

**DETERMINANTS FOR LOCAL PEARL MILLET CONSUMPTION IN SINGIDA
RURAL AND KISHAPU DISTRICTS**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE
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ABSTRACT

Pearl millet is among the crops which are performing well in Central and Lake Zone of Tanzania and due to its adaptation to semi-arid climate. The crop has a very high potential for improving livelihoods of farmers residing in those areas. Unfortunately, farmers are not getting maximum benefits from the crop due to some limiting factors. One of the key factors is low demand for the crop within and outside the semi-arid areas. Small quantity of pearl millet traded is an indication of low crop demand. The present study aims at finding out what could be done to increase demand for pearl millet by looking at the factors that influence demand. This study was carried out in Singida Rural and Kishapu districts in Tanzania. Purposive sampling was used to select villages and simple random sampling was used to select farmers, consumers, traders and processors. Data were collected from 385 respondents as follows: 180 farmers, 85 consumers, 76 traders and 44 processors. Both descriptive and quantitative analytical tools were used to analyze the data. Multiple regression model was used to determine the factors influencing pearl millet consumption. The findings show that, education level of the household head, age of the household head, occupation, pearl millet price and household food priority are the main factors that influence pearl millet consumption. Since the consumption of pearl millet is important for a better livelihood of the farmers in semi-arid areas and since the existing demand does not foster their livelihood, then promotion and awareness rousing the importance of pearl millet as food and feed from the farmers is needed to increase demand. Moreover, policies to improve consumption of pearl millet should be developed by the government to recognize pearl millet as a viable crop alternative.

DECLARATION

I, Mwasiti Abdallah, do hereby declare to the SENATE of Sokoine University of Agriculture, that this dissertation is my original work and has neither been submitted nor concurrently being submitted for a degree award in any other institution.

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The above declaration is confirmed

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LIST OF ABBREVIATIONS AND ACRONYMS

ANOVA	Analysis of Variance
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
CATREG	Categorical Regression Estimation
ECARSAM	Eastern and Central Africa Regional Sorghum And Millet Network
FAO	Food and Agriculture Organization
GDP	Growth Domestic Product
GoT	Government of Tanzania
HH	Household
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
Kgs	Kilograms
LTD	Limited
MAFC	Ministry of Agriculture, Food Security and Cooperatives
NGO	Non- Governmental Organization
NSMIP	National Sorghum and Millet Improvement Program
OLS	Ordinary Least Square
PER	Protein Efficiency Ratio
PM	Pearl Millet
R ²	Coefficient of Determinations
SADC	Southern African Development Community
SAT	Semi-Arid Tropics
SMIP	Sorghum and Millet Improvement Program
SNAL	Sokoine National Agricultural Library
SPSS	Statistical Package for Social Sciences

SUA	Sokoine University of Agriculture
TANSEED	Tanzania Seed Company Limited
TDL	Tanzania Dairies Limited
TOSCA	Tanzania Official Seed Certification Agency
Tshs	Tanzanian Shillings
URT	United Republic of Tanzania
USA	United States of America
USAID	United State Agency of International Development
VEO	Village Executive Officers
VETA	Vocational Education and Training Authority
WASAT	West Africa Semi-Arid Tropics
WCA	West and Central African

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Pearl millet (*Pennisetum glaucum*) originated in Africa as a cereal for human consumption (Burton *et al.*, 1972). It contributes a great part of dietary nutrients for 90 million people in semi-arid tropic regions of the world who live in agro climatic zones where there are severe limitations to crop production due mainly to heat, low and erratic rainfall, and soil type. It is often considered highly palatable and a good source of protein, minerals and energy (Andrews *et al.*, 1993, Abdalla *et al.*, 1998a). Pearl millet is the most widely grown of all millets, and it has the highest yield potential of all millets under drought and heat stress (Dendy, 1993).

According to FAO (2012), pearl millet is the fourth most grown cereal in the Africa. It is grown annually about 20.1 million ton in the arid and semi-arid tropical regions. India is the largest` producer of pearl millet in Asia, both in terms of area (about 9 million ha.) and production (8.3 million tons) with an average productivity of 930 kg/ha during the past three years (Mula, *et al.*, 2010). West and Central African (WCA) region has the largest area under millets in Africa (16.8 million ha) with grain yield of 880 kg/ha), of which more than 95% is pearl millet. In Eastern and Southern Africa, pearl millet is cultivated on about 2 million ha. where productivity increase (from 800 kg/ha to 920 kg/ha) from 1970-2006 respectively in the region (Mula, *et al.*, 2010). Despite limited investments in improved crop management, Tanzania's average pearl millet yields are among the highest in Eastern and southern Africa (Rohrbach and Kiriwaggulu, 2001). Produced about 243 729t per 293 554ha. of pearl millet in the year 2011/2012 (MAFC, 2012). This reflects the relatively long growing season and favorable soils found in the country's pearl

millet production zones (Rohrbach and Kiriwaggulu, 2001). Pearl millet production in Tanzania is concentrated in the drought-prone areas of Dodoma, Singida, and Shinyanga as it can better withstand periods of heat stress than sorghum (Rohrbach and Kiriwaggulu, 2007).

Pearl millet is grown generally with relatively little agricultural inputs as compared to wheat (*Triticum aestivum*) and rice (*Oryza sativa*), and is important for food security in arid and semi-arid regions of Asia and Africa (Baker, 2003). Despite its high potential in semi-arid areas, yet it is not consumed in large quantities (Baker, 2003). Industrial utilization of pearl millet also is rare and most of the produce is consumed in the homesteads where it is produced. The high production potential of this crop in semi-arid areas suggests that substantial opportunities exist for its commercialization (Sharma, 2006).

1.2 Consumption for Pearl Millet

Pearl millet ranks first as the major staple food for human consumption in arid and semi-arid areas of African countries (ECARSAM, 2010). It forms the staple cereal in Sudan and Eritrea, and an important component of the diet in Ethiopia, Kenya, Rwanda, Somalia, Tanzania and Uganda mostly while small quantities are used for animal feed and industrial production. Approximately 60% of pearl millet production in Africa is consumed at farm level and the remaining 40% is predominantly sold in local markets (ECARSAM, 2010). Pearl millet is consumed in many forms, of which the most important are leavened bread (*injera*) in Eritrea and Ethiopia, *kisra* in Sudan); thick and thin porridge (*ugali* and *uji*) in Tanzania, Kenya and Uganda, non-alcoholic beverages (*hulumur*, *abrey* and *huswa*) in Sudan, (*obushera*) in Uganda, and alcoholic beverages (*pombe*) in Tanzania, (*busaa*) in Kenya, (*tela*) in Ethiopia and Eritrea, (*ajon* and *omuramba*) in Uganda (ECARSAM,

2010). Specifically in Tanzania, large quantity (more than 95%) of pearl millet produced is consumed within the production area commonly in the form of *uji* and *ugali* whereas; small quantity is used for poultry (Rohrbach and Kiriwaggulu, 2007).

1.3 Marketing for Pearl Millet in Tanzania

According to Monyo *et al.* (2004), many pearl millet producers in Tanzania experience periodic food deficits and most grain trade is between neighboring households. Small quantity of grain move from the few farmers able to produce a surplus to the many experiencing production deficits. It is hard to accurately estimate the quantity of pearl millet entering the national market. No records are maintained for wholesale market deliveries of pearl millet. The Marketing Development Bureau of the Ministry of Agriculture and Cooperatives in Tanzania maintains partial records of grain flows into the major urban wholesale markets (ASARECA, 2004). Failure to keep record on pearl millet reflects limited quantities of pearl millet grain traded, poor processing techniques, unstable supplies and stagnate pearl millet consumption (ASARECA, 2004).

1.4 Problem Statement and Justification

Pearl millet production is low but the grain is relatively a very important source of food and farm income for small scale farmers in semi arid areas and can be enhanced if linked to new markets (Larson *et al.*, 2006). World consumption of pearl millet as food has only grown marginally in contrast to the significant increase in consumption of other cereals like rice, maize and sorghum (ASARECA, 2004). However, pearl millet is considered as one of the most important crops for human consumption in semi arid areas of Africa and India because of the fact that it is a drought tolerant crop (Hadimani *et al.*, 2001).

Tanzania produced over 240 000t of pearl millet in 2011/12 which was approximately twenty one times less than the total production of maize and three times less than sorghum (MAFC, 2012). Lack of interest, unfamiliarity and uncertainty about consumer demand for pearl millet encourages farmers to maintain a subsistence level of production though it remains to be the main source of food security in arid and semi arid areas (Rohrbach and Kiriwaggulu, 2007, Chisi, 2007 and ASARECA, 2004). Like other semi-arid regions of Tanzania, low demand for pearl millet in Singida Rural and Kishapu districts is a major challenge which limits farmers from getting maximum benefits from the crop including better livelihood (Monyo *et al.*, 2004). Pearl millet consumption is important for the people in Singida Rural and Kishapu districts where food security and income are dependent upon agriculture and pearl millet is among the crops which have high potential in these areas.

Several efforts were initiated to improve demand for pearl millet in central and Lake Zone of Tanzania. For example National Sorghum and Millet Improvement Program (NSMIP), in collaboration with the SADC/ICRISAT Sorghum and Millet Improvement Program (SMIP), to develop several new varieties that mature earlier and give higher yields than landraces (Monyo *et al.*, 2004) also ASARECA empowers pearl millet farmers to add value of their produce (Mafuru *et al.*, 2012). Yet demand for pearl millet in Tanzania is still low, Singida Rural and Kishapu districts are among the areas facing the challenge. Relatively small proportion of rural households sell their produce and those who do sell, the quantity is often small (Barrett, 2008). Only less than five percent of pearl millet enters the formal markets (Rohrbach and Kiriwaggulu, 2007). This is also proved by the limited amount of pearl millet food products in the markets, probably because of the drudgery involved in their domestic processing as the mechanical processing is not in place and the prestige attached to it (Murty and Kumary, 1995).

Small quantities of pearl millet are traded for food consumption; both in the form of grain and meal. In contrast, finger millet is widely traded for the production of beer and meal and records are maintained on market (Rohrbach and Kiriwaggulu, 2007). Limited quantities of pearl millet traded reflect low demand for the crop. Therefore, it is plausible to undertake this study to assess the demand for pearl millet in Singida Rural and Kishapu districts to come up with suggestions that would help to increase demand for crop. This would help farmers in the regions to increasing production and benefit from the huge potential of this crop in the study area.

1.5 The Objectives of the Study

1.5.1 Overall objective

The overall objective of the present study is to find out what could be done to increase pearl millet consumption by looking on the factors that influence consumption and examining marketing channels for pearl millet.

1.5.2 Specific objectives

- i. To identify the determinants for pearl millet consumptions in the study area.
- ii. To examine marketing channels for pearl millet in the study area.
- iii. To determine the strategies that can be used to promote pearl millet consumption in the study area.

1.5.3 Research questions

- i. Can price for pearl millet, price for substitute, household income, age of the household head, gender, household size, education level, household food priority (food preferences) and occupation (source of family income) influence pearl millet consumption?
- ii. How marketing channels are structured along pearl millet value chain?

- iii. What are the main reasons for the selection of the marketing channel?
- iv. What are the main constraints facing different actors (producers, traders, processors and consumers) for demanding pearl millet?
- v. What strategies can be adopted to increase pearl millet consumption among actors (producers, traders, processors and consumers)?

1.6 Significance of the Study

The present study generates useful information to increase pearl millet consumption in the study area through the identification of the factors that determine the consumption, tracing the marketing channel for pearl millet and put forward strategies that will help to promote the consumption of pearl millet and hence improve the livelihood of the farmers in semi arid areas of the country. The potential users of this information are farmers, traders, food and feed processors, consumers, policy makers, government and non-government organization who want to introduce intervention in pearl millet. Furthermore this study provide a good background information for further studies on pearl millet.

1.7 Organization of the Report

The present study on the determinants for local pearl millet consumption is organized into five chapters. The first chapter covers the introductory part which includes background information, problem statement and justification, study objectives and questions. The second chapter dwells on the review of relevant literature and the methodology adopted for similar studies conducted in different parts of the world. The third chapter covers the methodology used to undertake the study as well as instruments used in data collection and analyses. The fourth chapter presents the research findings and their discussions whereas conclusions and recommendations as well as policy suggestions are presented in chapter five.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Pearl Millet Production in Tanzania

Pearl millet is one of the most extensively cultivated cereals in Africa, after maize, sorghum, wheat then millet particularly in arid and semi-arid regions (Table 1).

Table 1: Africa major grain crops during 2012

Crop	Production (million t)
Maize	64.1
Sorghum	26.9
Wheat	24
Millet	20.1
Rice	17.3
Barley	6.1

Source: FAO, (2012)

According to (FAO, 2003), Sub-Saharan Africa annually produces about 13 million metric tons of pearl millet. Tanzania produced about 243 729 t of pearl millet in the year 2011/2012 (MAFC, 2012). Regions which mostly produce pearl millet in Tanzania include Dodoma, Singida, Shinyanga and Lindi. Table 2 shows the area and yield of pearl millet by regions that produced most pearl millet in Tanzania during the 2011/2012 season. In the past years starting 2010 and back evaluation of pearl millet production was complicated by the failure of national statistics to distinguish pearl millet from other millets. Pearl and finger millet were collectively classified as millet. However, finger millet tends to be grown in higher-rainfall zones than pearl millet (Rohrbach and Kiriwaggulu, 2007).

Table 2: Major pearl millet producing regions in Tanzania

Regions	Area (ha)	Yield (t)
Dodoma	93 388	65 371
Singida	43 772	30 640
Rukwa	20 057	22 063
Shinyanga	21 219	19 097
Lindi	19 515	17 563

Source: MAFC (2012)

Few pearl millet farmers in Tanzania invested in improving the management of their crop. According to a survey conducted in 1992, less than 5% of pearl millet growers have ever tried an improved variety (Minde and Mbiha, 1993). Farmers in most pearl millet growing areas in Tanzania sow traditionally, use unimproved seed varieties and only a minority of them farmers use manure. Since most farmers are planted by hand, farmers also face difficulty in timing their sowing with the rains (Rohrbach and Kiriwaggulu, 2007). Average grain yields could still be at least doubled through the adoption of improved inputs. Pearl millet is the main source of food security in the central high plateau (Singida and Dodoma), and second in importance only to maize in the Western Lake, and Southern Zones (Rohrbach and Kiriwaggulu, 2001).

