

**CONTRIBUTION OF DAIRY GOAT FARMING TO HOUSEHOLD INCOME  
AND DIETARY DIVERSITY IN THURDIBUORO LOCATION, NYAKACH SUB  
COUNTY, KISUMU COUNTY, KENYA**

**By**

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## DECLARATION

I certify that this thesis is my original work and has not been presented for a degree in any other university.

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## **DEDICATION**

This thesis is dedicated to the people of Nyakach in their daily attempt to improve their living standards by enhancing agricultural productivity

## ABSTRACT

Over the years, poverty and food insecurity have arisen as some of the major global issues facing people worldwide. 414 million people in Sub Saharan Africa, according to Gorta, an Irish Charity, live on less than 1.25 dollars a day. This extreme poverty is concentrated in rural areas. In Nyakach Sub County of Western Kenya, over 60% of people live in poverty. Agricultural productivity is constrained by poor climatic conditions leading to low income and food insecurity. In these difficult circumstances, people are trying to earn enough money to feed their families and afford essentials. While dairy goat keeping has proved ideal for these struggling populations as indicated by various studies done in the past across East Africa, no studies have been undertaken in Thurdibuoro, Western Kenya to determine if the economic enterprise has achieved similar successes in the area. Building on the success of other dairy goat projects in Eastern Africa, Gorta dedicated to ending hunger and poverty with a particular focus on helping families achieve balanced diets in rural Africa has established various dairy goat farming projects in Eastern Africa which have proved successful in poverty reduction and improving food security. However, no studies have been undertaken to determine if the Thurdibuoro Dairy Goat Farming Project, also established by Gorta, has improved income and food security in the study area. This study set out to assess the effect of the dairy goat farming project on the household income and dietary diversity of the people of Thurdibuoro community. The specific objectives were: to establish the contribution of dairy goat farming to household income, determine the contribution of the dairy goat farming project to household dietary diversity and identify challenges faced by farmers rearing dairy goats in Thurdibuoro. A cross sectional study design was applied and a sample of 115 beneficiaries of the dairy goat farming project drawn from a population of 124 project members using disproportionate stratified random sampling. Household interviews were undertaken using a set of pre-tested structured and semi-structured questionnaires administered to the 115 beneficiaries. Focus Group Discussions were also held with the farmers to provide an insight on what they thought about key issues relating to the study topic. Descriptive statistics were used to analyze data. The study established that 59.5% of the milk produced was allocated for sale accounting for 34% of the average monthly income of Kshs 8258 earned by the farmers which according to the Kenya Integrated Household Budget Survey 05/06 was above the poverty line of Kshs 1562 for rural areas, thereby rendering the project suitable for income reduction. Part of this income (32%) was allocated towards buying more variety of foods for more diversity in diet. This was further enhanced by the channeling of manure to kitchen gardens hence improving soil fertility and a resulting increase in yields of more food crops thereby more diversity in diet. Of the milk produced, 41% was allocated towards home consumption for nutrition improvement as well. As per the Kenya National Guidelines on Nutrition and HIV/AIDS 2006 report, 83% of the respondents were able to meet the daily recommended frequency of servings for various nutrients. The greatest challenge faced by 72% of the project beneficiaries as revealed by the study findings was shortage of pasture due to seasonal fluctuations out of poor/erratic climatic conditions. This could be addressed through identifying alternative feed sources through feasibility studies and availing the findings to dairy goat farmers as has been proved effective in the recent past by similar projects, for instance, in Malaysia. The research will contribute knowledge that may promote agricultural productivity not only in the study area but country wide as well.

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## LIST OF ACRONYMS

CBO-	Community Based Organization
DFID-	Department for International Development
DGA-	Dietary Guidelines for Americans
FAO-	Food and Agriculture Organization of the United Nation
FGD-	Focus Group Discussion
GDP-	Gross Domestic Product
GOK-	Government of Kenya
ICRW-	International Center for Research on Women
IFAD-	International Fund for Agricultural Development
ILRI-	International Livestock Research Institute
KIHBS-	Kenya Integrated Household Budget Survey
MDGs-	Millennium Development Goals
NGO-	Non Governmental Organization
PEM-	Protein Energy Malnutrition
SPSS	Statistical Package for Social Scientists
UNEP-	United Nations Environment Programme
UN-	United Nations
UNICEF-	United Nations International Children's Emergency Fund.
WHO-	World Health Organization

## WORKING TERMS AND DEFINITIONS

- Contribution-** Significant input/part played by a person or organization in bringing about a result.
- Household dietary diversity-** Number of different foods or food groups consumed by a household over a given reference period.
- Food poverty-** Inability to afford or have reasonable access to food which provides a healthy/ nutritionally adequate diet.
- Food security-** The state of having reliable access,at all times, to a sufficient quantity of affordable, nutritious food to meet one's dietary needs and food preferences for an active, healthy life.
- Household income-** A measure of the combined incomes of all people sharing a particular household or place of residence.
- Income poverty-** Living below the minimum acceptable way of life/ one's income failing to meet a federally established threshold that differs across countries.

## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.1 Background to the Study**

Farmers and pastoralists all over Africa are gradually turning to goats as a means of survival and a way of boosting their incomes. Food and Agriculture Organization of the United Nations (FAO, 1991) estimated the world population of dairy goats to be over 590 million, where countries in Europe and around the Mediterranean region have the most developed dairy goat industry and dairy goat focused research. Goats form an integral component of the livestock sector in Kenya, and the goat population is estimated at 10.9 million (Republic of Kenya, 2003) spread throughout all the agro-ecological zones. In particular, goats are suitable for small scale resource poor farmers: they are cheap to acquire compared to cattle, they require little land, they reproduce quickly, and they are able to feed on a wide range of forages. As a result, goat rearing is an important activity for resource poor farmers under the mixed crop-livestock production systems that are commonly practiced in Kenya. Dairy goat farming has proved to be a popular source of cash income, household daily milk requirements and manure for smallholder farmers in medium to high potential zones of Kenya. In less developed countries, goats are sometimes referred to as the poor people's animal and are primarily owned by smallholder farmers mostly nomads where they contribute the major income that significantly affects the economy and food supply of the poorest sectors of the society. Kenya was ranked 20<sup>th</sup> among the world leaders in goat milk production and the fifth largest producer in Africa (FAO, 1991).

Kenya is a low-income country, with per capita income averaging about US\$360. It ranks 148th among 177 countries in the United Nations Development Programme's human development index, which measures a country's development in terms of life expectancy, educational attainment and standard of living. More than half of the country's 41.6 million people

(World Bank, 2011) are poor, and 7.5 million of the poor live in extreme poverty. About 80 per cent of the populations, including three out of four poor people, live in rural zones and the rural households rely on agriculture for most of their income. The rural economy, in turn, depends mainly on small holder farming, which produces the majority of Kenya's agricultural output. About 70 per cent of the poor are in the central and western regions, living in areas that have medium to high potential for agriculture (International Fund for Agricultural Development, 2015). Kenya's population has tripled over the past 30 years, leading to increasing pressure on natural resources, a widening income gap and rising poverty levels that erode gains in education, health, food security, employment and incomes. The causes of rural poverty include: low agricultural productivity exacerbated by land degradation and insecure land tenure, unemployment and low wages, difficulty in accessing financing for self-employment, poor governance and poor roads, high costs of health and education and HIV/AIDS. Kenya's rural poor people include: small farmers, herders, farm laborers, unskilled and semi-skilled workers, household headed by women, people with disabilities and AIDS orphans (International Fund for Agricultural Development, 2010). The Economic Survey 2005 (Ministry of Planning and National Development, 2005) lists Nyanza as Kenya's poorest province with poverty levels ranging from 65 percent to 80 percent. The Kenya Demographic and Health Survey 2003 says

only 0.6 percent of Nyanza residents have access to piped water in their dwelling places despite the presence of massive water sources in the area. A paltry 5.1 percent of the people have access to electricity. Nyanza performs poorly on both child mortality and the proportion of people infected with HIV/Aids. It reports 206 deaths per 1000 live births before the children's fifth birthday. The province has the highest HIV/Aids prevalence rates in the country. The large number of orphans is compounded by reports that most of them have no grandparents.

