables 6 and 7 the consumption of pulses and adult equivalent in the households were higher in rural than urban areas. Similarly decision makers in rural areas were older than those in urban areas. In contrast, the decision makers in the rural spent fewer years in school than those who were in the urban. However total expenditure of the households in urban areas was higher than those in rural areas whereas the foodstuffs considered were generally more expensive in urban than rural areas. Table 8 shows *t*-tests for mean difference between variables hypothesized to influence market participation and consumption of pulses in these areas.

Table 8: Test for mean difference of continuous variables between urban and rural areas

Variable	Location	n	Mean	Std. Error Mean	*t*-test
Adult-equivalents	Rural	2583	4.5	0.1	7.79***
	Urban	1263	3.8	0.1	
Quantity of pulses consumed per month (TZS)	Rural	2583	5.6	0.2	5.61***
	Urban	1263	4.4	0.2	
Total household expenditure per month (TZS)	Rural	2583	217 540.0	3 311.7	14.49***
	Urban	1263	362 350.0	9433.2	
Age of main decision maker (years)	Rural	2583	47.6	0.3	9.52***
	Urban	1263	42.7	0.4	
Number of years the main decision maker spent in school	Rural	2583	4.9	0.1	14.67***
	Urban	1263	7.2	0.1	
Pulses price per kg	Rural	2583	1367.9	44.4	0.91
	Urban	1263	1476.8	111.4	
Weighted price of meat	Rural	2583	3763.9	15.2	19.37***
	Urban	1263	4274.8	21.6	
Weighted price of fish	Rural	2583	2668.3	26.2	11.94***
	Urban	1263	3268.2	42.9	

NB: *** means significant at $p<0.01$

Results of the *t*-test show that mean values of family sizes (adult equivalent), consumption of pulses and age of main decision makers are significantly lager in rural than in urban areas while mean values for total expenditure on food and non-food items, years of schooling and prices of pulses, meat and fish are significantly larger in urban than in rural areas ($p<0.01$). Experience from previous studies shows that the consumption of- and expenditure on pulses are normally higher in the rural than urban areas (Lucier *et al*., 2000; Leterme and Carmenza Muñoz, 2002; Schneider, 2002; Bentley and Griffiths, 2003; Mitchell *et al*., 2009).

The finding that the overall consumption is higher in rural than urban areas, implies that part of the consumption in rural areas comes from own-production. However, the fact that total expenditure is higher in urban than in rural areas implies that the prospect for market growth is higher in urban than in rural areas. These implications are evaluated further as the findings of the double hurdle model for rural and urban areas are compared. The results are discussed in sequence starting with the maximum likelihood estimates for

the two stages followed by the assessment of the impact of regressors on the dependent variables of the double hurdle model. It is worth noting that the dependent variable in the first hurdle was whether the household decided to participate in the market or not whereas in the second hurdle the dependent variable was the quantity of pulses consumed.

Table 9: Factors Influencing Pulses Consumption in Urban and Rural Areas

Variable	Urban		Rural	
	Coefficient	**Z**	**Coefficient**	**Z**
Decision to consume or not				
Age	0.005 (0.005)	0.89	0.002 (0.003)	0.53
Sex	0.261*** (0.096)	2.71	0.023 (0.066)	0.34
Marital status	0.167 (0.160)	1.04	0.021 (0.104)	0.20
Adult Equivalent	0.0216*** (0.031)	7.01	0.039*** (0.012)	3.30
Education level	0.018* (0.009)	1.90	0.049*** (0.007)	6.57
Constant	-0.533 (0.333)	-1.60	0.129 (0.199)	0.65
Level of consumption				
Age	0.178** (0.086)	2.07	0.187 (0.208)	0.90
Sex	0.706 (1.474)	0.48	-2.453 (4.421)	-0.55
Marital status	-1.557 (2.387)	-0.65	9.201 (8.003)	1.15
Adult Equivalent	2.062** (0.947)	2.18	2.515*** (0.609)	4.12
Education level	-0.357* (1.87)	-1.91	-2.739** (1.225)	-2.20
Total expenditure	5.619** (2.439)	2.30	22.454* (11.192)	2.01
Price of pulses	0.379 (3.599)	0.11	-36.830** (15.415)	-2.39
Weighted price of meat	6.609 (4.834)	1.37	-30.551** (14.600)	-2.09
Weighted price of fish	-1.809 (1.328)	-1.36	1.750 (3.272)	0.53
Constant	-135.904* (75.196)	-1.81	163.168* (82.775)	1.97
Sigma				
Constant	9.456*** (2.788)	3.39	21.496*** (5.242)	4.10

NB: *** means significant at p<0.01; ** means significant at p<0.05; *means significant at p<0.1
Figures in brackets are robust standard errors

The results presented in Table 9 show that sex and education level of the main decision maker and adult equivalent are significant variables underlying the decision to consume pulses in urban areas at p<0.01, p<0.1 and p<0.01 levels of significance, respectively. The model shows that age and education level of the main decision maker along with adult equivalent and household's expenditure are significant variables of the level of consumption at p<0.05, level of significance. The Wald χ^2 statistic shows that the decision variables fit the model at the (p<0.01).