2.2 Area Under Pearl Millet Cultivation in Tanzania

Pearl millet covers about half of the land under cereal cultivation in semi arid areas of Tanzania. Apart from sorghum; it is a crop on which farmers depend for their food (Letayo *et al.*, 1996). About 293 554 ha. were under pearl millet production in different parts of the country in the year 2011/202 (MAFC, 2012). Pearl millet is widely grown in three of the country's six zones, *i.e.* the Central, Western, and Lake Zones. The major production areas (Fig. 1) are Dodoma and Singida in the Central Zone; Tabora in the

Western Zone; Shinyanga, Mwanza and Mara in the Lake Zone; and Lindi and Mtwara regions in the Southern Zone. Dodoma, Singida, and Shinyanga account for a large proportion of pearl millet area in Tanzania's agriculture sector (Monyo *et al.*, 2004). Dodoma covers about 22% of the area under pearl millet production, Singida covers 10% of the area and Shinyanga covers about 7%. Farmers have been growing the local pearl millet varieties and the most common variety is local landraces (Letayo *et al.*, 1996).

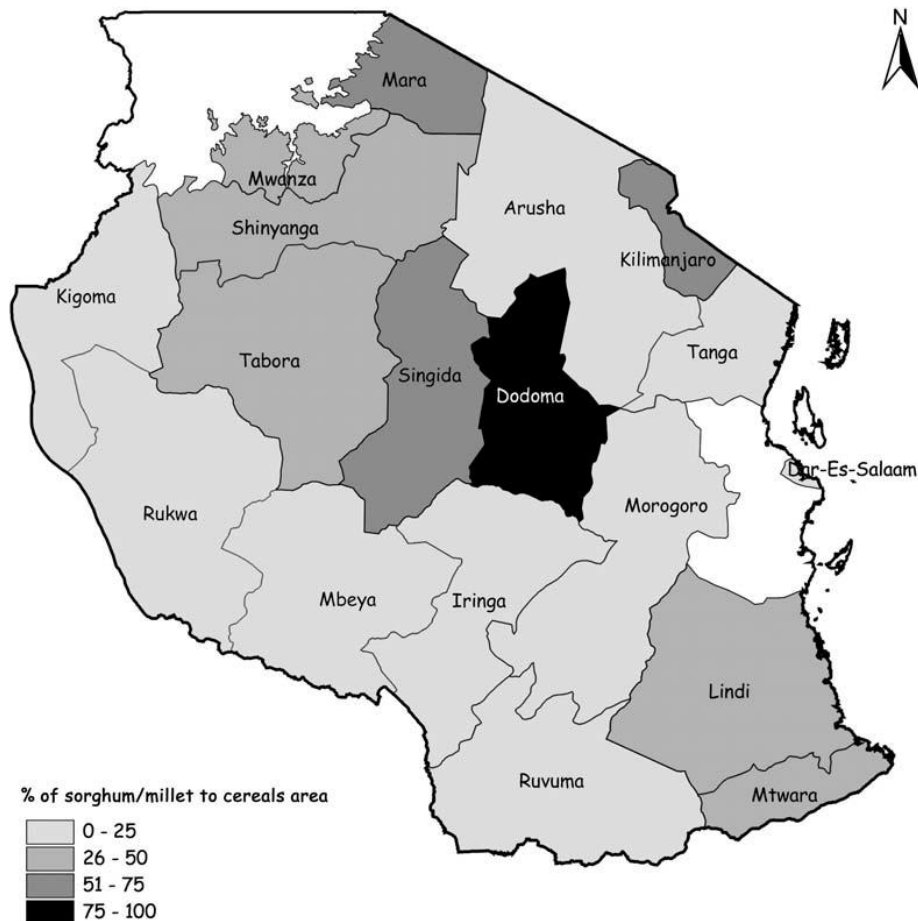


Figure 1: Map of Tanzania, showing districts and major cities.

Source: Monyo *et al.* (2004)

2.3 Pearl Millet Varieties

Many farmers grow local landraces that are tall and late-maturing which is of a serious concern in the drier regions (the main production areas), where frequent drought spells occur, resulting in very low grain yields (Letayo *et al.*, 1996). Some of the pearl millet varieties released in different years to overcome the problem as presented in Table 3.

Table 3: Different pearl millet varieties and their characteristics

Variety	year	Characteristics of the varieties	Source
FMV 1	1987	Dwarf, high tillering, early maturity	(Rohrbach, 1999).
PMV 2	1992	Intermediate height, dark gray seed, early maturity	(Rohrbach, 1999).
PMV 3	1998	Creamy white bold grain, good for composite flour	(Rohrbach, 1999).
Okoa and Shibe	1994	Mature earlier and give higher yields than landraces	(Monyo <i>et al.</i> , 2004).

2.4 Adoption of Pearl Millet Improved Varieties

Despite the research that has gone into creating improved pearl millet varieties, farmer's adoption of these improved varieties is poor due to factors related to seed supply and access, or farmer demand (Minde and Mbiha, 1993). Reasons for poor adoption, include inadequate seed production and delivery systems for small grains, an unpredictable grain market (weaknesses at different stages of the seed supply chains) that arise with research, production, or distribution, lack of appropriate processing technologies like threshers and milling machines. Demand side issues such as farmers risk attitudes, the perceived appropriateness of the seed, and access to fertilizer or other complementary inputs (Rohrbach, 1999). The national program, in partnership with other research organizations, engaged in activities to resolve these problems (Rohrbach, 1999).

2.5 Pearl Millet Consumptions

Cereal food makes up the most important part of the diet of most developing countries (Tucker, 2003). These cereal foods contribute significantly to the dietary intake of rural people in developing countries (Hamphries *et al.*, 2005). Pearl millet is grown and consumed mostly in arid and semi-arid parts of Tanzania in a form of porridge (stiff and thin). The grain is pounded or milled into flour (Mafuru *et al.*, 2012). A limited quantity of pearl millet which is currently used by Tanzania's food and feed industries reflect both lack of familiarity with this crop and uncertainty about consumer demand. Industry is also commonly concerned about problems of grain quality, availability and price (Rohrbach and Kiriwaggulu, 2007). In Niger, pearl millet represents about 75 percent of total cereal food consumption and is a staple food in Namibia and Uganda. Pearl millet is a high-energy, nutritious food, especially recommended for children, convalescents and the elderly (Léder, 2004).

Several food preparations are made from pearl millet, though they differ between countries and even between different parts of a country. Common pearl millets food products are thick and thin porridges, (Plate 1), which are common in East and West Africa while pearl millet is boiled like rice products (Plate 2) and flat bread, either unfermented (mostly Asia) or fermented (Eritrea and Sudan). Others include steam-cooked products, alcoholic beverages, non-alcoholic beverages and snacks. However, because whole meal quickly goes rancid due to high fat content and hot climates, pearl millet flour is prepared by pounding or milling and stored only for short periods (Léder, 2004).



Plate 1: Pearl millet porridge

Source: www.cookatease.com



Plate 2: Pearl millet rice like cook

Source: www.cookatease.com

2.6 Importance of Pearl Millet Consumption

2.6.1 Nutritive value of pearl millet in the human body

Pearl millet grain is among the most nutritious food of the major cereals, at least equivalent to maize and generally superior to sorghum in protein content and quality. Its protein content is not only high, but of exceptionally good quality of about 11.6/100g comparable to wheat (11.8 g/100g), higher than rice (6.8 g/100g), sorghum (10.4 g/100g) and maize (4.7 g/100g) reported by Vanisha *et al.* (2011). It also has good levels various essential micro nutrients needed by the body. Overall mineral content of pearl millet is 2.3 mg/100g which is high as compared to commonly consumed cereals. It is rich in B-vitamins, potassium, phosphorous, magnesium, iron, zinc, copper and manganese (Vanisha *et al.*, 2011). Pearl millet consumption contributes 20–30% of the zinc intake, and 35–50% of the total iron intake in the human body (Jambunathan and Subramanian, 1988).

The grain is richer in fat content (5 mg/100g,) while it is deficient in essential amino acids, also contains 35% more lysine than sorghum (Rooney and McDonough, 1987).

(Jambunathan and Subramanian, 1988). The carbohydrate content of pearl millet is 67.5 g/100g, which is lower than wheat, rice and sorghum, but higher than maize. It is a rich source of energy (361 Kcal/100g) which is comparable with commonly consumed cereals such as wheat (346 Kcal/100g), rice (345Kcal/100g) maize (125 Kcal/100g) and sorghum (349Kcal/100g) reported by Vanisha *et al.* (2011).

2.6.2 Importance of pearl millet consumption as therapeutic food

Pearl millet consumption has been recommended for several therapeutic purposes, as it has been found to inhibit tumor development (Huang and Ferraro, 1982), control blood pressure and plasma, control low density lipo-protein, control cholesterol levels, and has anti-allergenic characteristics (Asp NG. 1996). Due to its high fiber content pearl millet is also recommended for the treatment of severe constipation and stomach ulcers, (Nambiar, 2012).

2.7 Pearl Millet Consumption as Animal Feed

Pearl millet can be utilized as emergency forage that regularly performs well as an economical one-year forage crop option (Newman *et al.*, 2006). Pearl millet is grown in developed countries like USA for animal feed. In developing countries, the use of millet grain as animal feed is concentrated in Asia; very little is consumed as feed in Africa. According to Léder (2004), it is estimated that less than 2 million tons of millet is fed to animals, compared to about 30 million tons of sorghum. Alternative uses of pearl millet such as poultry feed has increased. Indeed, Smith *et al.* (1989) reported that pearl millet can replace maize in chick diets without affecting weight gain or feed efficiency. The crop residue/straw has dual purpose; pearl millet is an important source of fodder, accounting for 40–50% of dry matter intake year round, and the most used feed in the dry months (Hash *et al.*, 2003). The use of pearl millet for fodder predominates in low input

crop livestock systems, is likely to become a very important component of the sustainability of such systems (Hash *et al.*, 2003).

According to Newman *et al.* (2006), pearl millet is a high nutritive-value summer-annual forage crop, popular among livestock producers for grazing, silage, hay, and green chop. According to Mayers (2002), the protein content of pearl millet is 45% higher than feed corn and is also 40% higher in lysine. This higher protein and other feed characteristics have helped to drive the interest in the grain by poultry producers and other livestock producers. In comparison to sorghum, pearl millet is much lower in tannin than sorghum and its seed is about half the weight of a sorghum seed. When millet and sorghum grain were compared in high-silage growing rations for steers adjusted to equal protein intake, the results suggested pearl millet protein had a high biological value as the addition of Rumensin to the rations gave millet grain a 10% advantage over sorghum grain (Brethour, 1982).

Pearl millet is equal to or better than typical maize-soybean poultry diets for broiler production and can be fed at up to 10 percent of the ration without grinding (Davis *et al.*, 2003; Hidalgo *et al.*, 2004), thus reducing feed processing costs. Broilers fed on pearl millet rations were heavier and had better feed conversion rate than those fed on maize (Lloyd, 1964). Kumar *et al.* (1991) studied feed efficiency of laying hens and found increased egg size and better feed conversion when pearl millet was substituted for maize at 60% by weight. So pearl millet is significant an excellent feed for birds and animals, including dove, turkey, song-birds, ducks, chicken, cow, goat and swine (Gulia *et al.*, 2007).

2.8 Industrial Utilization of Pearl Millet

2.8.1 Industrial utilization by food processing (milling) industries

Though pearl millet is most commonly consumed in various forms of thin and thickened porridge, industrial processing of pearl millet meal has been relatively limited (Mafuru *et al.*, 2012). In comparison, maize meal is much more widely produced on an industrial scale particularly in southern and eastern Africa (Rohrbach, 2007). There are many reasons for the dominance of maize in these economies, not least the relatively higher productivity of maize production in higher rainfall zones. The main constraint that millers are commonly complaining about is the contamination of the pearl millet with sand and small stones due to the common practice of threshing the grain on the ground, and then sweeping the threshed product into grain bags destined for the market (Rohrbach, 2007). Pearl millet retains a niche as industrially processed food grain though the size of this market is difficult to estimate. The largest and most immediate prospect for expanding industrial utilization of pearl millet is in resolving continuing production deficits on the farm. Opportunities for improving the level and stability of semi-subsistence production should not be ignored. However, the long term future of these crops depends on the success of their commercialization (Rohrbach and Kiriwaggulu, 2007).

2.8.2 Industrial utilization by animal feed processing industries

The use of pearl millet for feed in Sub-Saharan Africa remains extremely limited due to the fact that animal feed manufacturers lack consistent access to low priced grain (Rohrbach and Mutiro, 1998). The use of pearl millet as feed may be available after a particularly favorable rainy season, but supplies may then be limited when rains are poor. While industrial manufacturers of feed will commonly shift their ingredients as relative input prices change, this practice is less common among the many smaller-scale feed manufacturers in Sub-Saharan Africa (Rohrbach and Mutiro, 1998). Instead, many feed

processing industries seem to prefer a consistent formulation of other cereal grain than pearl millet (Rohrbach and Mutiro, 1998).

2.9 Determinants for Pearl Millet Consumption

Socio-economic and demographic factors are very important approach that help to identify main drivers of food consumption (Pack, 2007). The selection of foodstuffs by consumers depends on many factors including social-economic factors, consumer preferences, income, price as well as availability of substitutes (Pack, 2007).

Previous researchers identified some of the factors that can affect household food consumption, though in the case of pearl millet, studies on consumptions are limited. Radhakrishan (2005) in his study shows that the decline in per capita consumption of pearl millet both in rural and urban areas at all-India level is due to several factors but the most important ones were increase in per capita income, growing urbanization, changing tastes and preferences. Onyemauwa (2008), in a study on the determinants of cereal consumption in Owerri Municipality used multiple regression models to identify determinants of cereal consumption in the area. The independent variables used are price of cereals consumed, price of substitutes, household size, household income, form or state of cereals mostly consumed and age structure of the households. The results show that the price of substitutes of cereals, household size, household income and the form of cereals consumed were the variables found to be significant at different levels of significance. The results also show that all the significant variables have positive coefficients. This implies that an increase in their magnitude will lead to an increase in the quantity consumed of cereals by an average household in the area other factors held constant.

Akande (2002) asserted that urbanization appears to be the most important cause of the shift in consumer preferences towards rice in Nigeria. Duncan (1992) observed that

increasing women's share of income results in a higher marginal utility for household food consumption and other investments in the quality of human capital than income from other sources. Fanning *et al.* (2005) showed that non-economic factors (that is education, sex and family size) are important determinants of consumers' decisions. Assoc (2009), provides information about rice consumption in the United States and shows similarities and differences in the diets of those who consume rice compared with those who do not. Logistic regression analysis was used to examine relationship among economic, social, and demographic factors that affect rice consumption. The findings suggest that the design of food assistance and meal programs and nutrition education should consider ethnicity and income as important factors in the food choices made by individuals.