Agriculture in Kenya remains a dominant sector in the economy. Agriculture contribution to rural employment, foreign exchange earnings and rural incomes are so important that any broad-based improvement in rural living standards will almost certainly require substantial productivity growth in agriculture. Agricultural productivity and growth in Kenya however, has stagnated for many years, largely because of institutional failures, poor climatic conditions and market constraints, along with limited transfer and adoption of improved technologies by smallholder farmers. This has resulted in decreased productivity and poor income generation in many rural families, fuelling a vicious cycle of poverty and food insecurity (FARM Africa, 2008).

Increased human population pressure, and the ensuing land demarcation in Kenya, have stimulated use of dairy goats in rural development efforts, which according to Josserand, were previously ignored in favor of cattle as cow's milk and beef constituted a larger share of consumption (Josserand, 1984). Furthermore, where there is a low agricultural potential pattern due to an erratic climate/rainfall, goats have been proved as a viable option for improving agricultural production hence increasing income and reducing food

poverty. Goats need less space than cows. Pure exotic or crossbred dairy goats and associated technologies are preferred as a fast means of improving animal production of smallholder farmers and quickly improve their economic status and diet quality. Smallholder farmers in Kenya are therefore increasingly turning to dairy goat rearing as a means to increase incomes while improving their diversity in diet. It is also a good source of manure needed for improved crop productivity which further contributes to diet diversity (Ogola, Nguyo, & Kosgey, 2010). It is as a result of this that Gorta, an Irish NGO dedicated to eradicating hunger while improving diets in families, established a dairy goat farming project in Thurdibuoro, Western Kenya, with the intention of teaching the community members to become self-independent in food production.

However, no research has been undertaken in Thurdibuoro, to determine whether the dairy goat farming project has improved income poverty and food poverty. Furthermore, previous studies have not taken into account the effect self-help groups may have on the development or failure of dairy goat farming. This can be considered an area for further research. Women are more active than their male counterparts in the participation in self-help groups commonly known as '*chamaas*'. These have been noted to be a contributing factor in encouraging the spread of many developmental issues among community members. Noting all the above, the study aimed at finding out if the same success achieved in other areas could also be achieved in Nyakach amid issues outlined above through the rearing of dairy goats with the aim of improving household income and household dietary diversity.

## **1.2 Problem Statement**

In Thurdibuoro, located in Nyakach Sub County, Kisumu County, Western Kenya, over 60% of its people live in poverty (Kenya National Bureau of Statistics, 2009). Farming is limited, because the average household owns just half a hectare of land which is not enough to sustain them in terms of availing reliable income. There is low agricultural potential in the area owing to an erratic weather pattern which limits agricultural productivity options for improving income and dietary diversity. Hence the constant reliance on inter district trade with neighboring high potential Nandi district for a significant share of food eaten, which mostly consists of cereals only, living a deficit in other essential nutrients necessary for a balanced diet and a healthy well-being. Household income is therefore a crucial component determining accessibility to a nutritious variety of food and livelihood improvement (Republic of Kenya, 2003). The erratic weather patterns in the area have further led to inadequate pasture which is a major challenge facing dairy farmers in arid areas (AfriAfya, 2014), hence milk production in the recent past has slowly declined. Earlier studies have shown that engaging in the dairy goat farming sector is profitable and can contribute to a rise in income and nutritional statuses of rural poor (Peacock et al 2011). Further studies have indicated that goats have proved that they can thrive in such climatic conditions amid challenges such as inadequate pasture while improving agricultural productivity (Ahuya et al, 2005). Goats are easier to feed compared to cattle since they are browsers and feed mostly on shrubs which are the most common form of vegetation in the area. It is with this background that Gorta, a nongovernmental organization (N.G.O) from Ireland, came in to support the people of Thurdibuoro community to become self-sufficient in food

production and income generation amid challenges outlined above through the Thurdibuoro dairy goat farming project. However, no research has been conducted to determine whether the project has improved household income and household dietary diversity in the study area. Hence, taking into account all the above, the study set out to find out the effect the Thurdibuoro dairy goat farming project has had on improving household income and dietary diversity in Thurdibuoro.

### **1.3 Objective of the Study**

#### **Main Objective**

The main objective of this study was to assess the contribution of dairy goat farming to household income and household dietary diversity of the people of Thurdibuoro community.

#### **Specific Objectives**

1. To establish the contribution of dairy goat farming to household income.
2. To determine the contribution of dairy goat farming towards household dietary diversity.
3. To identify challenges faced by farmers rearing dairy goats in Thurdibuoro.

### **1.4 Research Questions**

1. How has dairy goat farming affected household income in Thurdibuoro?
2. In what ways has dairy goat farming affected household dietary diversity in Thurdibuoro?
3. What are the challenges faced by farmers rearing dairy goats in Thurdibuoro?

### **1.5 Justification of the Study**

The dairy goat sector is one of the emerging and fast growing sectors. It has seen an improvement and increased attention resulting from its benefits on poverty reduction (Ahuya et al, 2004). This has been attributed to the income generation from the sale of the goats' milk, meat, hides and manure for crop propagation hence acting as a financial intermediary to the resource constraint farmers. Engaging in this sector is not only beneficial in poverty alleviation through income generation but also in eradicating hunger and diversifying the diet through consumption of the animal protein hence improved nutritional status of rural communities (Peacock, 2008). Though the sector has many benefits on alleviating poverty levels, information on goat industry in terms of its effect on household income and dietary diversity in Nyakach Sub County is not well documented hence necessitating this research. Also, the challenges, solutions and opportunities in this Industry within the sub county are not well documented since no similar research has been undertaken before in the area. The need of this research is of great importance as it will address the various aspects outlined above that have not been fully investigated yet they form a major part in the growth and development of the rural economy in Thurdibuoro.

Among the key goals of Gorta is that of helping community members become self-reliant in the production of adequate food of good quality for a balanced and/or diversified diet and sustainable livelihood. This has been realized in other projects conducted by the NGO within East Africa (Gorta, 2014). However, this is yet to be established by the dairy goat farming project in Thurdibuoro necessitating this research with the intention of

investigating key aspects above and therefore helping contribute valuable knowledge on dairy goat farming with the aim of helping farmers become independent in food production and consequently diversify their diets as opposed to the constant reliance on trade with neighboring locations for specific, monotonous types of food.

Past studies have indicated inadequate pasture and inaccessibility & poor service delivery by extension workers as some of the challenges facing Dairy Goat Farming in Kenya thereby scaring many farmers and investors from investing in the sector (The beehive, 2015). However, these are yet to be proved in Nyakach, hence the need for the research to determine these among other challenges that may currently be faced by dairy goat farmers in Thurdibuoro. This would provide valuable information on dairy goat farming necessary to enable extension workers come up with improved services and assist in proper decision making on the part of farmers and investors.