These findings are consistent with the prevailing evidence. Experience from other African countries reveals that the decision to consume and the extent of consumption could vary between males and females based on whether the purchase activity is perceived as males' or females' obligation (Alene *et al*., 2008; Zamasiya *et al*., 2014). The level of education has been acknowledged to shape choices of food and other products as it creates awareness that plays a pivotal role in the adoption of healthier food habits (Worsley, 2002).

The link between adult equivalent in the households, decision to consume and extent of consumption has been established in economic literature as larger households normally need more food than smaller households (Rehman *et al*., 2014). Moreover, age has been found to be associated with the decision to consume pulses because it influences one's ability to comprehend and use market information (Gebremedhin and Hoekstra, 2007).

The results presented in Table 9 also show that adult equivalent and education level of the main decision maker are significant variables that influence market participation in rural areas ($p<0.01$). The table shows that adult equivalent ($p<0.01$), education level of the main decision maker ($p<0.05$), household's expenditure on food and non-food items ($p<0.1$), price of pulses ($p<0.05$) and weighted price of meat ($p<0.05$) are significant variables that influence the consumption of pulses in those areas. The Wald χ^2 statistic reveals that the decision variables fit the model at the ($p<0.01$). Authors of this manuscript have already pin-pointed the evidence linking to the decision and extent of consumption with many of factors as previously discussed. However, there is evidence to suggest that low-income consumers might be more sensitive to price changes than other consumers within the population. Thus the total budget for food and food prices will

always influence what one buys (Lucier *et al*., 2000; Bentley and Griffiths, 2003; Mitchell *et al*., 2009).

The likelihood of rural and urban people to decide on consuming pulses was about 0.73 and 0.76, respectively. The expected consumption for people in rural and urban areas who consume pulses on a regular basis was estimated to be 7.5kg and 5.5kg per month, respectively. The model predicted the overall pulses consumption to be around 5.5 kg per month in rural areas and about 4.4 kg per month in urban areas. Effects of regressors that were included in the market participation equation on the probability of actual participation of rural and urban people are presented in Table 10. The relative importance of the regressors is discussed in the light of statistical significance.

Table 10: Partial Effects of Regressors on Actual decision to consume pulses

Variable	Rural		Urban	
	Mean	**Std. Dev**	**Mean**	**Std. Dev**
Adult-equivalents	0.01	0.02	0.06	0.02
Age	0.00	0.00	0.00	0.00
Sex	0.01	0.00	0.07	0.02
Marital status	0.01	0.00	0.05	0.02
Education level	0.02	0.00	0.01	0.00

The results presented in Tables 9 show that adult equivalent and education level were the only significant variables that influenced the decision in the rural areas while these two variables along with sex of the main decision maker were the significant variables in the urban areas. Table10 reveals that a unit increase in adult equivalent and being more educated are likely to increase the likelihood of deciding to consume pulses in the rural areas, although the resulting changes in probabilities are generally small (less than 0.1). In addition to these two factors, having a female decision maker in urban areas increases marginally the likelihood of market participation. Overall, the combined effect of these

factors seems to be higher in urban than in rural areas implying that the prospect for market development could be higher in urban areas, although the consumption of pulses was lower in urban than in rural areas. These findings are consistent with literature (Louw *et al*., 2004; NNBS, 2012).

The partial effects of specific regressors on the expected pulses consumption for those people who consume pulses are presented in Table 11. The results from the double hurdle model suggest that age and education level of the main decision maker, adult equivalent, total expenditure as well as prices of pulses and meat were significant variables in influencing the consumption in the rural areas. With respect to people in urban areas; adult equivalent, education level of the main decision maker, total expenditure and price of pulses and meat were significant variables that influenced the consumption.