Adeniyi *et al.* (2012) looked into the consumption pattern of fish among households in Ibadan north local government area of Oyo State, Nigeria. The study aimed at examining factors affecting the level of consumption of fish. Multiple regressions analysis was used to capture the factors that affect the consumption of fish. The results showed that household income was a significant determinant of the level of daily per capita fish consumption. Ahamed (2009), explored the consumer's attitude and consumption of fish in Dhaka City by applying the theory of planned behavior. He depicted the socio-demographic information (gender, age, marital status, profession, household size, education, and household income). Multiple regression analysis was used to depict the socio demographic information. The results show that gender, age, marital status, household size and education influence positively the consumption. Onyemauwa (2010), analysed household consumption of cassava products in Ohaozara, Ebonyi State, and Southeast Nigeria. Quantity of cassava consumed were analyzed using ordinary least squares multiple regression technique. The findings of the study show that, household size, household income, and the cost of substitutes were the statistically significant

determinants of the quantity consumed of cassava products by the respondents in the area. The significant variables have positive coefficients, which imply that an increase in their magnitude will lead to an increase in the quantity consumed of cassava products in the area and vice versa.

a) Age

Consumption decisions are shaped by the age of the consumer. Jerome and Perreault (1991) noted that, young people spend more on basic necessities than the aged who spend a lot more on durable consumer goods. According to Pack (2007), younger people more often make use of ready-to-serve meals and fast food than the elderly. At the same time, the elderly pay more attention to health in their diets and usually have more knowledge about nutrition than the young. Middle-age people are interested in food that can be quickly prepared, whereas children are only interested in taste and have no awareness of health-related issues (Pack, 2007).

b) Sex

Sex of the consumer influences the purchasing decisions and hence consumption expenditure on goods and services. Obasi, (2000) noted that males and females have different purchasing and spending patterns due to differences in their needs and wants. It was noted that, males are normally concerned about capital expenditures as well as away-from-home food expenditures while females are mostly interested in the purchase of clothing, cosmetics, and most importantly food for the home, among other things.

c) Income

The fact that lower income households on the one hand respond mainly to price and on the other hand prefer filling food such as potatoes, bread and rolls is confirmed by

Trichopoulou *et al.* (2002). Income is therefore as relevant to consumption decisions as the basic desire and preferences. According to Baker (1981), having income or purchasing power implies having a choice not only between products but also between different versions/brands/varieties of the same product. The purchase of sustainable products is positively correlated with income (Thøgersen, 2005). Conversely, other evidence suggests that, the direction of the influence of income levels on sustainable purchases is the reverse way.

d) Education

The effects of education are widely researched in many advanced societies. The level of education is likely to affect the consumption patterns of households. The level of formal education is likely to be highly influential in either promoting traditional attitudes or introducing new attitudes towards food (Jerome and Perreault, 1991). The higher the level of formal education and the more widely available it is, the more it will be an agent of change in the definition of wants and needs. As people become more conscious that a better standard of living is possible, new needs for health and standard food develop as old ones become satisfied (Kinsey, 1988).

f) Occupation (source of family income)

Consumer's occupation affects the products purchased and consumed. Seyoum (1988) found that differences in consumed quantities of food and beverage categories by selected labour force status groups (farming households, self-employed households and employees, public servants and clerks in low, middle, high or top positions) demonstrate that the group of employees (including public servants and clerks) in middle, high and top positions have the lowest in-home consumption figures than farming households. The survey by Delgado and Reardon (2000) revealed that, rice consumption is especially

sensitive to work patterns, as women enter the work force, and men work away from home, there is strong demand for staples that can be prepared quickly at low cost and that are available in roadside restaurants. As household members eat away from home, the total expenditure on at home food consumption decreases.

g) Price

When price is raised or lowered, the effect may be either an increase or a decrease in the amount spent on a commodity depending on the price for the commodity in question. Price is a key element in the sustainable marketing mix (Charter *et al.*, 2006). Consumers are prone to pay a premium price for sustainable products only when they believe that the benefits of purchasing them outweigh the costs of such purchases (Jones *et al.*, 2008). A rise in the price of a substitute increases the demand for the competing product while a decrease in the price of the substitute causes a reduction in the demand for the competing product (Theil, 1975).

h) Household size

Household can be defined as a group of people (or a social unit) who live together and eat from the same pot (Mark and Winicki, 2000). It is expected that, quantities of food consumed increase with each additional member living in the household, however not in a proportional way (Pack, 2007). Household size has relevant implications for household purchasing and spending behaviour (Jerome and Perreault, 1991). Households with large family sizes spend more on consumer goods than households with small family sizes, *ceteris paribus*. Sdrali (2006) noted that, household size was a positive and significant factor in food expenditure, consistent with the results of Cage (1989) and Kalwij *et al.* (1998).

i) Household food priority (food preferences)

Preferences can play an important role in purchase decisions such as the choice of products and brands (Vermeir & Verbeke, 2006). However, in light of the fact that priority is relatively stable across time (Collins *et al.*, 2007). Any change towards more sustainable consumption pattern will require a lot of efforts and will take long time (Thøgersen & Ölander, 2002). If the family prefers to consume a certain type of food, this will encourage increasing the rate of consumption and vice versa.

2.10 Market Structure for Pearl Millet in Tanzania

The majority of small scale producers of pearl millet consume most of their produce to a large extent of about 95% (Rohrbach and Kiriwaggulu, 2007).. The remaining surplus can be sold either at the farmer's house, along the road side, local markets or to national markets depending on the choice of the producer and the accessibility of the market (Rohrbach and Kiriwaggulu, 2007).

2.11 Pearl Millet Marketing Channels and Functionaries

Stern *et al.* (1996) define marketing channel as a set of interdependent organizations involved in the process of making a product or service available for consumption or use. It consists of various agencies that perform the various marketing functions in sequence as the produce moves from the producers to ultimate consumers. The process connects producers and final consumers and influences competition and prices within the market. Johnson *et al.* (1996) considers the link between the actors involved in the transformation of a good as a chain or a sequence where the different steps, through which a product must pass to reach the final consumer, are analyzed. In an agricultural context this typically means producing, collecting, processing, storing, transporting, wholesaling and retailing of the goods in question (*i.e.* pearl millet in this study). The selection of the marketing

channels becomes imperative for the farmers since the real benefit obtained from them is mainly dependent upon the choice of the agency or the channel for disposal of their produce (Naik, 2007). The length of the marketing channels depends on the size of market, nature of the commodity and the nature of the demand at the consumer level. The marketing channels for agricultural commodities in general can be divided into two broad groups *i.e.* direct to consumer and indirect (Raju and Von Oppen, 1980).

2.11.1 Direct channels

Direct market channels for pearl millet market between farmers and consumers represent a significant portion of the pearl millet market, and are key components of pearl millet systems (Mafuru *et al.*, 2012). They present consumers with the opportunity to interact with the producer (Russo & McLaughlin, 1991). Consumers are attracted to these types of retail outlets in part because they enjoy connecting directly to their food source (Kolodinsky and Pelch, 1997).

2.11.2 Non-direct channels

Other pearl millet consumers depend on non-direct food retail outlets such as food processors and traders to access the crop. These outlets place one degree of separation or more between farmers and consumers, but help to remove the possible barrier of inconvenience of searching for pearl millet, cited by many consumers (Naik, 2007). A wholesale market is one in which commodities are bought and sold in large lots or in bulk. Transaction in these markets takes place mainly between traders. A retail market is one in which commodities are bought and sold to the consumers as per their requirements. Transactions in these markets take place between retailers and consumers.

2.12 Pearl Millet Marketing Agents in Tanzania

The main types of pearl millet marketing agents in Tanzania are presented in Table 4. The informal pearl millet markets in Tanzania comprise numerous types of market from which Intermediaries often play slightly different and overlapping roles. These roles are distinguished by scale of operation depending on the client they serve. Processors, retailers, wholesalers, assemblers and consumers are the main actors of pearl millet in Tanzania (Mafuru *et al.*, 2012).

Table 4: Main types of market agents for local pearl millet markets in Tanzania

Type of seller	Description
Producer	Producer who is also a seller of pearl millet, is a pearl millet farmer who sells his produce either at the farm, along the road, home and in the local market to different agents.
Processors	This is a pearl millet agent who buys pearl millet and sells after processing into different forms for consumption. This including home processor and industrial processor.
wholesalers	The one who buys pearl millet in large quantity from the producers and/or rural assemblers and sells it mainly to retailers.
Retailers	The one who buys and sells pearl millet to the consumers as per their requirements. Transactions in these markets take place between retailers and consumers. Retailers purchase pearl millet from the wholesaler, farmers and assemblers sell in small lots to the consumers.
Assembler	The one who buys and sells pearl millet to different actors. He collects pearl millet from the farmers and sells generally to the wholesalers/retailers. Transaction takes place mainly between traders.
consumer	The one who buys pearl millet from different actor for consumption. The actors might be farmers, processors, wholesalers and retailers.

Source: Mafuru *et al.* (2012)

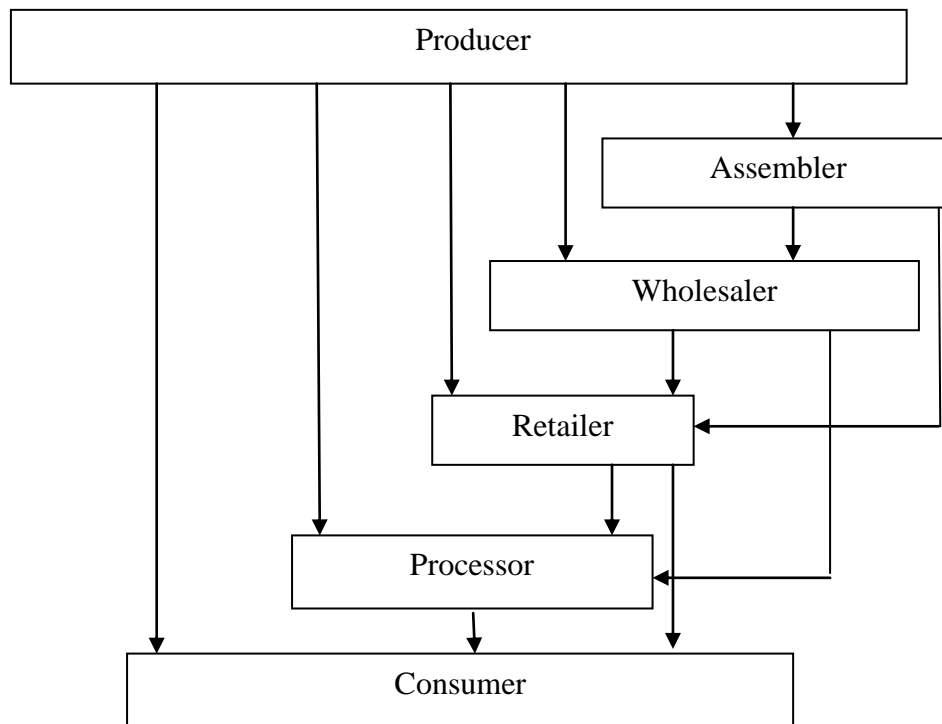


Figure 2: Common cereals marketing channels in Tanzania

Source: Lyatuu (2007)

The farmer can use either or combination of the channels of marketing to sell their produce. Different studies select the marketing channels based on different reasons. Naik (2007) addressed the marketing channel for millet in Savi (little millet) and Navane (Foxtail millet) by using five important channels given as below;

- i. Channel –I: Farmers— assembler— wholesaler— Retailer— Consumer
- ii. Channel –II: Farmers— assembler— Retailer— Consumers.
- iii. Channel –III: Farmers— Wholesaler— Processor— Wholesaler— Retailers— Consumers.
- iv. Channel –IV: Farmers— Assembler— Wholesaler— Processor— Wholesaler— Retailer Consumers.
- v. Channel –V: Farmers— Consumers.

The findings for Savi show that majority of the respondents sold their produce to wholesale merchants (61.67%). Main reasons attributable were better price (100%), immediate cash payment (100%) and correct weighment (100%). Apart from this 67.6% sold to these agencies due to spot payment made and 32.4% of farmers preferred these agencies because of lower marketing cost and previous agreement with these agencies also forced them to sell their produce to this particular agency. For Navane the results show that, farmers sell their produce to village traders, small quantity of produce for sale (100%) was the main reason for selling to this particular agencies followed by immediate cash payment (85%), lower market cost (80%), social ties with intermediary (75%), absence of middlemen (40%), and correctness in weighment (30%). Farmers preferred wholesale merchant due to better price (100%), immediate cash payment (100%) and correct weight (100%). Spot payment was also one of the important reasons for selling to these wholesale traders as stated by 75% of these respondents, while 25% respondents preferred wholesale traders just because of their previous agreement.

According to Mdoe and Nyange (1994), involvement of the market intermediaries in the marketing of milk from the producer to the consumer, six marketing channels were observed:

- i. Producer – Consumer
- ii. Producer - Small Milk Trader - Consumer
- iii. Producer - Small Milk Trader – Retailer - Consumer
- iv. Producer - Dairy Cooperative - Consumer
- v. Producer - Dairy Cooperative - Retailer - Consumer
- vi. Producer - Tanzania Dairies - Consumer

All milk that was sold through TDL (Tanzania Dairies Limited) (channel vi) through formal market. The informal market consists of direct sales to ultimate consumers (channel i), milk sales through small milk traders (channels ii and iii) and milk sales through dairy cooperative (channels iv and v). Presence of a large number of small milk traders who purchase milk from producers and sell milk to ultimate consumers indicates competitiveness at both the producer and retail end of the milk marketing system in Hai District and nearby urban centers. Apart from competition among themselves, small milk traders compete with (TDL) and dairy cooperatives, and the nearly identical consumer prices charged by small milk traders and dairy cooperatives in each season in 1990.

Lyatuu and Lebotse (2010) studied the marketing of indigenous leafy vegetables and how small scale farmers can improve their Incomes in Tanzania. They show marketing channel that a farmer can use to sell their indigenous leafy vegetables. The channel helps the farmer to increase efficiency in business hence raise the total generated income and improve competence thereby increasing the market share.

- i. Sell directly to consumers-at farm gate or at market place
- ii. Sell to a wholesaler through a broker
- iii. Sell directly to restaurant/hotel/supermarkets
- iv. Sell to an exporting company
- v. Sell to the retailer directly

Balaji *et al.* (2001) studied the marketing channels of groundnut grown in Tinavannamalali District of Tamil Nadu. In this study five marketing channels were identified. The most important channel was selling through regulated markets (55% of the quantity sold) and the least important one was selling to the primary processors which was 15% of the quantity sold. They found that, producer's share to consumer was the

highest (76.48%) in selling to oil millers since farmers sold the produce directly to oil millers.

2.13 Constraints for Pearl Millet Consumption

Several studies addressed major constraints for pearl millet consumptions in different parts of the world. Hash and Bramel-Cox (2000), observed that, markets for pearl millet are not large enough to allow substantial increases in production of the crop to be economically attractive. In fact, the area sown to this crop tends to drop as grain and fodder yields increase. Monyo *et al.* (2004) found that there are limited facilities for seed storage which make management of carryover stocks difficult. ASARECA (2004) found out that, lack of effective plant variety protection is a strong disincentive for private investment in genetic improvement of this crop. This also results in, strong incentives to manipulate markets to produce seed shortages of popular cultivars in the first few years that they are available. This practice serves to maximize short-term profit margins and facilitate control of proprietary hybrid parental lines. Rohrbach and Kiriwagguru (2007) ascertain that, limitations on size of agricultural land holdings restrict farmers to increase production.