### **1.6 Scope and limitations of the Study**

The study was undertaken in Thurdibuoro location, Nyando sub county, Kisumu County in Western Kenya. It specifically covered three sub locations within Thurdibuoro namely: Upper Kadiang'a, West Koguta and Anding'o Opanga. The study was limited to dairy goat farming and involved the examining of its contribution to household income and household dietary diversity within the study area. It also involved the identification of various challenges faced by dairy goat farmers in the study area and the suggesting of viable solutions. Respondents interviewed included farmers/ beneficiaries of the Thurdibuoro dairy goat farming project and officials of the project. Key parameters to be

used were limited to the change in the amount of milk produced, change in income from proceeds from the sale of milk or the sale of dairy goats and change in the amount of manure available from the dairy goats. A negative or positive change would mean a negative or positive outcome respectively on the household income and household dietary diversity.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

Mary et al (2012) studied production, performance and contribution of dairy goats to income of small scale farmers in Bahati and Kongwa districts in Tanzania. The authors used semi structured questionnaire to collect data from 40 small scale dairy goat farmers and 40 non-dairy goat farmers from four villages. Gross margin analysis was used to assess the profitability of the Industry. They found that goats contribute 32% in Babati and 25% in Kongwa districts of the total household income. Average incomes for dairy goat farmers were higher than that of the non-dairy goat farmers. Conclusions made indicated that dairy goat enterprise was profitable and significantly contributed to household income.

Tabby (2010) studied adoption and profitability of small holder dairy goat production in Meru South and Central districts. The author used the econometric model to identify and explain the influence of various factors on adoption. The gross margin analysis estimated the profitability of the enterprise. Employment of the household survey for 260 randomly sampled small holder farmers revealed that 46% of sampled farmers adopted, 47% had not adopted and 7% had adopted and abandoned. The study concluded that adoption is characterized by households with high dependency ratio and that the enterprise is profitable hence can contribute to income.

The above two are among many studies that have focused on assessing the profitability of the dairy goat farming enterprise and its contribution to household income rendering the

sector profitable for increased income and livelihood improvement. Since the dairy goat production enterprise has been seen as a sector where revenues and incomes can be generated, resulting in profits and diversification (Kamau et al., 2008), many organizations have supported the sector especially in rural areas.

## **2.2 Contribution of Dairy Goat Farming to Household Income**

In Kenya, early efforts focusing on the rearing dairy goats were in missionary centers and government institutions. The most important institutions involved in distribution of dairy goats to small-scale farmers in rural areas were Heifer Project International (HPI), Farm Africa, and church based organizations. The impetus for these institutions to promote smallholder dairy goat production was to contribute effectively to poverty alleviation and improve food security among the rural poor people. Moreover, introduction of dairy goat breeds in rural areas was aimed at upgrading the local breeds and increase their growth rates, milk yield and hence, improve food security as well as household income (Peacock, 2008).

On-farm dairy goat keeping at community level did well as opposed to the on-station based approaches (Eik, Mtenga, & Olsen, 1985). This led to increased interest on the strategy of using dairy goats as a tool for poverty reduction and combating malnutrition by government and non- governmental organizations (Ogola, Nguyo, & Kosgey, 2010).

In Nyakach, Gorta an Irish Charity with a vision of a world without hunger or poverty came in with the intention of focusing on working with the local community members from Thurdibuoro with the main aim of moving them from subsistence to entrepreneurship through Dairy Goat Farming. Its targets focused on food security,

nutrition, water & sanitation and enterprise development. Kenya has been a programme country of Gorta since the mid 1970's with its initial involvement carried out with the cooperation of missionaries and in particular Irish religious orders based throughout Kenya. Since then, there has been a shift to partnering with small scale community based organizations and self-help groups and engaging with more strategic local partners. Gorta supports skills training for income generating activity especially among women, as an approach to greatly reduce people's vulnerability to food shortages, poor health and poverty. In Thurdibuoro, this was done through: supporting skills training for Dairy Goat Farming as an income generating activity among the self-help groups and advising on and provision of access to the necessary credit or business loans, working with the Dairy Goat small holder farmers through the creation of farmers groups and associations which promoted farming as a business (Gorta, 2014).

In recent years, dairy goats have gained popularity as a source of milk and income, particularly to the poor people and their milk is normally consumed at household level (Shirima, 2005). Dairy goats are named as "poor man's cow" for the poor farmers because of low initial and maintenance costs which can be afforded by small-scale farmers, and they can be looked after by any member of the family, even children (Tadele, 2007).

Dairy goat enterprise is an important avenue for poverty reduction of small-scale farmers due to its contribution to income generation through sale of milk, milk products, live animals and manure. Income from such production often accrues to women, who use the money to provide better nutrition and education to their children (Chenyambuga., *et al*

2014). Furthermore, dairy goats are an alternative source of milk to most rural people who cannot afford keeping dairy cattle. According to Haenlein the consumption of goat's milk reduces malnutrition among poor people in developing countries and goat milk is tolerated by people with gastro-intestinal disorders (Haenlein, 2004). Also most of the small-scale farmers have limited access to land and capital, and so the rearing of dairy goats using common property resources at least gives them an opportunity to improve their income position (Riethmuller, 2003).

The economic contribution of small-scale dairy goat production to farmers' livelihood improvement has not been studied in Thurdibuoro, Kenya. Moreover, information on the benefits of dairy goat enterprises towards a diverse diet is lacking. Using data from a field survey in Thurdibuoro, Nyakach the current study examined the contribution of the Thurdibuoro dairy goat farming project on the household income and the household dietary diversity on the Thurdibuoro community. The main objective of the study was to assess the contribution of dairy goat farming to household income and household dietary diversity of the people of Thurdibuoro community.

### **2.2.1 Dairy Goat Farming and Income**

Dairy goat production is an alternative livestock enterprise suitable for many small scale or part time livestock operations. Some dairy goat producers have been successful in pasteurizing goat milk and building an on farm jugging business; others have ventured into processed milk products for retail distribution. Goat's milk has specialized markets because of its composition. It has higher digestible protein and fat content than cow's milk. Interest in Dairy Goat Production has been growing recently for a variety of

reasons: Dairy goats are less costly to buy and feed and dairy goat farming for profit is not very hard to do. Goat farming, in itself, is already a very profitable business. Goats are simple to manage and if given proper attention, they can live healthily. They also don't need too much feed because they eat a variety of foliage, including thorn bushes and high branches that sheep can't reach. Goats also reproduce anytime of the year with a short gestation period of only 150 days. Most efforts to improve dairy goat farming are focused on producing more and better milk. To do this, breed and animal health are given special attention. Particular breeds are more valuable as milk producers (Hedrich, 2008). To add to this, goats are sources of a variety of commercial products. Among the most important are milk and meat. Other products that can be sold to earn income include hides, skins, manure to fertilize soils for growing crops and also to produce biogas, hide, mohair, leather, and cashmere. Dairy goat farming for profit concentrates on milk production as its top source of income. However, the other products may also be sold as available to avoid too much waste as during deaths or when the goats are no longer viable for milk production. The minimal investment and the high returns are behind very successful dairy goat farming for profit. Milk, being a basic commodity, ensures the success of any dairy farm. In fact, more people around the world consume goat milk than cow milk. Dairy goats provide farmers with milk to drink and sell, and manure to fertilize soil and the goats themselves can also be sold. With the extra income, farmers can pay household bills, send children to school or reinvest in the farm and other economic activities (AfriAfya, 2014).