Table 11: Partial Effects of Regressors on Actual Consumption of Pulses

Variable	Rural		Urban	
	Mean	Std. Dev	Mean	Std. Dev
Adult-equivalents	0.26	0.18	0.47	0.30
Age (years)	0.02	0.01	0.04	0.03
Sex	-0.26	0.18	0.16	0.10
Marital status	0.96	0.66	-0.35	0.23
Education level	-0.29	0.19	-0.08	0.05
Total expenditure (TZS/annum)	2.35	1.61	1.28	0.83
Price of pulses (TZS/Kg)	-3.86	2.64	0.09	0.06
Weighted price of meat (TZS/Kg)	-3.20	2.19	1.50	0.97
Weighted price of fish (TZS/Kg)	0.18	0.13	-0.51	0.27

Table 11 reveals that a unit change in adult equivalent is likely to increase the average consumption of pulses by 0.26 kg in rural and 0.47kg per month in urban areas. An additional year of schooling may decrease pulse consumption by 0.30 kg in rural and 0.08 kg per month in urban areas. However, when expenditure increases by one unit the

overall consumption of pulses is likely to increase by 2.35 kg and 1.28kg per month in rural and urban areas, respectively. The effect of prices of pulses and meat was prominent in the rural areas where a unit change in the price of pulses might decrease the average consumption of pulses by 3.86kg per month. Though unexpected, a unit increase in the price of meat seemed to be associated with a decrease of 3.20 kg per month in the consumption of pulses in rural areas. The unexpected sign of this coefficient could be attributed to their relatively lower rate of market participation owing to the consumption of own-produced pulses. Moreover, previous studies such as Poulton *et al*. (2006) found that many consumers in these areas are poor, and their budget share of food items is more than 0.5. While substitution is possible, its effect may be negligible as the income effect resulting from an increase in price may particularly be huge as their limited income is normally spread across a wide range of consumables leading to an overall decrease in quantities purchased. The implication of these findings is that there are more factors affecting the consumption of pulses in rural than in urban areas, and the effect of the common and unique factors seem to be more severe in rural than in urban areas implying that the extent of change in consumption of pulses is more likely to be drastic in rural than in urban areas.

The partial effect of regressors that are hypothesized to influence both decision and consumption on expected consumption for the entire sample is presented in Table 12. This table shows that a unit change in adult equivalent might increase the overall consumption by1.33 and by 0.41 kg per month in urban and rural areas, respectively. An additional year of age is likely to increase the average pulses consumption in urban areas by 0.05kg per month while an additional year of schooling might increase the average consumption by 0.06 and 0.01 kg per month in urban and rural areas,

respectively. Overall the effect of these factors seems to be huge in urban than in rural areas.

Table 12: Partial Effects of Regressors on the Expected Consumption of Pulses

Variable	Rural		Urban	
	Mean	**Std. Dev**	**Mean**	**Std. Dev**
Adult-equivalents	0.41	0.25	1.33	0.95
Age (years)	0.02	0.01	0.05	0.04
Sex	-0.07	0.08	1.28	0.88
Marital status	0.83	0.58	0.44	0.27
Education level	0.06	0.06	0.01	0.01

3.7 Conclusion and Policy Implication

In conclusion, the second hypothesis was rejected as results show that there are common and unique socio economic factors underlying the decision to consume pulses and the extent of its consumption. In terms of decision to consume, results show that it is lower in rural than in urban areas implying that the prospect for increasing its consumption is higher in urban than in rural areas.

Thus, traders should devise effective strategies to tap into the growing demand for pulses in urban areas to increase their market share. These strategies should be founded on thorough understanding of desired attributes of these products and purchasing power of different consumer groups.

3.8 Acknowledgements

The authors gratefully acknowledge funding from Feed the Future Innovation Lab for Collaborative Research on Grain Legumes through a project titled “Enhancing Value Chain Performance through Improved Understanding of Consumer Behavior and Decision-making.” Legume Innovation Lab Project: SO2.2. However, the authors take full responsibility for all errors and other shortcomings of this paper.

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CHAPTER FOUR

4.0 Conclusions and Recommendations

4.1 Conclusions

The main thrust of this study was to document on pulses consumption patterns in the country and explore the main factors influencing market participation and the consumption of pulses among urban and rural Tanzanians.

Results show that pulses consumption vary among comparison variables except in terms of marital status of the decision maker. Average intake of pulses was high in the middle expenditure group, while household heads aged from 16-30 years consumed less than other consumers.