Mafuru *et al.* (2012) observed that, low pearl millet quality is due to the fact that farmers use poor threshing technology whereby sticks and tractors are used. In so doing pearl millet gets mixed with sand and other unwanted materials. During selling, some traders mix pearl millet with other grains like sorghum to add weight and that reduces its quality. Large scale buyers want clean and graded pearl millet; therefore traders who mix grains are forced to sell at low value market. The main constraint limiting consumption for pearl millet in Tanzania's feed industry is the perceived lack of grain at prices competitive with maize said Rohrbach and Kiriwagguru (2007). Also Rohrbach and Kiriwagguru (2007) found that, poor road infrastructure resulted in grain shortages in urban markets, high and

unusually variable grain prices. These constraints particularly affect outlying pearl millet production zones.

Alur *et al.* (2005) in their study of small scale pearl millet observed farmers facing several constraints with regard to the access and operation in the markets. They claim to have observed poor market access which was categorized into three dimensions: physical access to markets; structure of the markets; and producers' lack of skills, information and organization. Although pearl millet is nutritious and staple food for millions under privileged section of the society, the increased utilization and diversification is impeded by problems mostly related to milling and storage characteristics reported by Varriano - Marston and Hosoney (1983). Serna-Saldivar and Rooney (1997) argue that, pearl millets are known for its high (three to seven percent) fat content in the kernel, bran and germ, also contain a major portion of the lipid material which makes the shelf life of the milled flour to be short.

2.14 Strategies for Promoting Pearl Millet Consumption

Monyo *et al.*, (2004) shows how National Sorghum and Millet Improvement Program (NSMIP), in collaboration with the SADC/ICRISAT Sorghum and Millet Improvement Program (SMIP) developed several new varieties that mature earlier and give higher yields than landraces. Also Rooney and Dykes (2006) suggest developing pearl millet traditional products with sustainable quality, the use of specifying seed variety and hybrid. Value addition of the crop will stimulate pearl millet market (Mafuru *et al.*, 2012).

2.15 Model Used for Assessing Pearl Millet Consumption

Onyemauwa *et al.* (2008) used multiple regression analysis to determine quantitatively how the relevant socio economic factors interact to influence household cereal

consumption in Nigeria and the results show that the price of substitute cereal, household size, household income and the form of cereals consumed were the variables found to be significant at difference levels of percentage. Friedly *et al.* (2007) also used the same technique of multiple regressions to analyze social economic factors for food consumption behavior in Australia and showed that age, income and household size are important factors in influencing food consumption.

This study therefore adopted the multiple regression models in assessing factors that influence pearl millet consumption.

2.15.1 Multiple regression analysis

In this study, multiple regression analysis was used to identify key determinants for pearl millet consumption. Multiple regression analysis is a statistical technique that allows us to predict the variance in an interval dependent, based on linear combinations of interval, dichotomous, or dummy independent variables. Through multiple regressions it could be established that a set of independent variables explains a proportion of the variance in a dependent variable at a significant level (through a significance test of R^2), and can establish the relative predictive importance of the independent variables (by comparing beta weights).

2.15.2 The hypotheses

The significance level set has: $\alpha = 0.05$. If p-value (Sig) $< \alpha$, regression line fits the data better than a flat line; the relationship is significant. The R-square (R^2) refers to the proportion of variance in the dependent variable (pearl millet consumption) which can be explained by the independent variables (socio-economical characteristics). It statistically provides information on the strength of the relationship (Wuensch and Poteat, 1998).

2.15.3 Assumptions of the multiple regression model

Multiple regressions make four assumptions, and these need to be checked. The assumptions are about the errors from the model; the errors are the difference between the predicted value of the dependent variable and the actual value of the dependent variable. Multiple regressions assume that the errors from the model are normally distributed; that the errors have constant variance; that the mean of the errors is zero; and that the errors are independent. Many difficulties tend to arise when more than five independent variables are used in the equation (Gordon, 1992).

2.16 Conceptual Framework

2.16.1 The theory of consumer behaviour

Loudon and Bitta (1993) define consumer behavior as the decision process and physical activity individuals engage in when evaluating, acquiring, using, or disposing of goods and services. Consumer purchase decisions appear to be based on a combination of economic and sociological factors and they could therefore be better understood if the concepts of the two disciplines are combined for the purposes of analysis. Pearl millet consumers vary tremendously in age, income, educational level and taste, among other factors and therefore buy an incredible variety of goods and services to satisfy their needs (Gary and Kotler, 2000). The household's consumption function gives the maximum amount of commodities consumed as a function of product price, income and some qualitative socio-cultural factors (Varian, 1990). When a consumer goes to the market, his/her concern is not limited to how much pearl millet to buy; rather he/she must decide which of the many available cereals to buy at their respective prices. Varian (1990) argues that the key to utility maximization is not simply buying what one likes best; instead, one must compare goods on the basis of their marginal utility and price. To maximize utility, the consumer should choose that good which delivers the most marginal utility per shilling. Optimal

consumption refers to the mix of products that maximizes total utility for the limited amount of income one has to spend (Varian, 1990). This condition gives the greatest satisfaction from the limited income of the consumers.

2.16.2 The theory of consumer demand

A consumer's demand gives the number of units of a particular product that the consumer would choose to buy at each possible price over a specified period of time (Ekelund and Ault, 1995). Given any available cereal varieties, the consumer chooses that cereal which maximizes his utility or satisfaction. Thus, consumer's demand for a cereal is the quantity chosen as a result of this utility maximization, which is also dependent on precisely what kind of cereals available. According to Henderson and Quandt (1986), commodity prices and consumer income are the main determinants of the demand level for a commodity. McKenna and Rees (1992) also noted that prices, consumer income and preferences interact to determine the individual demand function.

Lipsey and Crystal (1999) concluded that the 'law' of demand is a fundamental economic principle, which indicates that a decrease in the price of a commodity results in an increase in the quantity of the commodity that buyers are willing and able to purchase in a given period of time, if other factors are held constant. Apart from product price, prices of substitutes and income, certain household socio-cultural factors play very significant roles in shaping household consumption patterns. Household factors such as household size/number of dependants, age, gender and socio-cultural factors such as educational background, and occupation, among others, affect consumption pattern (Lipsey and Crystal, 1999). Pearl millet consumption is also expected to be influenced by those factors. According to Gao and Spreen (1992), socio-economic variables also have significant impacts on consumer demand for commodities.

Demand is defined as the quantities of goods and services people are willing and able to buy at alternative prices in a given time period (Marshall, 1920; Schiller, 1997). For the ultimate buyer of food, demand could relate retail prices to amounts that will actually be consumed within a given time frame. Purchases essentially reflect the demand for immediate consumption. Consumption is defined as the quantity of a particular commodity consumed or amount spent on the commodity by the household in a specified period. Consumption of food items is expressed in terms of three different measures: weight of food items consumed, expenditure on different food items, and nutritive value of food items expressed in terms of calories, proteins, fats, and other vitamins and minerals (George and King, 1971). While we are interested in pearl millet demand for an individual, the most appropriate measure of consumption would be the quantity of pearl millet being used. Food consumption refers to the quantity and quality of food intake by households or individual family members (Migotto *et al.*, 2005). Pearl millet consumption in the present study refers to the quantity of pearl millet spent by the household in a given period of time, *i.e.* a week or month. Measurement of pearl millet consumption in nutritive value terms is beyond the scope of this study as that might require some chemical analysis. Consumption patterns are determined by the combination of the main factors including the income level, preferences of the household and the market price.

2.16.2.1 Income

The studies of (Thøgersen, 2005) show that the purchase of sustainable food is positively correlated with income. Conversely, other evidence suggests that the direction of the influence of income levels on sustainable purchases is the reverse way. Indeed, Selfa *et al.* (2008) report that, when making purchase decisions, lower income households are more likely to purchase cheap and low quality food than higher income households. It is important to note that food desire is only the first step in the consumption process. To

acquire the product one must be willing and able to pay for one's wants. Producers will not give his/her produce just because you want to satisfy your household food needs instead producers want money in exchange. Income is therefore as relevant to consumption decisions as are basic desires and preferences. Hence, in explaining consumer behavior for pearl millet, demand entails both the willingness and ability to pay for it.

2.16.2.2 Market prices

The use of "market price," instead of "price," is because the actual price that a consumer pays is a function of the in-store price and travel costs to the store where the food purchased (Feather, 2003 and Rose *et al.*, 2009). The product characteristics such as own price and price of substitutes have effects on pearl millet consumption patterns. The quantity of pearl millet demanded is fairly sensitive to changes in price. That is, changes in own price results in significant changes in quantity demanded (Mansfield, 1989). The prices of substitute products also affect the demand for pearl millet commodity, in this study the main substitute is sorghum. Two commodities are said to be substitutes if both can satisfy the same need of the consumer. A rise in the price of a substitute increases the demand for the competing product while a decrease in the price of the substitute causes a reduction in the demand for the competing product (Theil, 1975). Two key assumptions were adopted, buying price and selling price are the same and the household resources are pooled and the household has a single set of preferences (Aidoo, 2009).

2.16.2.3 Consumer's preferences

Household income, price and availability of the food affect what consumers are able to purchase or consume whereas, consumer preferences on the other hand shapes the decisions that consumers make regarding what they choose to purchase or consume (Ruel

et al., 2004). Until the physiological needs to satisfy hunger are met, households have little choice but to eat cheap sources of foods like grains and other starchy foods. Once their basic needs have been met then they will diversify their food diets by including animal food sources, dairy products, fruits and vegetables and it is at this stage that consumer preference plays a role in shaping the food consumption patterns (Ruel *et al.*, 2004). The conceptual framework presented in (Fig. 5), attempt to capture the key variables for present study.

Applying the standard household model for pear millet consumption, the following factors are the main determinants for consumption:

- i. -household income
- ii. -The price of pearl millet relative to other prices.
- iii. -Household member's preferences

These three hypothesized determinants of pearl millet consumption are illustrated in (Fig. 3).

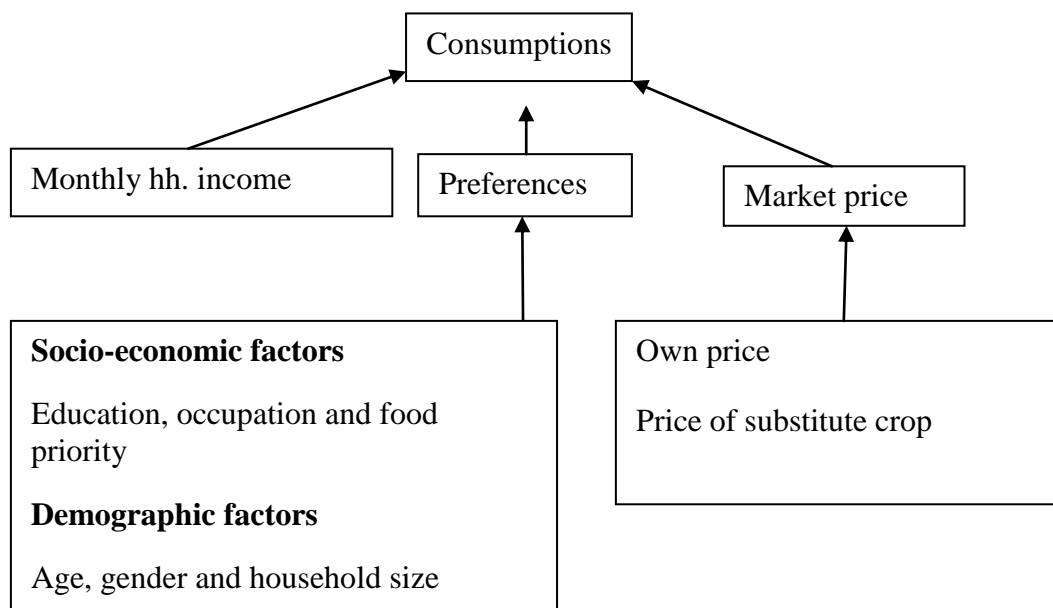


Figure 3: The conceptual framework for pearl millet consumption

Source: Ruel *et al.* (2005)

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Area

3.1.1 Location and rationale for selecting Singida rural and Kishapu districts

The study was carried out in two districts i.e Singida Rural and Kishapu districts in central and Lake Zone of Tanzania respectively. The two districts were selected due to their high potential in pearl millet production.

3.1.1.1 Singida Rural District

3.1.1.1.1 Geographical location

Singida rural is located in Singida region. It is in the central zone of Tanzania and is one of the four districts of Singida Region. It is bordered to the North by the Iramba District, to the East by the Singida Urban District, to the South by the Manyoni District and to the West by the Tabora Region (Fig. 4). The district lies between 3⁰ and 7⁰ latitudes south of the Equator and 34⁰ and 35⁰ Longitudes East (Mafuru *et al.*, 2012).