Crossbred milking goats have proved to be a popular source of cash income, household daily milk requirements and manure for smallholder farmers in medium to high potential

zones of Kenya. The three-quarter Toggenburg crossbred appears to be the most suitable in terms of both milk production and growth rates. Goats form an integral component of the livestock sector in Kenya, and the goat population is estimated at 10.9 million spread throughout all the agro-ecological zones. In particular, goats are suitable for small scale resource poor farmers: they are cheap to acquire compared to cattle, they require little land, they reproduce quickly, and they are able to feed on a wide range of forages. As a result, goat rearing is an important activity for resource poor farmers under the mixed crop-livestock production systems that are commonly practiced in Kenya. Dairy goats have considerable potential in the highlands of Kenya, where a majority of the population live. There has been significant interest in the use of crossbred goats, but although dairy goats have been introduced in various parts of the country, most projects have not taken sustainability into account, and the benefits have ended soon after the funding ceases. In previous attempts to genetically improve the local goat populations, breeding programmes have generally been centralized and research-centered, with minimal farmer participation. In addition, the contributions and/or preferences of the farmers intended to benefit from such efforts are usually ignored, leading to delays in the adoption of the technologies, low adoption rates or total failures (FARM Africa, 2005).

From surveys that have been conducted through various studies in the recent past, farmers have reported reasons for keeping dairy goats as follows: To have enough milk for the family, to have goats to sell in emergencies, goats take very little fodder therefore easy to manage, goats have very good and high quality milk, goats have many good benefits milk, meat, manure, goats can finish their poverty, feeding goats is easier than feeding cattle. There are a number of factors that act against livestock keeping by small-

scale resource poor farmers. These include: lack of grazing and feed resources due to limited land; lack of water; inappropriate land tenure systems (subdivision of land owned by most resource poor farmers); poor management systems and practices; high prevalence of animal diseases; low animal genetic potential; inaccessibility or costs of farm inputs; lack of access to technical information (extension services); lack of market information; and poor infrastructure (Kaberia, P, & Ahuya, 2003).

## **Goat Breeds in Kenya**

### **Saanen Dairy Goats**

The Saanen dairy goat originated from Switzerland, in the Saane Valley. Their milk generally produces 3 to 4 percent fat and a healthy doe weighs between 55kg and 65kg. The Saanen is white in colour. The hair on their coats is short and fine, although a fringe over the spine and thighs is often present. Ears should always be erect, preferably pointing forward. The face should be straight or dished (National Farmers Information Service, 2014).

### **Toggenburg Dairy Goats**

Toggenburgs are allegedly the oldest known Dairy Goat breed. They are from the Toggenburg valley of Switzerland located in Obertoggenburg. This breed is more slender than the Saanen and visibly lighter, the females weighing in at about 55kg. Their hair is short, soft and fine. Its body colour is brown and they have distinct marking which is very important for a Toggenburg to be recognized by the Kenyan stud breeders. Compared to the Saanen they are considered medium milk producers. Toggenburgs are the most common breed in Kenya. This breed is noted for its excellent udder

development and high milk production, and has an average fat test of 3.7 percent (National Farmers Information Service, 2014).

### **British Alpine Dairy Goat**

The British Alpine was developed in Great Britain in the early 1900s. This is a beautiful animal, which is black in colour and has distinct white markings. The females resemble the Saanen does in size and posture and generally weigh about 60kg. They are tall, rangy and graceful, which can best be seen in a proud male animal. They are the second most popular breed in Kenya and the quality of the breed is as good as anywhere else in the world (National Farmers Information Service, 2014).

### **Benefits of Dairy Goat Farming**

There are a lot of reasons why farmers practice goat keeping apart from this venture being cheaper and a lot easier than managing cows or other livestock; anthropological evidences suggest that goats were used as a milk and meat source. Goat hair and bones on the other hand were utilized to make clothing and tools, while its hide was made into water bottles parchment and even wine bottles. Considering all these benefits, goats were even used by traders as money for purchase during the barter system. All the said goat benefits still hold true today and just like the old times a lot of people practice goat keeping to raise goat meat and milk. However, if the two industries will be compared, raising goats' milk is still behind goat meat farming in terms of popularity but it is currently a steadily growing venture because of the following benefits that could be derived from consuming goat's milk (Sullivan, 2013).

Delicious with a slightly sweet and sometimes salty undertone, goat's milk is the milk of choice in most of the world. Unlike cow's milk there is no need to homogenize goat's milk. While the fat globules in cow's milk tend to separate to the surface, the globules in goat's milk are much smaller and will remain suspended in solution. When individuals have sensitivity to cow's milk, goat's milk can sometimes be used as an alternative (Coach Farm, 2015). Goat's milk is a very good source of calcium and the amino acid tryptophan. It is also a good source of protein, phosphorus, riboflavin (vitamin B2) and potassium. Other research has found some anti-inflammatory compounds (short-chain sugar molecules called oligosaccharides) to be present in goat's milk. These oligosaccharides may make goat's milk easier to digest, especially in the case of compromised intestinal function. In animal studies, goat's milk has also been shown to enhance the metabolism of both iron and copper, especially when there are problems with absorption of minerals in the digestive tract. Allergy to cow's milk has been found in many people with conditions such as recurrent ear infections, asthma, eczema, and even rheumatoid arthritis. Replacing cow's milk with goat's milk may help to reduce some of the symptoms of these conditions (Murray, 2014).

Goat's milk can sometimes even be used as a replacement for cow's milk-based infant formulas for infants who have difficulties with dairy products. Unfortunately, goat's milk is lacking in several nutrients that are necessary for growing infants, so parents interested in trying goat's milk instead of cow's milk-based formula for their infants should ask their pediatricians or other qualified healthcare practitioners for recipes and ways to add these important and vital nutrients. Goat's milk is a very good source of calcium. Calcium is widely recognized for its role in maintaining the strength and density of bones. In recent

studies, this important mineral has been shown to: Help protect colon cells from cancer-causing chemicals, help prevent the bone loss that can occur as a result of menopause or certain conditions such as rheumatoid arthritis, help prevent migraine headaches in those who suffer from them. Calcium also plays a role in many other vital physiological activities, including blood clotting, nerve conduction, muscle contraction, regulation of enzyme activity, cell membrane function and blood pressure regulation (Blythe, 2014). Including goat's milk and other dairy products in your healthy way of eating may reduce your risk of metabolic syndrome by up to 62%, and may improve insulin action and reduce blood glucose levels. Goat's milk is a very good source of riboflavin, a B vitamin important for energy production. Riboflavin has been shown to be able to reduce the frequency of migraine headaches in people who suffer from them (Cheng & Kroger, 2005). Goat's milk is a good source of low-cost high-quality protein, providing 8.7 grams of protein (17.4% of the daily value for protein) in one cup. Goat's milk is a good source of potassium, an essential mineral for maintaining normal blood pressure and heart function and may help to prevent high blood pressure and protect against atherosclerosis (Elwood & Pickering, 2007).

### **2.3 The Contribution of Dairy Goat Farming Towards Household Dietary Diversity**

Food poverty has been defined in a number of ways but can be typically thought to relate to those individuals and households that are unable to obtain a nutritionally adequate diet. The FAO definition of food security states that “ food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. The initial focus, reflecting the global concerns of 1974 was on the volume and stability of

food supplies. Food security was defined in the 1974 World Food Summit as availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices. In 1983, FAO expanded its concept to include securing access by vulnerable people to available supplies, that is, ensuring that all people at all times have both physical and economic access to the basic food that they need. In 1986, the highly influential World Bank report "Poverty and Hunger" elaborated the concept in terms of access of all people at all times to enough food for an active, healthy life. Hence food security exists when all people at all times have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. A widely used conceptual framework published by UNICEF in 1990 identifies three main underlying determinants of nutritional status: availability and access to adequate food, the quality of feeding and care-giving practices and the health of the surrounding environment and access to health care (United Nations Children's Fund, 1990). Thus good nutritional outcomes can only be attained if an individual has access to a nutritionally adequate diet relative to his/her physiological requirements. According to the World Health Organization dietary guidelines, a healthy and well balanced diet consists of adequate food intake consisting of various nutrients, specifically, proteins, carbohydrates, vitamins and minerals on a daily basis.