Decision to consume pulses is higher in urban than in rural areas implying that there is higher prospect for increasing its consumption in urban than rural areas. Furthermore results show that there are more factors affecting consumption of pulses in rural than in urban areas. The extent of change in consumption of pulses are more likely to be drastic in rural than in urban as effect of common factors seem to be more severe in rural than in urban areas

4.2 Recommendations

i. Sufficient intake level of pulses is clearly a solution to poor diet quality to both rural and urban consumers, it is also a cost-effective way to prevent protein energy malnutrition among children, pregnant and lactating mothers and a protective way against obesity and other chronic diseases.

ii. It is apparent that consumers (household head) of young ages are consuming less quantity of pulses compared to others and this should be the focus of public health policies and interventions in disseminating information on nutritional benefits of pulses. However it is still important to encourage all potential consumers to increase intake levels to at least reach the FAO recommended level of intake (30gm/day/person).

iii. Traders should devise effective strategies to tap into the growing demand of pulses in urban areas to increase the market share of pulses. These strategies should be founded on thorough understanding of desired attributes of these products and purchasing power of different consumer groups.

Appendix 1: Computation of expected values and probabilities

Statistic calculated	Equation	Details
Probability of participating in the market	$p(y_i > 0 \mid x_{1i}) = \Phi(x_{1i}\gamma)$	$\left\{\begin{array}{l} y_i = \text{Outcome that one will actually participate in the market} \\ \Phi = \text{Standard normal cumulative distribution function} \\ x_{1i} = \text{Vector of regressors in the decision equation} \\ \gamma = \text{Vector of coefficients} \end{array}\right\}$...(4)
Average consumption of pulses by a person who is actually consuming it	$E(y_i \mid y_{1i} > 0, x_{2i}) = x_{2i}\beta + \sigma\lambda(\frac{x_{2i}\beta}{\sigma})$	$\left\{\begin{array}{l} y_i = \text{Consumption for a person who consumes pulses} \\ \sigma = \text{St. Dev. of error for each observation in the consumption equation} \\ x_{2i} = \text{Vector of regressors in the cumption equation} \\ \beta = \text{Vector of coefficients} \\ \lambda = \text{Inverse Mills ratio} \end{array}\right\}$..(5)
Conditional average consumption of pulse	$E(y_i \mid x_{1i}, x_{2i}) = \Phi(x_{1i}\gamma)\left\{x_{2i}\beta + \sigma\lambda\left(\frac{x_{2i}\beta}{\sigma}\right)\right\}$	$\left\{\begin{array}{l} y_i = \text{Pulse consumption for a person} \\ \text{Note that other variables are as defined in equations 4 \& 5} \end{array}\right\}$..(6)
Partial effect of a specific regressor on the probability that people will actually participate in the market	$\frac{\partial p(y > 0 \mid x_{1i})}{\partial x_j} = \gamma_i \phi(x_{1i}\gamma)$	$\left\{\begin{array}{l} y = \text{Outcome that people will actually decide to consume} \\ \phi = \text{Standard normal probability distribution function} \\ \text{Note that other variables are as defined in equations 4 \& 5} \end{array}\right\}$..(7)
Partial effect of a specific regressor on the expected pulse consumption by a person who consumes pulses	$\frac{\partial E(y_i > 0 \mid y_{1i} > 0, x_{2i})}{\partial x_j} = \beta_j\left[1 - \lambda\left(\frac{x_{2i}\beta}{\sigma}\right)\left\{\frac{x_{2i}\beta}{\sigma} + \lambda\left(\frac{x_{2i}\beta}{\sigma}\right)\right\}\right]$	$\left\{\begin{array}{l} y_i = \text{Quanity of pulse consumed by a person who is actually consumes it} \\ \text{Note that other variables are as defined in equations 4 \& 5} \end{array}\right\}$..(8)
Partial effect of a specific regressor on the expected pulse consumption by all	$\frac{\partial E(y > 0 \mid x_{1i}}{\partial x_j}$ $\gamma_i \varphi(x_{1i}\gamma)\left\{x_{2i}\beta + \sigma\lambda\left(\frac{x_{2i}\beta}{\sigma}\right)\right\}$ $+ \Phi(x_{1i}\gamma)\beta_j\left[1 - \lambda\left(\frac{x_{2i}\beta}{\sigma}\right)\left\{\frac{x_{2i}\beta}{\sigma} + \lambda\left(\frac{x_{2i}\beta}{\sigma}\right)\right\}\right]$ *if* $x_j \in x_1, x_2$	$\left\{\begin{array}{l} y_i = \text{Quanity of pulse consumed by a all people} \\ \beta_j = \text{Coefficient on } x_j \text{ for regressors in the consumption equation} \\ \gamma_j = \text{Coefficient on } x_j \text{ for regressors in the decision equation} \\ x_1 = \text{Matrix of regressors in the decision equation} \\ x_2 = \text{Matrix of regressors in the consumption equation} \\ \text{Note that other variables are as defined in equations 4 \& 5} \end{array}\right\}$..(9)