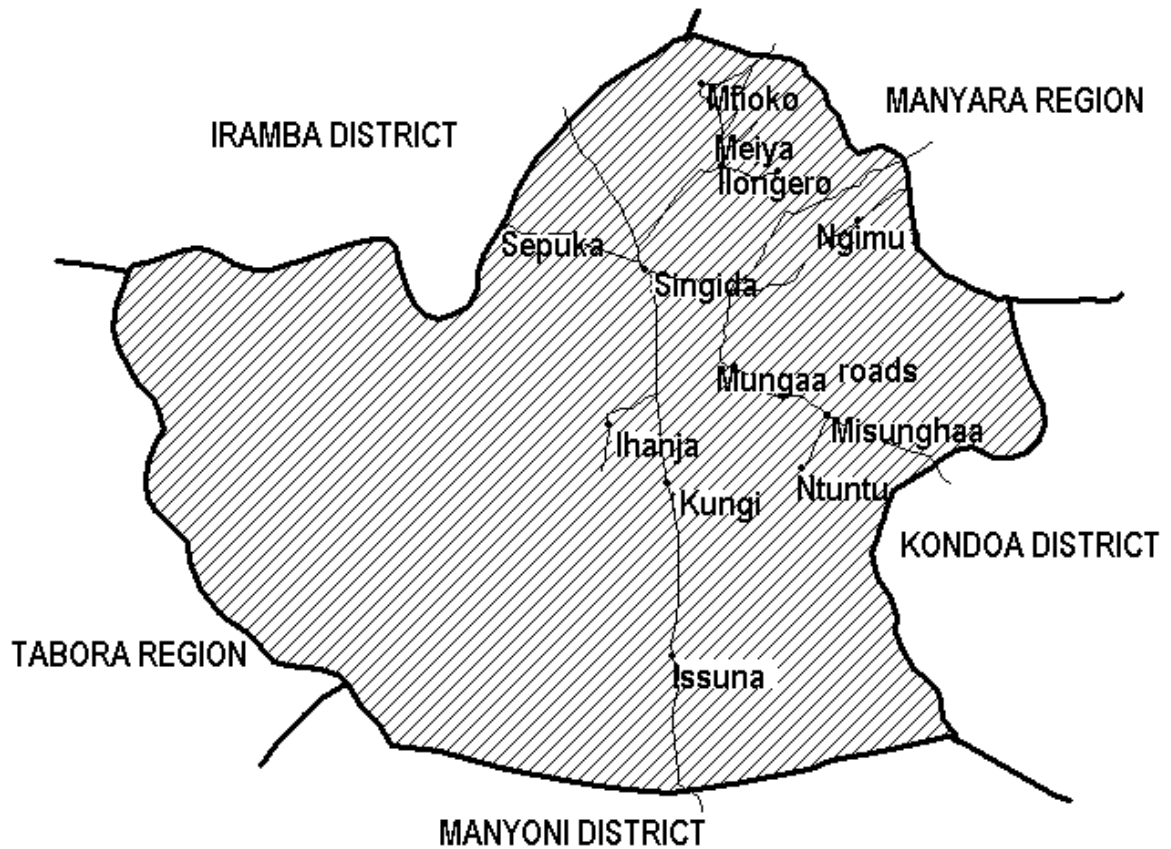


Figure 4: Map of Singida region showing the districts

Source: URT, 2007

3.1.1.1.2 Climatic condition of Singida Rural District

Singida District has a semi arid climatic condition. The District has two seasons; the dry season which is the longest (April to November) and the rainy season December to March. Average rainfall is between 600 – 700mm per annum while the temperature ranges from 15 to 30°C. The climatic condition of Singida district is characterized by long periods of up to eight months of dry season (from May to November). The district receives a unimodal type of rainfall which normally starts in November to March with typical tropical characteristics (Mafuru *et al.*, 2012).

3.1.1.1.3 Agricultural land in Singida Rural District

Singida Rural District has about 12 164 km² and more than 55% of the total arable land, from which 5282 km², 3737 km² and 2200 km² is under cultivation, grazing and forests respectively (Mafuru *et al.*, 2012). The land in Singida Rural is dry although it has high potential for pearl millet production over other cereal crop (Lazaro and Bisanda, 2004).

3.1.1.1.4 Important economic activities in Singida Rural District

Singida Rural residents are engaged in the production of in different crops such as pearl millet, sorghum, maize and sweet potatoes as food crop whereas pearl millet termed as the major food crop for the majority. Cash crops are sunflower, finger millet, onions, chick pea, celery (*giligiliani*) and cotton. Also there are different types of livestock kept in Singida rural including cattle, goat, sheep, donkeys and chicken (Mafuru *et al.*, 2012).

3.1.1.2 Kishapu District

3.1.1.2.1 Geographical Location

Kishapu District is located in Shinyanga region in the lake zone of Tanzania. Kishapu District is one of the eight districts of the Shinyanga Region of Tanzania. It is bordered to the north by the Maswa District, to the south by the Tabora Region, to the east by the Meatu District and to the west by the Shinyanga Rural and Urban Districts (Fig. 5). The district's geographical coordinates are 3° 37' 0" S and 33° 52' 0" E (Mafuru *et al.*, 2012).



Figure 5: Map of Shinyanga region showing the districts

Source: URT, 2007

3.1.1.2.2 Climatic condition in Kishapu District

The Kishapu District receives rainfall on an average of 450 to 900 mm per annum. Rainfall usually starts in early October up to late January. The season is interrupted by dry spells in the month of February and then resume in early March to May. The highest rainfall is normally in the month of March. Temperature in the district ranges from 22° C to 30° C (Mafuru *et al.*, 2012).

3.1.1.2.3 Agricultural land in Kishapu District

The district has an area of 4039 km². The land is characterized by flat and gently undulating plains covered with low and sparse vegetation which is divided into three agro ecological zones: gentle sandy soil, low land black soil and undulating calcareous soil. The area suitable for agriculture is 3192 km² however it is only 59% utilized (Mafuru *et al.*, 2012).

3.1.1.2.4 Important economic activities in Kishapu District

Majority of the residents in the district are engaged in crop and livestock production. The major crops are sorghum, pearl millet, sweet potatoes, maize, sunflower, groundnuts,

bambara nuts, cassava, rice and cow peas as food crops whereas pearl millet is the main food crop for the majority of the farmers. Cotton, green grams, chick peas and sisal used as cash crops (Mafuru *et al.*, 2012).

3.2 The Research Design

A cross sectional study design was employed in this study. Under this design, data from household's respondents was collected at a single point of time without repetition from the representative population and the design is useful for description purposes as well as for determination of relationships between variables (Casley and Kumar, 1998; Bailey, 1994). The design is ideal when resources are limiting to permit longitudinal studies.

3.3 The Sampling Frame

In this study, the sampling frame included farmers, consumers, processors and traders both wholesalers and retailers of pearl millet with various characteristics. Generally, the study covered about 385 respondents altogether. The respondents were selected due to their potentiality in pearl millet productions and consumptions.

3.4 Sampling Technique and Sample Size

This study applied two types of sampling techniques namely simple random sampling and Judgmental /purposive sampling. A purposive sampling was employed to select wards and villages and simple random sampling was used to select producers, consumers, processors and traders. These techniques have been recommended in social research by Kothari (2004) as they focuses directly to the area intended to be studied. Selection of wards and villages was done during pre-survey. In each village, stratified random sampling was used to select the number of household which was undertaken by the use of key informants to form strata. The sample size consisted of 385 respondents from seven

villages in Singida rural and Kishapu was estimated with reference to Bartlett *et.al.*, (2001), that is; 180 farmers, 85 consumers, 44 processors and 76 traders. The choice of this sample size was based on the fact that a sample size of greater than 30 respondents is good for statistical inferences (Kothari, 2004). List of potential pearl millet producers and consumers were obtained from village executive/extension officers who shaped the basis for selection of pearl millet farmers. While traders (wholesalers and retailers) within and around Singida Rural and Kishapu districts were selected by using simple random technique from different markets.

3.5 Data Collection Tools and Pilot Testing

A structured questionnaire was used to collect data from pearl millet farmers, consumers, food and feed processors and traders (wholesaler and retailers). It comprised of both open and closed ended questions. Swahili language was used during the interview for easy communication between the researcher and the farmers. Pre-testing of questionnaire was done for the purpose of identifying its effectiveness and appropriateness. Necessary corrections were made to the questionnaire from the pre tested sample. Farmers used for pre-testing were not involved in the actual survey. Data on quantity spent on pearl millet and substitute products (sorghum and maize) consumed for a period of one week, one month and year were gathered. Prices of these products as well as the income of the household members were also obtained. Data on personal characteristics and socio-economic of respondents were also collected. Other data collected were: marketing channel used and Reasons for the selection of the channel.

3.6 Data Sources and Collection Methods

Data for this study were gathered from two major sources that are primary and secondary. Primary data for this study were collected through survey to get an in-depth understanding

of issues related to pearl millet consumption in the study area. Survey involved personal interview using pretested questionnaire. The researcher trained four enumerators to conduct the interview so as to ensure quality in capturing responses from the interviewee. Secondary data on cereal production and price in Tanzania were obtained from various sources including the Ministry of Industry & Trade, National Food security Division, books, internet search and from Sokoine National Agricultural Library (SNAL).

3.7 Data Analysis

Data were analyzed using Statistical Package for Social Science (SPSS) software. Descriptive statistics such as percentages, frequencies and cross tabulation were used to examine marketing channel along pearl millet value channel and to determine the strategies that can be used to promote pearl millet consumption. Multiple regressions were used to analyze the factors influencing pearl millet consumption.

3.7.1 Description of the multiple regression models

Multiple regression analysis was used to examine the factors that influence the demand for pearl millet.

Several studies use multiple regressions in assessing the determinant for food consumption. This includes the study by Punt *et al.* (2003), on the factors influencing the food consumption and expenditure pattern in Limpopo province. Other studies include that of Onyemauwa (2008) on the determinants of cereal consumption in Owerri Municipality.

This study therefore adopted the multiple regression model in assessing the factors that influence pearl millet consumption. From the conceptual framework, the demand for pearl

millet is influenced by demographic characteristics such as age, education level, household size, household food priority, gender of respondent, location of the household as well as price and income of the household.

Mathematically, the model is represented as:

$$Y = \beta_0 + \beta_1 \text{PMPRICE1} + \beta_2 \text{AGE} + \beta_3 \text{INCM} + \beta_4 \text{SEX} + \beta_5 \text{EDUC} + \beta_6 \text{OCCP} + \beta_7 \text{SPRICE} + \beta_8 \text{HFPRIO} + \beta_9 \text{HHSIZE} + \dots \quad (1)$$

Where:

- Y = mean quantity of pearl millet consumed per month in kilograms (kg)
- $\beta_0 - \beta_{13}$ = Coefficients to be estimated
- $\text{PMPRICE} (x_1)$ = mean pearl millet price in 2012 (Tshs/kg.)
- $\text{AGE}(x_2)$ = age of household head (age in years category) (dummy, 1 for specific age group) – D_1 = age of 36 to 55 years
– D_2 = age greater than 55 years
- $\text{INCM} (x_3)$ = mean family income in 2012 (Tshs/month)
- $\text{SEX} (x_4)$ = sex of household head (dummy, 1 for female)
- $\text{EDUC} (x_5)$ = educational level of respondent (dummy, 1 for specific education level). – D_1 = primary education level
– D_2 = secondary education level
– D_3 = advanced education level
– D_4 = university education level
- $\text{OCCP}(x_6)$ = occupation (main source of family income) (dummy, 1 for agriculture)
- $\text{SPRICE}(x_7)$ = mean price of close substitute in 2012 (Tshs/kg.)

- HFPRIO (x_8)= household food priority (food preferences) (dummy, 1 for pearl millet as family food priority)
- HHSIZE(x_9) = household size (total number of people sharing same house and food at least a month)

3.7.2 Expected signs of the hypothesized independent variables from multiple regression models

a) Age

Pearl millet consumption is expected to be negatively influenced by age as it has been described in section 2.8 in Chapter 2

b) Sex

Sex was considered as an important factor that determined the type of food to be consumed by the household. More important under this assumption is that, in most of the African societies, females are more involved in various issues related to food consumptions.

c) Income

According to Basavaraj (2010), pearl millet is consumed mainly by the low and middle income groups of people. Then the present study expects consumption to decrease with rising income.

d) Education

This study expects educational level of household head to influence household pearl millet consumption negatively as it was described in section 2.8 in Chapter 2.

f) Occupation (source of family income)

Seyoum (1988) found that consumer's occupation affects the food products purchased and consumed. Therefore occupation is expected to influence pearl millet consumption positively. More detail refers section 2.8 in Chapter 2.

g) Price

Consumers are prone to pay a premium price for sustainable products only when they believe that the benefits of purchasing them outweigh the costs of such purchases (Jones *et al.*, 2008). Therefore the present study expect price to influence consumption negatively; this is according to the law of demand.

h) Household size

Households with large family sizes spend more on consumer goods than households with small family sizes, *ceteris paribus* (Jerome and Perreault, 1991). Family size in this study is expected to have a positive influence to pearl millet consumption.

i) Household food priority (food priority)

Household food priority can play an important role in purchase decisions such as the choice of products and brands (Vermeir and Verbeke, 2006). In this case is expected to have positive sign as described in section 2.8 in Chapter 2.

Table 5: Summary of expected signs of the hypothesized independent variables

Variables	Definitions	Expected sign
PMPRICE	mean pearl millet price in 2012	-
AGE	age of household head	
	i. D ₁ = age of 36 to 55 years	+
	ii. D ₂ = age greater than 55 years	-
INCM	mean family income in 2012	+
SEX	sex of household head	+
EDUC	education of household head	
	i. D ₁ = primary education level	+
	ii. D ₂ = secondary education level	+
	iii. D ₃ = advanced education level	-
	iv. D ₄ = university education level	-
OCCP	occupation of household head	-
HHFPRIORITY	Household food priority	+
HHSIZE	household size	+

3.8 Limitations of the Study

The study encountered some limitations in the course of data collection in the study areas. First, majority of the households relied on their memories to estimate their food consumption and household expenditures. In addition, some respondents were skeptical in providing some of the information required for the study fearing that if they gave the information it could result in unpopular consequences to them. The researcher assured them on the issue of privacy, that the obtained information was intended for academic purpose and the increase of pearl millet demand and not otherwise. Secondly the language barrier seems to be a major obstacle that limited direct communication between the researchers and some respondents in order to probe further some responses during data collection since the local language was the means of communication; this is much observed in Kishapu District. However data collection was possible by the use of trained enumerators who spoke both Kiswahili and the local languages of the respondents.

3.9 Ethical Issues

The respondents were informed of the purpose/reason for conducting the research and the kind of information that would be sought before commencing the interviews. It is based on their willingness that they were interviewed.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio-economic Characteristics of the Consumer

Socio-economic characteristics are essential elements in understanding the general behavior and attitude in decision making and its probable expected responses to many stimuli exposed to it (Akyoo, 2004). Findings in Table 6 show that 79% of the respondents were females while 21% were males. The greater percentage of women relative to men was due to the fact that, most of the men approached for responses referred the researcher to their wives when they learnt that the subject matter was household consumption. This is a confirmation to a general belief that food matters in the areas are affairs of women.

Table 6 shows that the modal class of the age of the respondents is 18 to 35 years of age and 53% of the respondents belong to this category. Middle-age group is an active age class in terms of energy and nutrient requirement and pearl millet has a lot to do under this group. They are likely, therefore, to consume significant quantities of pearl millet in their households. The result of the present study also show that, 36% of the respondent belong to the 36 to 55 age group and the last group is of the age greater than 55 years of age which represent 11% of all respondents. On the other hand, the household size (number of persons) of the sampled households represent only eight percent of the respondents with household size of 1to 2 people while 33% of the respondent have 3 to 5 household size, only seven percent represent the respondent of more than 10 people in the household and 6 to 10 household size represent 52% of the respondent which means majority of the respondent have large number of household size.

Comparing the age of the respondents and the household size, it could be deduced that majority of the households of the respondents are still in their tender age (18 to 35 years of age). People in this age class are believed to consume greater quantities of cereals than any other kind of food due to the type of activities involved to them (Onyemauwa, 2008). One of the major factors that may affect decision making of individuals with respect to the type and quality of food they eat is their level of education. The present study shows that the level of education attained by the respondents that eight percent of the respondents attained primary education, 27% ordinary level education, 19% attained advanced level education and 24% achieved university education level whereas, 22% did not get any formal education. The findings are in line with that of Behrman and Wolfe (1984).