A diet which is sufficiently diverse reflects nutrient adequacy. This statement is based on the fact that there is no single food which contains all required nutrients for optimal health. Hence, the more food groups included in a daily diet the greater the likelihood of meeting nutrient requirements. Monotonous diets, based mainly on starches e.g. maize,

bread, have been closely associated with food insecurity. According to Hoddinott, dietary diversity is an outcome measure of food security at the individual or household level, while food security is defined as access by all people at all times to enough food for an active, healthy life (Hoddinot, John, & Yisehac, 2002).

Dietary diversity (DD) is universally recognized as a key component of healthy diets. Dietary diversity has long been recognized by nutritionists as a key element of high quality diets. Increasing the variety of foods across and within food groups is recommended in most dietary guidelines, in the U.S (US Department of Agriculture Human Nutrition Information Service, 1992) as well as internationally (World Health Organisation, 1996) because it is thought to ensure adequate intake of essential nutrients and to promote good health. Additionally, with the current recognition that dietary factors are associated with increased risks of chronic diseases, dietary recommendations promote increased dietary diversity along with reducing intake of selected nutrients such as fat, refined sugars and salt.

Lack of dietary diversity is a particularly severe problem among poor populations from the developing world because their diets are predominantly based on starchy staples and often include little or no animal products and few fresh fruits and vegetables. These plant-based diets tend to be low in a number of micronutrients, and the micronutrients they contain are often in a form that is not easily absorbed. Although other aspects of dietary quality such as high intakes of fat, salt and refined sugar have not typically been a concern for developing countries, recent shifts in global dietary and activity patterns

resulting from increases in income and urbanization are making these problems increasingly relevant for countries in transition as well (Ruel, 2006).

Since 1990, life expectancy at birth has increased in all regions, largely due to reductions in infant and child mortality. However, the gain in life expectancy has not been even in all regions, with Africa having the shortest life expectancy. Wide variations are also seen within countries, with rates of child mortality and stunting generally higher among those in the lowest wealth quintile and those whose mothers have the least education (World Health Organisation, 2013). In Latin America, the Caribbean and parts of Asia, the disparity in rates of underweight children between rural and urban areas increased between 1990 and 2008 (United Nations, 2010). Throughout the developing world, socioeconomic inequality in childhood malnutrition is independent of the average rates of malnutrition (Ellen, 2008). At the same time, the largest increase in overweight among preschool-age children has been seen in the lower middle-income group (World Health Organization, 2013).

Malnutrition is costing millions of lives, in particular women and children. It also prevents millions of people from contributing to the Continent's growth and development. In Africa, one in four people suffer from malnutrition, twenty-five percent of children are undernourished and forty percent are stunted. Fifty-three percent of pregnant women in Africa are anemic. It is directly linked to achieving the MDGs, including poverty reduction, child mortality, maternal health, AIDS and many other infectious diseases. It is estimated that countries lose up to 3% of GDP due to malnutrition (New Partnership for Africa's Development, 2011).

Dietary inadequacies of micronutrients are common in developing countries, like Kenya, where most of the dietary energy supply comes from cereals (with maize being the staple cereal in Thurdibuoro). Consumption of red meat, poultry, and fish is often rare, because of economic, cultural and religious reasons (Moorman & Meijer, 2013). It is important to include various food groups/ nutrients in sufficient amounts in the diet. However, this is lacking in many households in many parts of the country including Thurdibuoro due to poverty hence inability to afford a variety of foods.

At times, availability of these foods often depends on the season and their consumption therefore is often small in food insecure environments, like in Thurdibuoro, Kenya. The rural population groups, as the case of Thurdibuoro, are the most affected by poverty, inability of large food production and under nutrition. These populations are dealing with the most deficiencies of various nutrients (Food and Agriculture Organization of the United Nations, 2005).

Although Kenya has made substantial achievements in providing for the well-being of its citizens, malnutrition especially in young children remains a matter for concern. National nutrition surveys carried out indicate that the situation is particularly severe and are worsening in Coast, Nyanza and Western parts of the country. Malnutrition has been recognized as a national problem (Republic of Kenya, 2003), whose root causes and treatment must be addressed through planning and inter-ministerial co-ordination. It is a District problem in that District Development Plans often mention it. The Ministry of Health defines it as a 'family problem' in that the nutrition unit is placed within the Division of Family Health. Yet in practice, childhood malnutrition is a women's problem,

and is treated as such by health authorities, who address their nutrition intervention efforts to mothers.

The ‘*gorogoro* economy’ is the term Cohen and Odhiambo use to describe the Western Kenya rural economy in which staples are sold by a standard measure (a *gorogoro*) whose size has steadily decreased while its price has remained the same. Characteristic for this economy is that inadequate subsistence agriculture is supplemented by insufficient, irregular remittances from migrant men. When a home’s own crops have been eaten, food is bought by the *gorogoro* to tide the family through to the next harvest. Most families are not even able to produce enough staples to last from one harvest to the next. In some parts of Kisumu and Siaya Districts, the second rains are very unreliable, so only a single harvest each year can be counted on. In the dry season, there are not many vegetables. Most families do not have their own supply of milk; those who are fortunate enough to have milking cows usually sell at least some of the milk. Given the difficulties of producing an adequate diet, it is clear that some food must be purchased. The remittances sent home by husbands working on the sugar and tea estates, or in towns, have to buy food as well as paying for school fees, taxes, medicine, transport and clothing (Cohen & Odhiambo, 1989).

A number of studies have shown that more than half of the Western Kenyan population keeps small numbers of livestock such as poultry, rabbits and dairy cattle. However, they are still unable to obtain sufficient food of diverse diet for their own consumption from their production and rely on purchases to a large extent (FARM Africa, 2008). Dairy goat farming may improve nutrition and/or dietary diversity either directly when farming

households increase the production and consumption of nutritionally diverse diets e.g. milk and meat, or indirectly when household and national income increases through the sale of milk and meat and further used in the purchase of more varieties of food for diet diversification purposes (Irish Aid, 2014). The same is yet to be established in Thurdibuoro, however, hence the study set out to determine if dairy goat farming in Thurdibuoro could also contribute to an improvement in household dietary diversity either directly or indirectly.

#### **2.4 Challenges Facing Dairy Goat Farming in Kenya**

Keeping goats for milk is a concept still to catch up due to the numerous challenges involved: some communities have cultural traditions against drinking goat milk, traditional goat farming uses free range grazing method while dairy farming utilizes well managed and monitored feeding in an enclosure which is very demanding and labor intensive, zero grazing is an intensive method of farming that requires a good cash turn over therefore a vibrant market for the produce is required, those with little land parcels must look for feed to supplement zero grazing or buy hay making it complicated and breeding is by natural methods and sexually transmitted diseases like brucellosis can ravage herds (The beehive, 2015).

Poor management of dairy goats is another of the main challenges facing the dairy goat sub sector in Kenya. Although farmers spend a lot of money buying dairy goats, it is a pity when one visits their homesteads and sees the condition of the goats, including their sheds. Selective breeding is important, but farmers should know that breeding alone cannot give a good quality dairy goat. Breeding accounts for 33% of a goat's

productiveness whereas nutrition and management accounts for 66% while entrepreneurship accounts for only 10%. Hence proper feeding and general care of a dairy goat are the most important areas in dairy goat production (Ahuya et al 2005).

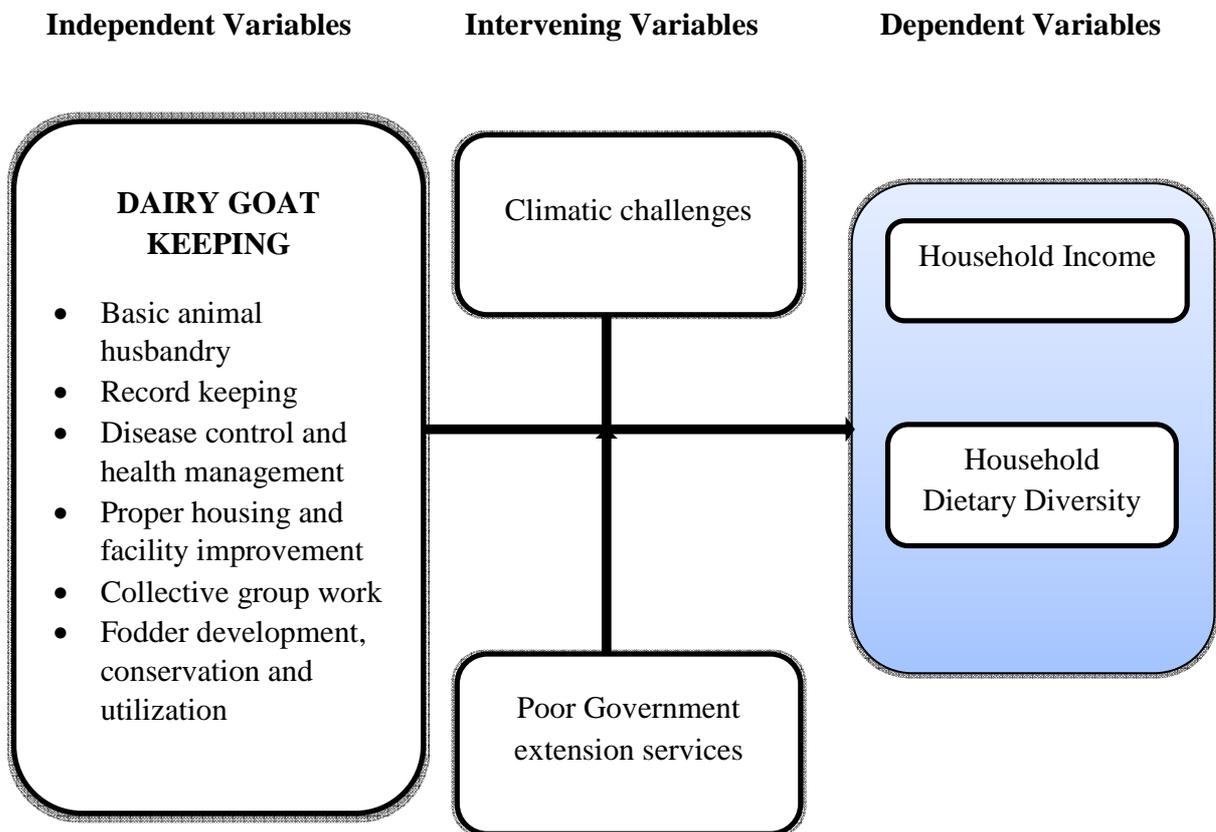
Maintaining hygiene and keeping goats in proper housing is still a big problem with most dairy goat farmers. Unlike other domestic animals, a dairy goat prefers to live in a dry and clean place. This can be done through building a house with a raised floor, made of timber pieces with spaces between to allow the urine and droppings to pass through leaving the floor clean and dry. The water and feeding trough should be placed outside the house and the goats be protected from windy conditions especially during the cold season when they easily contract pneumonia. However, not all farmers keeping goats observe the above; hence the exposure to poor hygiene leads to various diseases (Jamaluddin *et al.*, 2012).

Most farmers keep their goats indoors throughout the day. Most of the time, the goats can hardly move due to the small size of the house. All animals should be allowed to go out into open space where they can graze, exercise and get adequate light. Organic farming standards stipulate that all animals should be allowed free movement to reduce stress and allow them to express normal behavior. Farmers lack the most basic skills in dairy goat breeding, feeding and general management. The problem has been worsened by lack of an umbrella body that could regulate production, train farmers and set standards for improving the quality of dairy goats. Many farmers and brokers have taken advantage of this to sell low quality dairy goats claiming they are pure breeds. The privatization of

veterinary services and the government’s preoccupation with dairy cattle has further worsened the problem (Kamau, 2011).

## 2.5 Conceptual Framework

Miles and Huberman (1994) defined a conceptual framework as a visual or written product, one that “explains, either graphically or in narrative form, the main things to be studied—the key factors, concepts, or variables—and the presumed relationships among them”.



**Figure 1: Conceptual Framework**

*Source: Adopted and modified from FARM Africa (1998).*

The above framework gives a summary of the context of the study in terms of the independent variable (Internal factors affecting Dairy Goat Farming), the intervening variables (External factors affecting Dairy Goat Farming) and the dependent variables (household income and household dietary diversity).

The final outcome of the Dairy Goat Farming activity on the Household income and Household dietary diversity depends on various factors affecting the activity and how they are managed (independent factors). Good management results to a positive outcome, whereas poor management results to a negative outcome on the dairy goat farming project.

However, there are intervening variables (external factors) beyond the control of the farmers such as climatic challenges and government extension services which also affect the dairy goat farming enterprise. The intensity of their effect will however depend on the amount of effort put on the independent variables by the farmers.