Table 6: Socio-economic features of the consumers

Variables	Number of respondent	Percentage
Gender		
Male	18	21
Female	67	79
Total	85	100
Age (years)		
18 - 35	45	53
36 -55	31	36
>55	9	11
Total	85	100
Level of education		
primary education	7	8
ordinary education	23	27
advanced education	16	19
university education	20	24
No formal education	19	22
Total	85	100
Household size (number of people)		
1 – 2	7	8
3 - 5	28	33
6 – 10	44	52
>10	6	7
Total	85	100

4.2 Consumption of Pearl Millet

The findings in Table 7 show that, the sampled households consumed an average of 56 kg of pearl millet per month during the period of survey. Moreover the results show that 51% consume less than 10kg of pearl millet per month. The rate reflects low demand for pearl millet per month. On the other hand, two percent consume 11 to 20 kgs per month, 18% consume about 21 to 100 kgs per month and 29% consume more than 100 kgs per month. Majority of the consumers (60%) argued that pearl millet is not part of their family food priorities especially those from urban areas. Thirty one percent of people especially those who live in urban areas consume pearl millet because of some reasons such as sick people like diabetic people. About 28% of the consumers are children who use pearl millet as part of their daily meal and 48% of people use pearl millet as family food; the latter group categorizes pearl millet as their family food priority and mostly from rural areas. Majority of respondent (99%) consume pearl millet in the common form of *uji*¹ and *ugali*² and only one percent use alternatively like in the form of bites. The results also show that, household spent about 34 544 Tshs. for pearl millet consumption per month which constitute about 14% of household monthly income.

¹ *Uji*: refers to a thin cereal porridge usually made from pure or mixed flour from maize, rice, sorghum, finger millet and pearl millet.

² *Ugali*: refers to stiff/thick porridge made of pure or mixed flour from maize, sorghum, pearl millet, finger millet, cassava or combination of these depending on availability and preference of the consumer.

Table 7: Pearl millet consumption by consumers

Variable	Number of respondent	Percentage
Consumption		
porridge(thin and thick)	84	99
For bites	1	1
Total	85	100
Quantity consumed/month (kgs)		
1 to 10	43	51
11 to 20	2	2
21 to 100	15	18
>100	25	29
Total	85	100
Family food priority		
pearl millet	34	40
Otherwise	51	60
Total	85	100
Groups for pearl millet consumption		
Children	24	28
Diabetic people	26	31
All family members	41	48
Multiple responses		

4.3 Consumption of Substitutes by Respondents

The results from Table 8 show that, household consumed an average of 58 kg of sorghum per month during the period of survey and 38 275 Tshs. spent which is approximately 15% of household income. It was also observed that, respondents consumed more quantity of sorghum and devoted higher percentage of their monthly income on sorghum relative to pearl millet. This is an indication that sorghum is popular among consumers than pearl millet.

4.4 Industrial Utilization of Pearl Millet by Respondents

4.4.1 Industrial utilization of pearl millet by animal feed

Majority of Tanzanian animal feed industries use maize and little amount of sorghum in comparison to pearl millet. About 492 961t of maize and 989 t of sorghum used by feed industries per year and only limited quantity of pearl millet (2.2t per year) currently used by Tanzania's feed industries (see Table 8) and this was only consumed by one industry found in Singida region called VETA Animal Feed while other feed industries do not use pearl millet in their production and show slight interest or no interest in using the crop other factors kept constant. This reflects both unfamiliarity of pearl millet and uncertainty about consumer demand. Industries are also concerned about grain quality and unreliable price.

Table 8: Average industrial consumption of coarse grain in Tanzania (t/yr)

Industry	Maize	Sorghum	Pearl millet
Animal feed	492 961	989	2.220
Food processing	1 944 000	106	No purchases

4.4.2 Industrial utilization by food processors (milling industries)

Though pearl millet is most commonly consumed in various forms of thin and thickened porridge, industrial processing of pearl millet meal has been relatively limited. The data from this study found no food industry dealt with pearl millet though about 14% shows some interest if there will be reliable quantity and quality of the produced grain at a competitive price. In comparison to, the average of 1 944 000t and 106t of maize and sorghum respectively used by food industries per year (see Table 8). Respondents who intend to demand pearl millet, they think of less quantity than that of sorghum above. Maize meal is much more widely produced on an industrial scale in approximately every

milling industry in Tanzania. All respondents argued that, reliability and quality are the major reasons for the dominance of maize in these economies while, 86% supported the higher consumer demand for maize than pearl millet.

4.4.3 Industrial utilization of pearl millet by brewing industry

During the survey of industrial demand for pearl millet, manufacturers of both clear (Lager) and opaque beer (local beer) were interviewed. Representatives of the clear beer industry expressed little or no interest in using pearl millet. The main reason for consuming sorghum rather than pearl millet was stated to be the poor quality of pearl millet. Moreover they are not sure of the future demand for pearl millet as up to the present no clear beer is produced using pearl millet. Only local beer processors consumed pearl millet. About 21% of pearl millet produced in Singida Rural Districts and three percent of pearl millet produced in Kishapu Districts are used to make local beer.

About 15% of pearl millet produced from Singida Rural and Kishapu districts goes to local beer processors which is approximately equal to 27t of their produce per year. People in these areas consume local beer as part of their refreshments. The common name for local beer made by using pearl millet in Singida Rural is called *Ntui* or *Nkhangaa* by Nyaturu people and *Mataputapu* by Sukuma people. It was stated that, peak season for consumption of local beer is during the harvest because of high availability of pearl millet and income.

4.5 Details of Pearl Millet Marketing in Singida Rural and Kishapu districts

About 59% of pearl millet harvested is for the family consumption. Forty one percent enters the market and mostly transaction involves sale between neighboring households. Table 9 shows that, majority of the farmers (80%) sold their produce not because they had

surplus but because they needed money for other uses in the family while 12% sold their produce because they have surplus and eight percent sold their produce because of poor storage facilities. Low demand for pearl millet marketing contributes to the low production of the crop. About (50%) of pearl millet farmers in the selected villages produce an average quantity of about 4 to 10 bags per season, 1 to 3 bags produced by (21%), more than 10 bags produced by (25%) and less than one bag of 100 kgs (four percent).

Table 9: Marketing details of pearl millet in Singida Rural and Kishapu districts

Variables	Districts					
	Singida Rural		Kishapu		Total	
	n	%	n	%	n	%
Harvested pearl millet (kgs)						
less than one bag of 100	6	5	2	2	8	4
1 to 3 bag of 100	29	26	18	16	47	21
4 to 10 bag of 100	63	56	50	45	113	50
greater than 10 bag of 100	14	13	42	38	56	25
Total	112	100	112	100	224	100
Distribution of produce						
consumption	63	56	70	63	133	59
selling	49	44	42	37	91	41
Total	112	100	112	100	224	100
Reason for selling pearl millet						
surplus	4	8	7	17	11	12
need money for other family use	42	84	32	76	74	80
low storage facilities	4	8	3	7	7	8
Total	50	100	42	100	92	100

Details on the marketing of pearl millet by the growers with respect to price, mode of transport, place of market and the agency to whom sold are presented in Table 10. The results show that during the harvesting period the highest proportion of farmers sell their produce at a price between 5000 to 7000 Tshs. per tin of 18 kgs. (87%) and those who sell at a price less than 5000 Tshs. per tin of 18 kgs is 13%. On the other hand during the off season 16% of farmers sold their produce at a price of 7 000 to 10 000 Tshs. per tin of 18 kgs and 84% at a price of greater than 10 000 per tin of 18 kgs. Pearl millet growing farmers (91%) sell their produce at their home place, five percent along the road, four percent sold their produce at the market and three percent of the growers sell their produce at their farm. The agent to who pearl millet is sold during the period of survey involve consumers, (66%) of farmers sell their produce to consumers followed by traders (23%), local beer processors (15%) and industrial processors (three percent).

Table 10: Market information for pearl millet in Singida Rural and Kishapu districts

Variables	Districts					
	Singida Rural		Kishapu		Total	
	n	%	n	%	n	%
Pearl millet transaction						
in the market	4	8	0	0	4	4
near the farm	1	2	2	5	3	3
along the road	5	10	0	0	5	5
home	46	88	40	95	86	91
Multiple response						
Price during the harvest season/18kg tin						
(Tshs)						
less than 5 000	4	8	8	20	12	13
greater than 5 000 to 7 000	48	92	33	80	81	87
Total	52	100	41	100	93	100
Price during off season/18kg tin						
greater than 7 000 to 10 000	8	15	7	18	15	16
greater than 10 000	44	85	32	82	76	84
Total	52	100	39	100	91	100
Pearl millet customers						
local beer processors	11	21	3	3	14	15
industrial processors (food/feed)	1	2	2	5	3	3
traders	19	37	3	7	22	23
consumers	31	60	37	88	62	66
Multiple response						

4.6 Marketing Channels for Pearl millet in Singida Rural and Kishapu districts

The selection of the marketing channels is very important for the farmers in Singida Rural and Kishapu districts since the benefit accumulated by them is mainly dependent upon the choice of the agent or the channel for disposal of the produce. The channel selected influence marketing cost and hence the share of consumer's payment received by the

farmers. Farmers also select the marketing channel depending on the quantity of marketable surplus available, storage capacity, price structure and availability of infrastructural facilities. Seven most marketing channels for pearl millet observed in Singida Rural and Kishapu districts and arranged from the most preferred channel to the least depending on their contribution of pearl millet from the farmer to consumer.

- i. Farmer – Consumer
- ii. Farmer – Assembler – Wholesaler – Retailer – Consumer
- iii. Farmer – wholesaler – retailer – Consumer
- iv. Farmer – Processor – Consumer
- v. Farmer – Retailer – Processor – Consumer
- vi. Farmer – Retailer – Consumer
- vii. Farmer – Wholesaler – Processor – Consumer

The various marketing channels adopted by pearl millet farmers are shown in Fig. 6. The most frequent channel is the direct outlet (54%). Many reasons may have contributed to this scenario but the most important is that, consumers buy pearl millet and pay their money on the spot. Many farmers adopted this channel because of their urgent need of money and other conveniences attached to it. The other channels utilized by farmers are second channel (ii) (17%), the third channel (iii) mostly selected (13%), the fourth channel (iv) to be selected (six percent), the fifth channel (v) comprises of five percent, channel six (vi) (three percent) and the last channel (vii) comprises of two percent.

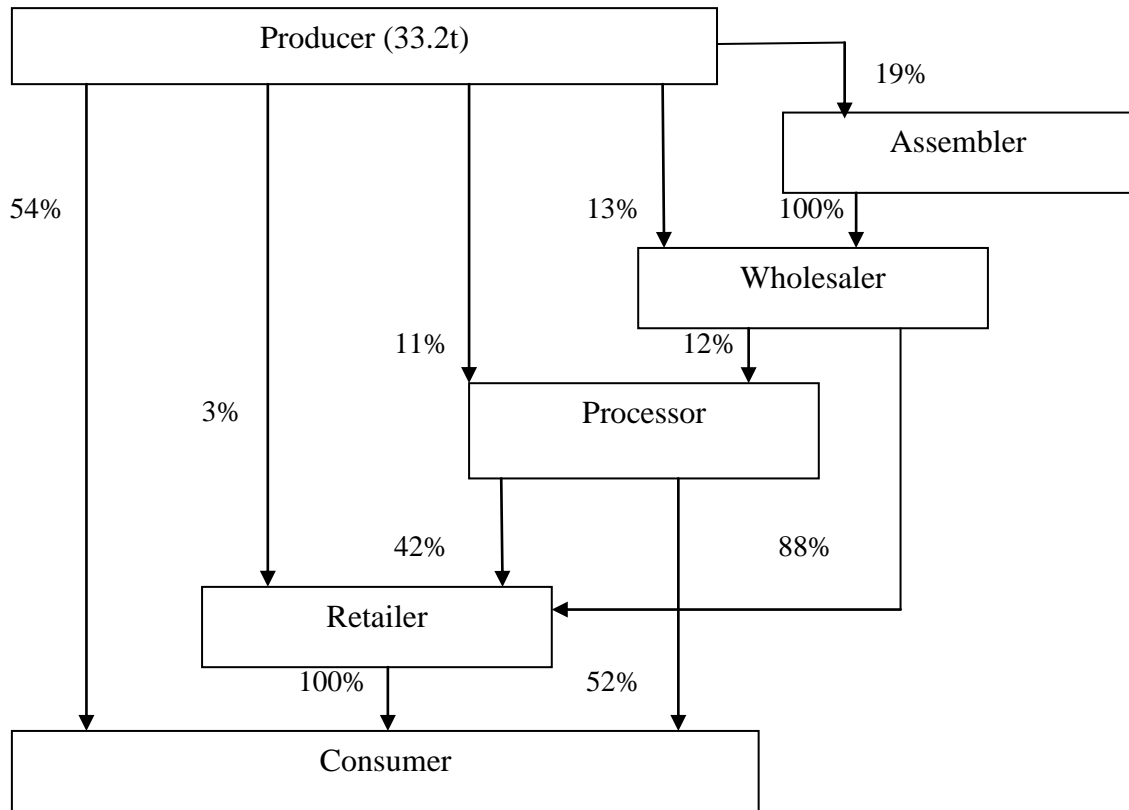


Figure 6: Contribution of pearl millet share from different actors to consumer

4.7 Reasons for sale of pearl millet to a particular agent in Singida Rural and Kishapu districts

Selling pearl millet direct to consumers is the major route for the farmers produce. The reasons for the farmers to select a particular agent are presented in Table 11. About nine percent of the respondents sold their produce to local beer processors, immediate cash payment (100%) was the major reason expressed by all the farmers who preferred to sell to the local beer processors. Nature of the demand (100%), as consumer is the most readily available customers, lower marketing cost (41%), poor infrastructure (33%), small quantity of the produce (33%) and better price (25%) is the other reason expressed by farmers for preferring local beer processors to sell their produce. Two percentages of the respondents sold their produce to industrial processors. Main reasons attributable to

farmers were better price (100%) and correct weightment (100%) and immediate cash payment (50%).

Apart from that, 13% of the farmers sold their produce to the wholesalers, 86% preferred these agencies due to immediate cash payment, better price (41%), correct weightment (12%) and 41% sold to wholesalers because of lower marketing cost. Fifty four percent of the farmers sold their produce to consumers. Main reasons attributed were the nature of the demand (100%), lower marketing cost (52%), poor infrastructure (50%), immediate cash payment (75%), small quantity produced (16%) and better price (seven percent) also influence the farmers to sell their produce to this agency. Moreover, three percent of farmers sold their produce to retailers because of the immediate cash payment, correct weightment (58%), better price (41%) and small quantity of produce (25%). Assemblers (19%) were the second most preferred agency for farmers to sell their produce. Immediate cash payment (63%), better price (64%), small quantity (11%), lower marketing cost (14%), correct weightment (8%) and nature of the demand (5%) were the reasons for the selection of the agency (Table 11).

Table 11: Reasons for selecting marketing channel by farmers in Singida Rural and Kishapu districts

Variable	Local beer processors		Industrial processor		Wholesaler		Consumer		Retailer		Assembler		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
	immediate cash payment	13	100	0	50	3	86	16	75	2	75	9	63	43
nature of the demand	12	100	0	0	0	0	21	100	0	0	1	5	34	57
poor infrastructure	4	33	0	0	0	0	10	50	0	0	0	0	12	34
lower marketing cost	5	41	0	0	1	12	10	52	0	0	1	14	14	28
better price	3	25	1	100	1	41	1	7	1	41	5	64	12	21
Small quantity of produce	4	33	0	0	0	0	3	16	1	25	1	11	9	14
correct weightment	1	8	1	100	1	12	0	0	1	58	1	5	5	9

4.8 Statistical Results on Determinants of Pearl Millet Consumption by Consumers

Multiple regression analysis was undertaken to show the effect of some independent variables either positively or negatively on the monthly quantity of pearl millet consumed (Table 13). Age of the household head, occupation, pearl millet price, education level and household food priority are the variables found to be significant at different levels of significance. Occupation have positive coefficient with the values of 21.750. This implies that an increase in the magnitude of this variable, results to higher quantity of pearl millet consumed by an average household in the area, other factors held constant. Another factor that influences pearl millet consumption is the price of pearl millet, university education level of the household head, age of the household head and household food priority which have negative coefficient with the values of 0.126, 33.235, 42.204, 38.975, and 68.873

respectively. This shows that, an increase in the magnitude of these variable driving factors leads to the decrease in the quantity of pearl millet consumed. The results show that the coefficient of determination (R^2) as 0.557. This indicates that the independent variables included in the model were able to explain about 56% of the variable in the quantity of pearl millet consumed per month. Therefore from the regression analysis, it is concluded that, the quantity of pearl millet consumed is influenced by the age of the household head, occupation, pearl millet price, education level and household food priority.

Table 12: Results of multiple linear regression analysis (Dependent Variable: mean quantity of pearl millet consumed per month)

Model parameters	Coefficients	Std. Error	p-value
(Constant)	91.298	52.465	0.086
Household size	-7.057	8.874	0.429
Sex (dummy)	0.035	17.009	0.998
Age category of respondent (dummy)			
Age (36 to 55)	-5.454	15.211	0.721
Age (> 55)	-38.975	20.527	0.062*
Occupation (dummy)	21.750	7.458	0.005***
Household food priority (dummy)	-68.873	22.347	0.003***
Income	-3.135	3.269	0.341
Pearl millet price	-0.126	0.054	0.023**
Sorghum price	0.034	0.047	0.469
Level of education (dummy)			
Primary education level	-33.781	25.777	0.194
Secondary education level	-14.748	19.792	0.459
Advanced education level	-33.235	22.878	0.091*
University education level	-42.204	23.269	0.074*
R = 0.746, R square = 0.557, F = 6.859			

* = Significant at $\alpha < 0.1$ ** = Significant at $\alpha < 0.05$ *** = Significant at $\alpha < 0.01$

(a) Age of the household head

Different age groups have different perception in consuming pearl millet. Household age of greater than 55 years shows negative association with pearl millet consumption. This means that as the age goes up the consumption of pearl millet goes down. Compared to other cereals like rice and maize, pearl millet has low digestibility which seems to be cumbersome to the older people. This is also proved in a study by Payer *et al.* (2000) that, the higher the age the lower the food requirements and on the other hand, younger and middle aged people eat more quantity of food whereas older people need light food that digest easily.

(b) Occupation of the household head

Occupation of the household head has positive influence on pearl millet consumption. Having household head with agriculture as the main occupation is positively associated with pearl millet consumption and low pearl millet consumption to the household having occupation different from agriculture. This compares with the study by Seyoum (1988) on the differences in the quantities of food consumed and beverage categories by selected labour force status groups such as farming households, self-employed households and employees, public servants and clerks, he found that, the group of employees (including public servants and clerks) have the lowest in-home consumption than farming households.

(c) Household food priority

Household food priority/preference is among the factors that influence pearl millet consumption. From the regression results, household food priority has negative influence to the quantity of pearl millet consumed. This means that, pearl millet is consumed much by families who value it as a family food other factors held constant. The study by Punt *et*

al. (2003), on the factors influencing the food consumption and expenditure pattern in Limpopo province shows that, among other factors, household food preference influence food consumption in a way that, the more the food is preferred by the household the more is consumed and vice versa.

(d) Education level of the household head

The results from regression model show that, education level influence pearl millet consumption negatively. Having household head with advanced and university education level is negatively associated with pearl millet consumption (Table 13). As hypothesized, advanced and university education level is more strongly associated with the quantity of pearl millet consumed. More education less quantity of pearl millet consumed. Educated people know how to balance food nutrient regardless of the price while low educated people mostly consider filling the stomach than nutrient the food contain. This was proved by the study of Oldiges (2012) on cereal consumption and per capita income in India and shows that, years of schooling are negatively correlated with cereal consumption. It seems plausible that more years of education help to increase people's awareness about food varieties, while it also opens doors for higher paid and less energy demanding jobs. This, in turn, enables individuals to diversify their diets. Also Trichopoulou *et al.* (2002) and Irala- Estevez *et al.* (2000) ascertain the connection between higher educational levels and lower consumption of cereals, but a higher consumption of low fat milk, fresh fruits, vegetable oils and animal lipids. While Gossard and York, 2003 found that, dietary choices of higher educated households are generally dependent on three factors: taste, time scarcity and health and/or environmental awareness.

(e) Pearl millet price

The price of pearl millet plays an important role on its purchase. Pearl millet price has negative influence to pearl millet consumption. An increase in pearl millet price causes a decrease in the quantity of pearl millet consumed by the household. According to Jones *et al.* (2008), when price is raised, the effect may be a decrease in the amount spent on a particular commodity hence lowers the quantity of that commodity. Ali and Tsou (1997) ascertain that, in most cases high priced food stuffs are consumed less times compared to low priced food stuffs.

4.9 Constraint for Pearl Millet Consumption by Respondents

4.9.1 Constraint for pearl millet consumption by consumers

Regular consumption of pearl millet as a staple food is rare in the majority of the communities. However, it is consumed regularly among the pearl millet growers and low income families. Different consumers stated on the constraints that limit them from consuming pearl millet (Table 14). Lack of knowledge on the alternative use of pearl millet was stated by 33% of the respondents.

Table 13: Constraints for pearl millet consumption as started by respondents

Reason	Number of respondents	Percentage
High purchasing price	49	58
low quality	66	78
Lack of improved milling technology	37	44
low knowledge	28	33
Lack of village markets	65	76

Majority of the respondents (99%) consume pearl millet in the form of *Uji* and *Ugali* and only one percent consume pearl millet in the form of bites (Fig. 7). Also many people lack the knowledge of the health benefits of pearl millet.

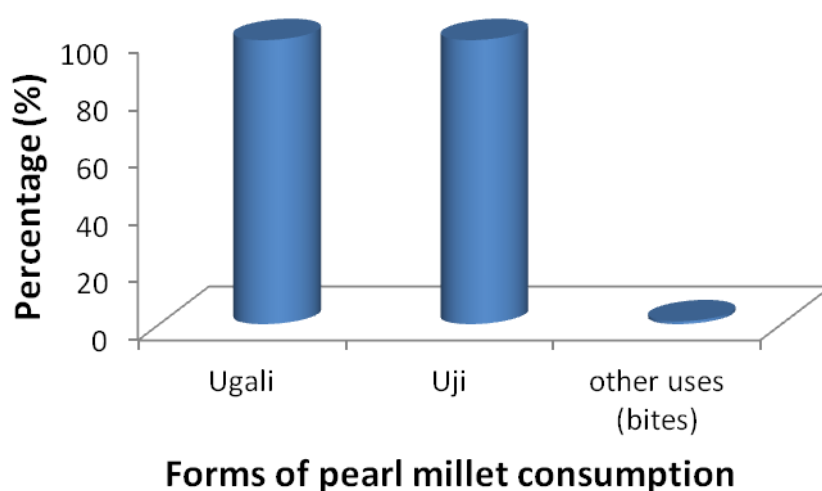


Figure 7: Common form of pearl millet consumption by the majority of respondents

Fig. 8 shows 78% of the consumers said that farmers opined that the low quality status is due to the presence of sand and other unwanted materials (89%), small seed size (26%) and presence of diseases and pest to the seed (21%) (Table 15).

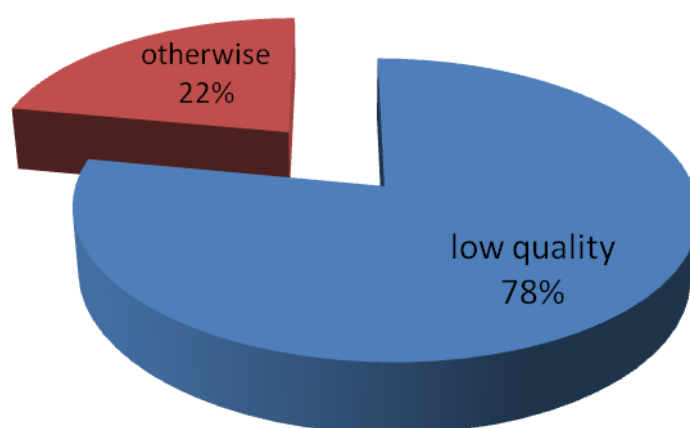
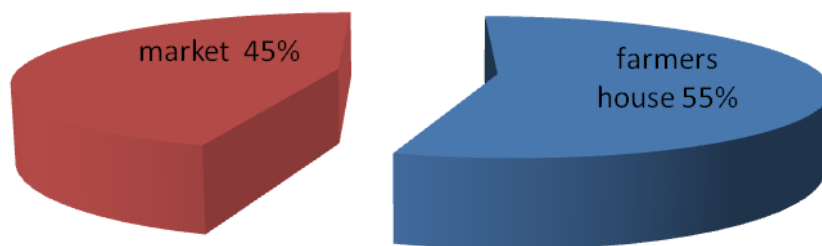


Figure 8: Quality for pearl millet

Table 14: Reasons for low quality of pearl millet

Reason	Number of consumers	Percentage
Presence of sand and other unwanted materials	59	89
Small seed size	17	26
presence of diseases and pest in the seed	14	21

Lack of improved milling technologies (44%) is another constraint for insignificant consumption of pearl millet to the majority of consumers. People are forced to use local method of milling. Grains are hand pounded or milled to get flour whereas pounded flour is mostly used for making thin porridge and milled flour used for making thick porridge. Other constraint facing several consumers with regard to the consumption of pearl millet is lack of local market in the majority of the villages (76%). Consumers are forced to find farmers at their home place for the purchase of pearl millet (55%) while only 45% purchase pearl millet at the market (Fig. 9).

**Figure 9: Common places for marketing pearl millet**

Another constraint for pearl millet consumption is high purchasing price. About 58% of consumers complain about high price of purchasing pearl millet (Fig. 10) compared to sorghum. The main reason for high price was stated to be low production level of pearl millet which is stated to be caused by low demand of the crop.

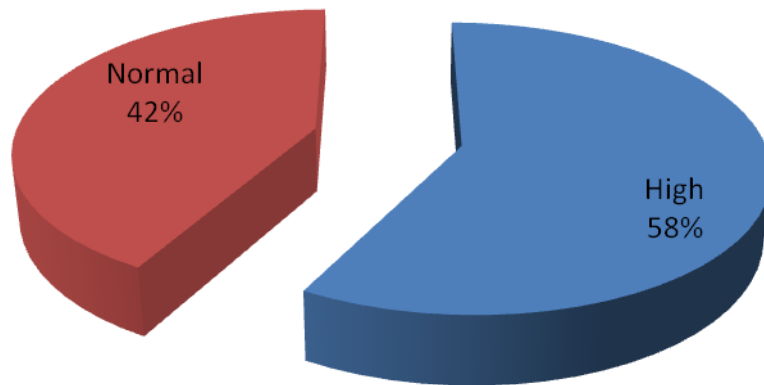


Figure 10: Purchasing price for pearl millet as stated by consumers

4.9.2 Constraint for pearl millet consumption by processors

Table 16 shows the constraints for utilizing pearl millet among processors. Low productivity is the main constraint stated by approximately all processors. The total production of pearl millet produced is 243 729 t/yr which was very small compared to maize and sorghum where production was 5 240 001 t/yr and 843 449 t/yr. respectively in the year 201/2012. This is compatible to the area of production as for maize was 4 127 757 ha. and for sorghum was 845 835 ha. while pearl millet was produced on a very small area compared to maize and sorghum which was 293 554 ha. This shows that maize was the most consumed followed by sorghum and then pearl millet. This problem is partly explained by the limited historical market demand for this crop as pearl millet is categorized to be subsistence crop by the majority.

Another constraint is inadequate of pearl millet markets in Tanzania. No reliable market for pearl millet in Tanzania, 76% of the respondents complained. Also all respondents were complaining about the low quality of pearl millet. Millers complain that pearl millet is more difficult to clean compared to maize, it needs extra cost to clean. During threshing, sand and small stones are commonly picked up and deposited in the grain bags.

This contributed by the poor threshing technology as well as size and color of the grain to be unlike, and therefore difficult to handle them. About 69% of the millers interviewed were skeptical about the level of demand for pearl millet meal. Millers reported that, most consumers have a taste preference for maize, rice, and wheat products than pearl millet. Pearl millet meal might survive simply as speciality products for special group of consumer.

Table 15: Constraints for pearl millet consumption among processors

Reason	Number of respondent	Percentage
Low production	85	100
Lack of reliable pear millet markets	65	76
Low quality	85	100
Low consumer demand	59	69

4.10 Strategies to Promote Pearl Millet Consumption

An attempt was made to assess strategies that could promote pearl millet consumption. Opinions were collected as the scheduled and results are depicted in Table 17. Majority of the consumers (64%) suggested that education to the people is needed about the crop. This is to include the importance of consuming the crop as food and feed to the health benefit of the user. Furthermore people opined that education on the alternative ways of consuming pearl millet is needed. Pearl millet can be processed into a wide range of acceptable commercial food products like cake, drinks, rice cook like, chapatti, popcorn, biscuits and fermented foods to increase consumption. Also education of consuming the crop as therapeutic purposes is important to the better health of the people. Asp NG. (1996) and Huang and Ferraro, (1982) stated that consumption of pearl millet helps to inhibit tumor development, control blood pressure and plasma low density lipo-protein cholesterol levels, and possesses anti-allergenic characteristics. Due to its high fiber

content pearl millet is also recommended for the treatment of severe constipation, stomach ulcers, and weight loss (Nambiar, 2012).