## **CHAPTER THREE**

### **STUDY AREA AND METHODOLOGY**

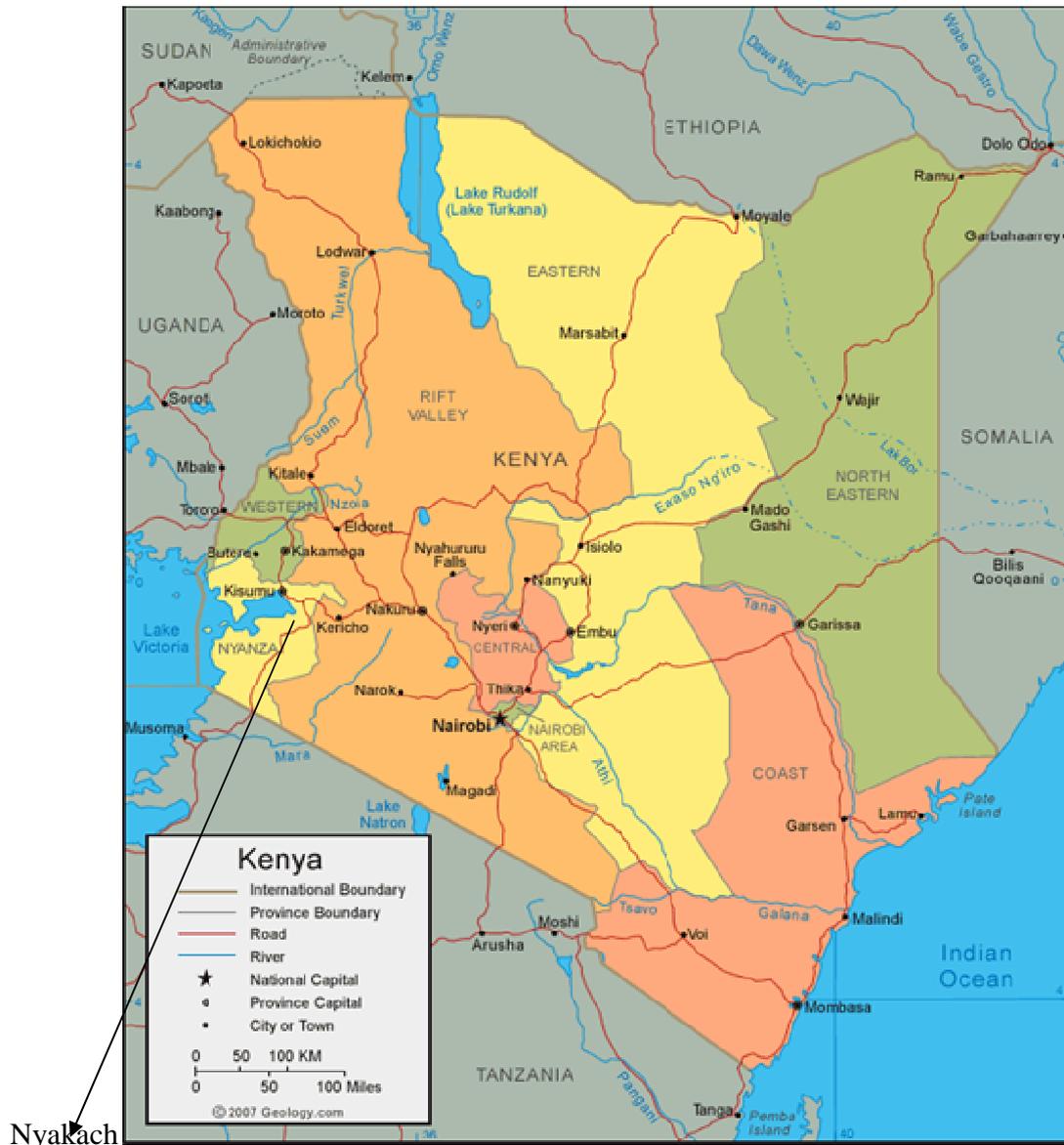
#### **3.1. Overview**

This discusses the methodology that was followed in the fulfillment of the research objectives. It outlines the research design, area of study, study population, sample and sampling techniques. It also includes data collection instruments, data collection procedure and data analysis techniques.

#### **3.2 Study Area**

The study was carried out in Thurdibuoro location, Nyakach sub County, Kisumu County in Western Kenya. It lies within longitudes 34.91667E and 34.55E and latitudes - 0.333333S and 0.20S. Nyakach Sub County occupies an area of 357.30 square kilometers with a population of 133, 041 people (Kenya Open Data, 2009). It is generally and seriously underdeveloped (a larger part of the district being dry and receiving low rainfall). The temperature ranges between 20°C and 35°C. Thurdibuoro location is one of the six locations of Upper Nyakach and has three sub locations namely: Upper Kadiang'a, West Koguta and Anding'o Opanga. It occupies an area of 54.3 sq. km (Kenya Open Data, 2011). The project was undertaken in the three sub locations.

The vast majority of the people belong to the Luo ethnic community, the third largest tribe in Kenya and one of the largest in East Africa. There are also small numbers of minorities from the other ethnic communities of Kenya owing to the establishment of the Sondu Miriu Hydro Electric Power Plant at Kolweny, a small village within the sub county (Kenya National Bureau of Statistics, 2013).

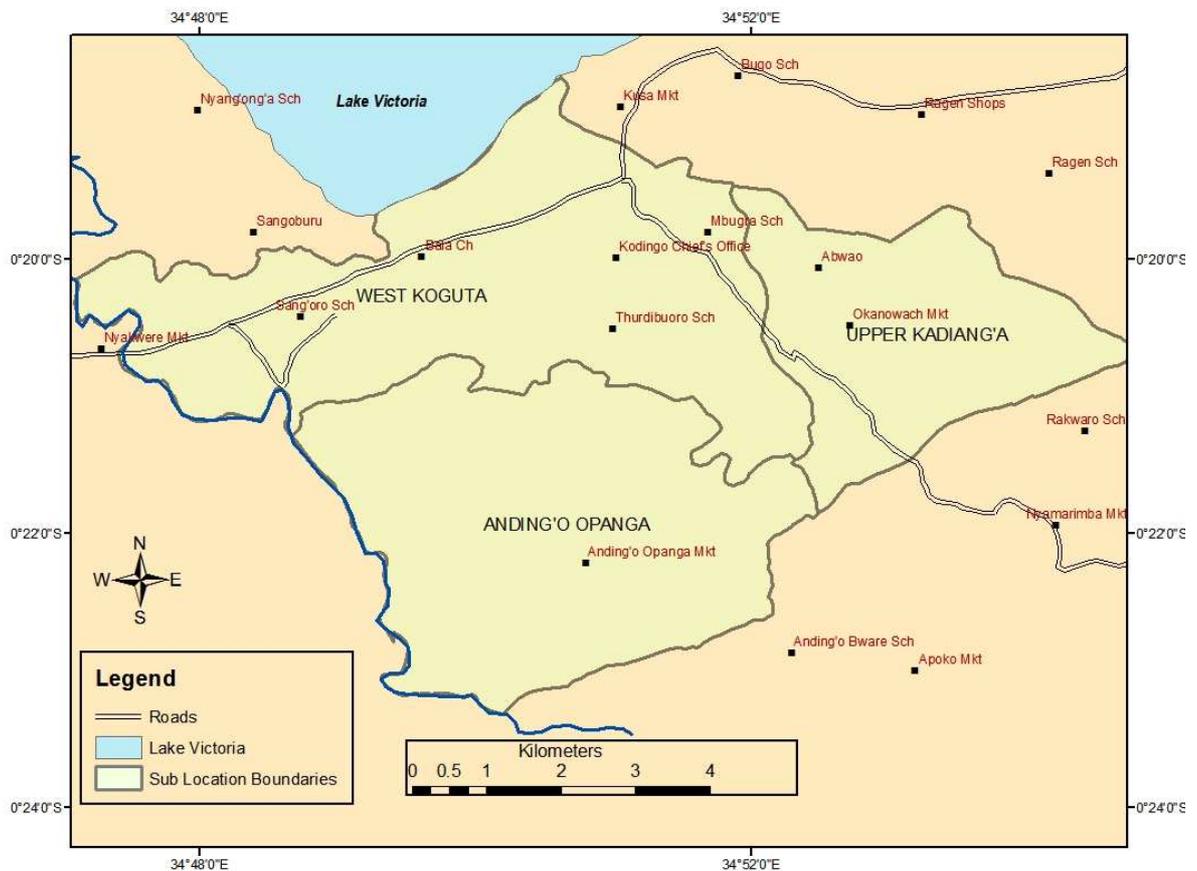


**Figure 2: A map of Kenya showing Nyakach Sub County**

*Source: Re-drawn by the author from MapCarta, 2014*

It has the highest primary school enrolment rate in the province and nationally at 4%, has a secondary school enrolment rate of 21.6% being ranked 5th in the province and 26<sup>th</sup> nationally, experiences the following main diseases: Malaria, Respiratory Tract Infections, Skin Diseases and Infections, Diarrhea diseases, and Urinary Tract Infections (Ministry of Education, Science and Technology, 2003).

Its economic mainstay are growing of rice, oilseed and fishing. The location sits on the shores of Lake Victoria, one of its major economic activities being fishing. However, the use of old technologies hampers the full development of the Industry. Moreover, the recent water hyacinth menace on the lake has contributed to a reduction in fish caught significantly.