About 46% of the respondents said that increasing the level of pearl millet production is important in order to convince consumers to demand more. This is said could be achieved by the adaptation of pearl millet production technology which includes; the use of improved seed varieties, the use of fertilizers and all other technologies supplied by pearl millet stakeholders like ASARECA under Ukiruguru Research. It was observed that majority of the farmers do not use fertilizer about 60% (Fig. 11) and for those who use fertilizer (40%) they use inadequate amount. Increase in production will improve crop availability reasonable price.

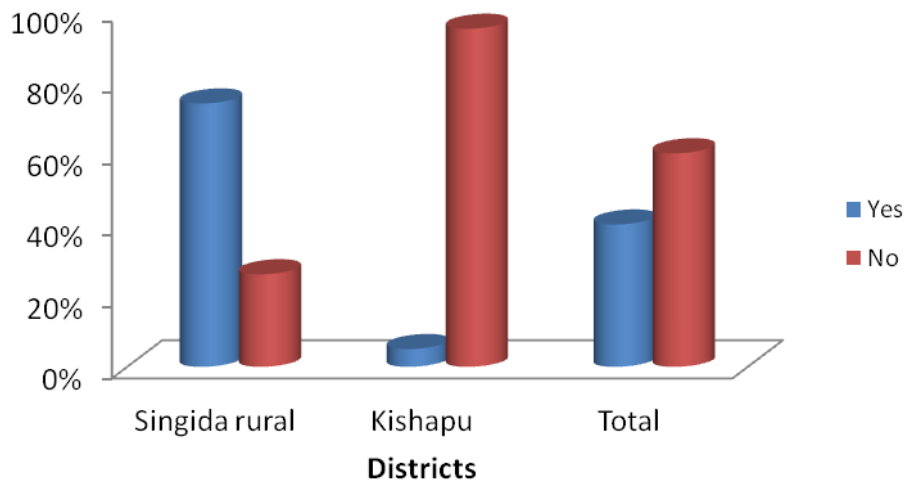


Figure 11: The use of fertilizer for farmers in the study area

About 28% of the respondents suggest that quality for pearl millet could be improved to encourage the increase of consumers purchase. This could be achieved by the use of thresher to reduce sand, small stones and other unwanted materials in the produce. Also

the use of improved seed variety would help the consumer to get quality seed for consumption.

Table 16: Strategies for improving pearl millet consumption among consumers

Reason	Number of respondent	Percentage
Education to the people	54	64
Increase production of the crop	39	46
Improve the quality of the crop	24	28

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The present study provides enough evidence that pearl millet consumption is influenced by education level of the household head, age of the household head, occupation, pearl millet price and household food priority. On the other hand, direct marketing channel was selected to be the best route for pearl millet in the study areas and the last marketing channel for pearl millet is from the farmers to retailer to consumer. Since the consumption of pearl millet is important for the better livelihood of the farmers in Singida Rural and Kishapu districts and the existing demand does not foster their livelihood then improvement of pearl millet quality and education strategy for the importance of pearl millet as food and feed is needed to increase demand.

5.1.1 Factors influencing pearl millet consumption

Education level of the household head, pearl millet price, age of the household head occupation and family food priority/food preferences are the major factors that influence pearl millet consumption in the study area. Increased demand for pearl millet will encourage farmers to increase production and benefit from the huge potential of the crop.

5.1.2 Marketing channel along pearl millet value chain

The study found different marketing channel along pearl millet value chain in the study area. The most preferred channel by the majority of the farmers was the direct channel *i.e.* from the farmers to consumers because of the nature of the demand *i.e.* consumer was the available customer. Increasing pearl production, quality and improving infrastructure will

increase competence and open more marketing channels to facilitate consumption to the people away from the production villages.

5.1.3 The strategies that promotes pearl millet consumption in the study area

Education to the people on the importance of pearl millet as food and feed is the main strategy observed.

5.2 Recommendations

In view of the foregoing presentation and discussions the study recommends the following:

5.2.1 Recommendations to pearl millet actors

- i. The study recommends expansion of the use of pearl millet by improving processing technologies and utilization methods including fermentation, backing, malting, steaming, milling, and product development.
- ii. Promotion and value added pearl millet products through demonstrations, training, exhibition, cooking competitions and message through radio and magazines are recommended.
- iii. Recommend/educate people to include pearl millets in their daily diet like wheat, maize and rice.
- iv. Expand the use of pearl millets in livestock feed industry
- v. Knowledge and awareness campaigns to improve market structure with respect to the availability and good quality pearl millets are recommended.
- vi. Thresher should be used to improve the quality of the produce. This should be done to avoid presence of sands and stone in the produce.

5.2.2 Recommendations for policy makers/government

- i. Policies to improve pearl millet consumption should be developed by the government to recognize pearl millet as a viable alternative crop.

5.2.3 Recommendations for further research

With reference to the importance of pearl millet as food and feed, future researches should concentrate on the aspects that are not fully addressed by this study including nutritional value and food security in the study areas.

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APPENDICES

Appendix 1: Description of variables used in the model

Variable	Binary variable	Variable discription
Dependent variable		Quantity of pearl millet/month in kg
Variables		
PMPRICE		mean pearl millet price in 2012 in Tshs
AGE (dummy)		age of household head (years)
	1	age (18 to 35)
	0	otherwise
	1	age (36 to 55)
	0	otherwise
	1	age (> 55)
	0	otherwise
INCM		mean family income in 2012 (Tshs.)
SEX (dummy)		sex of household head
	1	female
	0	male
EDUC (dummy)		educational level of respondent
	1	Primary education level
	0	otherwise
	1	Secondary education level
	0	otherwise
	1	Advanced education level

	0	otherwise
	1	University education level
	0	otherwise
	1	No. formal education
	0	otherwise
OCCP		occupation (main source of family income)
SPRICE		mean price of substitute in 2012 (Tshs)
HHLOCATION (dummy)		Place of respondent's residence
	1	rural
	0	otherwise
HHSIZE		Household size

Appendix 2: Questionnaire**General Instruction: Tick or circle the relevant code(s) and fill in the blank spaces**

Serial No.		
0.1	Researchers Name	
0.2	Region	
0.3	District	
0.4	Ward	
0.5	Village	
0.6	Division	
0.7	Cell phone No.	
0.8	Date	
0.9	Signature	

PART 1: pearl millet consumer (household interview)

A: Household characteristics			
1.1	How many people are currently living in your household?	1 = ≤ 2 2 = 3 - 4 3 = 5 - 6 4 = > 6	(.....)
1.2	What is the gender (sex) of the household head?	0 = Male 1 = Female	(.....)
1.3	What is the marital status of the household head?	1 = Married 2 = Divorced/separated 3 = Widow/widower 4 = Single	(.....)

1.4	What is the age of the household head (in years)?	a – <18 b – 18-30 c – 31 -55 d – > 55	(.....)		
1.5	Please complete the number of individuals from each age group and state whether they are engaged in earning income		Male	Female	Earn income
		a – 0 – 5 years			
		b - 6 –17 years			
		c - 18 – 55 years			
	d - 56 and above				
1.6	What are the main source of the family income	1 = agriculture 2 = business 3 = office work 4 = day work 5 = others (specify)	(.....)		
1.7	How much do the family earn per month?				
	Pearl millet consumption				
1.8	How much pearl millet does the family consume per month?				
1.9	Is the amount enough for your family?		0 = yes		
			1 = no		
1.10	If not, how much the family demands per month?				

1.11	How much sorghum does the family consume per month?		
1.12	Is pearl millet the family food priority?	0= otherwise 1 = no	(.....)
1.13	What are the family main foods? (lit at least three starting from the first priority food)	1 = 2 = 3 =	
1.14	How often do you consume pearl millet?	1 = every day 2 = after 2-3 days 3 = once per week 4 = others, (specify)	(....)
2: Market information			
		During harvesting period?	During the off season?
2.1	What is the purchasing price of pearl millet per tin of 18 kg.		
2.2	What is the purchasing price of sorghum per tin of 18 kg.		
2.3	Where do you purchase pearl millet?	1 = home 2 = along the farmer 3 = nearby the street 4 = in the market	(....)

		5 = not specific	
2.4	Do you think the purchased pearl millet has quality?	0 = otherwise 1 = no	
2.5	If not why do you think the purchased pearl millet has no quality?	1 = contain sand and stones 2 = small seed size 3 = affected by diseases and pest 4 = all of the above	(...)
2.6	What do you think can be done to improve the quality?	1 = farmers should use the improved seed varieties 2 = education to the farmers on postharvest handling 3 = both 1 and 2 above 4 = others (specify)	
2.7	Is the purchased quantity of pearl millet satisfying your need?	0 = otherwise 1 = no	
2.8	If not why the purchasing quantity is not enough?	1 = high purchasing price 2 = unavailability of the crop 3 = low quality 4 = others (specify)	
2.9	What do you think can be done?	1 = increase production 2 = improve the quality 3 = others (specify)	

B: Farmers interview

1: Household characteristics				
1.1	How many people are currently living in your household?	1 = ≤ 2 2 = 3 - 4 3 = 5 - 6 4 = > 6	(.....)	
1.2	What is the gender (sex) of the household head?	0 = Male 1 = Female	(.....)	
1.3	What is the marital status of the household head?	1 = Married 2 = Divorced/separated 3 = Widow/widower 4 = Single	(.....)	
1.4	What is the age of the household head (in years)?	a - < 18 b - 18-30 c - 31 -55 d - > 55	(.....)	
1.5	Please complete the number of individuals from each age group and state whether they are engaged in earning income	a - 0 - 5 years	Male	Female
		b - 6 -17 years		
		c - 18 - 55 years		
		d - 56 and above		
1.6	What are the main source of the family	1 = agriculture 2 = business		

	income	3 = office work 4 = day work 5 = others (specify)	(.....)
2: Farm characteristics			
2.1	What size of the land has been cultivated pearl millet over the last season?	1 = <1 acre 2 = 1 – 3 acre 3 = 4 – 5 acre 4 = >5 acre	(.....)
2.2	How much pearl millet has been harvested last season?	1 = < 1 bag of 100 kg 2 = 1 – 3 bag of 100 kg 3 = >4 – 10 bag of 100 kg 4 = > 10 bag of 100 kg	(.....)
2.3	How do you use your produce?	1 = for consumption 2 = selling and consumption 3 = for selling 4 = for seed	(.....)
2.4	How much of the harvested crop have been saved for home consumptions?		
2.5	How much of the harvested crop have been sold?		
2.6	How much do you reserve for seed?		
2.7	Do you think the produced pearl millet is enough for your family consumption?		
2.8	Have you experience any post-harvest loses?	0 = yes 1 = no	(.....)
2.9	If yes, how much per year/season?		

3: Market information			
3.1	If selling, where do you sell the produce?	1 =in the market 2 = near the farm 3. = along the road 4 = home	(.....)
3.2	Who are your main customers?		
3.3	Why selling to that customer and not others?		
3.4	Why do you choose to sell your produce?		
3.5	How much do you sell per 18 kg (1 tin) during the harvesting period?		
3.6	How much do you sell per 18 kg (1 tin) during the off season?		
3.7	Do you belong to any association?	0 = yes, 1 = no,	(.....)
3.8	Which association and what are their mandates?	1 = cooperative union 2 = CARE (VICOBA) 3 = SACCOS 4 = others, (specify)	(.....)
3.9	Do you get any market information before selling your produce?		
4: Productive assets			
4.1	Did you use fertilizer??	0 = yes, 1 = no	(.....)

4.2	What is/are your source(s) of labour to work on your land under cultivation?	1 = Household members 2 = Permanent employees 3 = Hired labour (temporary) 4 = Farming work group	(.....)
4.3	What is the main source of seeds?	1 = Purchase 2 = Personal stock 3 = Government 4 = NGOs 5 = Borrowing 6 = others, (specify)	(.....)
4.4	What is the means of transportation for your crop?	1 = head 2 = truck 3 = oxen/donkey 4 = others, (specify)	(.....)
4.5	What do you think the government can do to increase demand for pearl millet?	1 = to create awareness to people about the crop 2 = to subsidize the inputs 3 = to increase the number of extension officers 4 = Others, (specify)	(.....)
5: Identification of strategies that promotes demand for pearl millet.			
5.1	Do you think there is enough demand for pearl millet?	0 = yes 1 = no	(.....)
5.2	Why do you think the demand	1 = low production	

	is low outside the region?	2 = unawareness of the crop 3 = uncertainty about the crop 4 = all the above 5 = others, (specify)	(.....)
5.3	What do you think can be done to improve demand for pearl millet outside the region?	1 = education on the importance of the crop as food and feed 2 = government to intervene the crop 3 = to increase production 4 = all the above 5 = others, (specify)	(.....)

C: Interview with Pearl Millet Traders

1.1	What type of trade are you dealing with?	1= Wholesaler 2= Retailer 3 = both wholesale and retail	(.....)
1.2	Based on your business, is the demand for pearl millet increasing or decreasing?	1 = increase 2 = decrease 3 = not specific	
1.3	Where do you purchase pearl millet?	1 = direct from the farmers 2 = from village assemblers	(.....)

		3 = from your own stock 4 = from the wholesalers 5 = others, (specify)	
1.4	Who are your main customers?	1 = opaque beer processors 2 = industrial processors 3. = traders 4 = consumers 5 = not specific	(.....)
1.5	Do you think there is a way of increasing your market opportunity for pearl millet?	0 = yes 1 = no	(.....)
1.6	Is pearl millet available to the market throughout the year?	0 = yes 1 = no	(.....)
2: Demand analysis			
2.1	How much pearl millet have you demanded per month in 2012?		
2.2	What quantity have you purchased?		
2.3	What was the purchasing price?		
2.4	What was the selling price?		
3: Identification of strategies that promote demand for local pearl millet.			
3.1	Do you think there is high demand for pearl millet in the market?	0 = yes 1 = no	(.....)
3.2	Why do you think the demand is low?		
3.3	What do you think can be done to improve		

	demand for pearl millet?		
3.4	What are the challenges in your business based on demand?		
3.5	Do you think the purchased local pearl millet has quality?	0 = otherwise 1 = no	(.....)
3.6	If not, why?	1 = contain a lot of sand and dust 2 = nature of the local seed used 3 = poor handling after harvest 4 = all of the above 5 = others, (specify)	(.....)
3.7	Is there any way of improving its quality?	0 = yes 1 = no,	(.....)
3.8	What do you think can be done to improve the quality of pearl millet?		
3.9	Why do you think it is impossible to improve its quality?	1 = low production knowledge to the farmers 2 = lack of production tools 3 = low demand 4 = others, (specify)	(.....)
3.10	What do you think can be done to improve demand for pearl millet?		

Appendix 3: Checklist for industrial processors

1. What quantity of pearl millet do you demand per year?
2. What quantity of maize do you demand per year?
3. What are the main reasons for not purchasing pearl millet?
4. What quantity of sorghum do you demand per year?
5. If purchasing pearl millet, where do you buy from?
6. What limits you to purchase pearl millet?
7. What do you think can be done?