**Figure 3: A map showing Upper Nyakach**

*Source: Re-drawn by the author from Map Carta, 2014*

Rice is grown under irrigation on farms adjacent to/ along the shores of the lake. However, a collapse of many rice industries in the recent past has discouraged most of the locals from engaging in the venture as a reliable source of livelihood. It also engages

in the subsistence production of maize, millet, sorghum, sweet potatoes, cassava and vegetables. The staple food is fish along with Ugali, a local dish made of maize flour which can also be mixed with other grains; mostly millet, sorghum and/or cassava. It has a few paved roads the major one being the Katito-Homabay road. Public transport services are provided by matatus and buses. However, owing to its low levels of income, many opt to use bicycle and motorcycle bodabodas for short distance travel (Kenya Central Bureau of Statistics, 2005).

Its location along the shores of Lake Victoria makes it a major breeding ground for mosquitoes and malaria has been a perennial problem since time immemorial. Another health problem that has adversely affected the local community members and subsequently reduced man power is the relatively high rates of HIV infection (Kenya Central Bureau of Statistics, 2005).

**Table 1: Population figures for Thurdibuoro Location**

LOCATION	SUBLOCATION	MALE	FEMALE	TOTAL	HOUSEHOLDS	AREA IN SQ KM
THURDIBUORO		9216	10117	19333	4424	54.3
	UPPER KADIANGA	2034	2356	4390	1058	10.5
	WEST KOGUTA	5232	5637	10869	2486	23.0
	ANDING'O OPANGA	1950	2124	4074	880	20.9

### **3.3 Research Design**

A cross sectional study method was chosen for this study because it involved data collection from the respondents, in this case the project beneficiaries at a specific point in time with the aim of providing data on the entire population under study.

This kind of study method also came in handy because its main purpose is usually to find the prevalence of the outcome of interest, in this case, dairy goat farming on household income and household dietary diversity of the study participants. It was also favorable since a descriptive survey was used with the aim of describing the target population with respect to the outcome of the study.

### **3.4 Study Population**

The study was undertaken in all the three sub locations within which the dairy goat farming project was implemented. It involved an in depth study of the beneficiaries of the dairy goat farming project. This involved the interviewing of households directly involved/benefiting from the project. In total, the Thurdibuoro dairy goat project covered 124 households within the three sub locations.

### **3.5 Sampling**

Disproportionate stratified random sampling method was used in this study. From each sub location, farmers were apportioned and selected using different sampling fractions with respect to the total number of farmers from each of the three sub locations based on having reared the goats for at least one lactation period. Generally, a total number of 115 respondents from the three sub locations were interviewed from the study area. These were direct beneficiaries of the dairy goat project. The sample size was attained through

an input of a confidence level of 95% using the formula below (Creative Research Systems, 2010).

**Sample Size**

$$SS = \frac{Z^2 * (p) * (1-p)}{c^2}$$

Where:

- Z = Z value (e.g. 1.96 for 95% confidence level)
- p = percentage picking a choice, expressed as decimal (.5 used for sample size needed)
- c = confidence interval, expressed as decimal (e.g., .09 = ±9)

$$\text{new ss} = \frac{SS}{1 + \frac{SS-1}{pop}}$$

Where: pop = population

$$SS = \frac{1.96^2 * (0.5) * (1-0.5)}{0.09^2}$$

$$= \frac{3.8416 * 0.5 * 0.5}{0.0081} = \frac{0.9604}{0.0081}$$

= 118.567

$$\text{New SS} = \frac{118.567}{1 + \frac{118.567-1}{4424}}$$

$$= \frac{118.567}{1 + 0.0265} = \frac{118.567}{1.0265}$$

= **115.506**

**Figure 4: Sample size for the Thurdibuoro Dairy Goat Farming Project**

Source: Creative Research Systems, 2010.

**Table 2: Sample Frame**

<b>SUB LOCATION</b>	<b>STUDY POPULATION</b>	<b>PERCENTAGE</b>	<b>SAMPLE SIZE</b>
UPPER KADIANGA	30	24	28
WEST KOGUTA	69	56	64
ANDING'O OPANGA	25	20	23
TOTAL	124	100	115

Informal discussions were also carried out with other key informants. Data was captured through personal interviews with the use of a semi-structured questionnaire administered in the sampled farms. These included socio-demographic characteristics, landholding sizes, number and categories of dairy goats, husbandry practices and so on, reflecting farm practices from respondents with at least one dairy goat. The data was analyzed using excel and the Statistical Package for Social Scientists (SPSS) software.

### **3.6 Data Collection procedures**

The data for this study was collected through a survey of 115 beneficiaries of the Dairy goat farming project in Thurdibuoro. This included the number of assets (dairy goats) owned hence the total amount of milk produced per farmer, amount sold and that used for home consumption. Data was categorized into two periods (before and after the project) taking into account the fact that the project's duration at the study area since its inception had been two years by the time of the study. The period given to determine the difference was 36 months and 24 months reflecting the period before and after the project

respectively. This took into consideration the fact that by the time of the study, the project's existence at the study area had been two years.

The more the amount of milk sold, the more the income, hence the more the chance of affording a variety of foods of different food groups which in turn boosted their diversity in diet and nutrition. Hence the amount of milk produced had a direct effect on the income attained; and both a direct and indirect effect on dietary diversity and nutrition since milk as a source of protein is highly nutritious as well. Other components that could affect milk production being the key component were also taken into consideration since they had an indirect effect on income. For instance, the frequency in attendance of meetings held by self-help groups was taken into account since it had an indirect effect on the progress of the project owing to the fact that self-help groups are an important form of communication for passing information on key developmental issues within the rural set up, our key focus being dairy goat farming. Relevant parameters to be used for analysis were identified as various positive indicators including increase in the amount of milk produced, increase in income from proceeds from sale of milk, availability of more manure for crop production enterprises. An increase in the value of stock owned by a farmer would mean an increase in income.

### **3.6.1 Household Interview**

Primary data was obtained majorly through the use of semi structured questionnaires. Some of the questions in the questionnaires were closed ended, in that, specified choices were given to the respondents, while others were open-ended to allow variety of answers and explanations.

### **3.6.2 Key Informant Interview**

Kothari states that interview as a method involves presentation of oral –verbal stimuli and reply in terms of oral- verbal response (Kothari, 2004). According to Fraenkel & Wallen (2009), interview schedule enables the researcher to gauge the accuracy and genuineness of responses and probe on issues relating to opinion of the respondents on the study subject.

Data collection through interviews was done based on interviews guides with specific questions related to the main research questions (unstructured and non-directive oral interviews). Semi-structured interviews were also utilized. Among the key informants interviewed were: the Thurdibuoro dairy goat farming project chairperson, project coordinator and the project’s treasurer. Government officials from Kenya Agricultural Research Institute (KARI) and the Ministry of Agriculture, Livestock and Fisheries, Nyando were also interviewed.

### **3.6.3 Focus Group Discussions**

Discussions were also held with the farmers in gatherings to address the various study objectives with the aim of getting their opinions/views. This allowed the farmers to agree or disagree with each other thereby providing an insight into what they really thought about the study topic and various issues associated with it.

### **3.6.4 Observation**

Observation was also done through the systematic noting and recording of events as they unfolded and through the taking of photos as well.

### **3.6.5 Secondary Data Sources**

A thorough literature review related to the subject of study was carried out to get more insight and shed more light to the study subject and would give a basis for comparison and in-depth analysis of the study problem. The secondary sources of data included literature review from official publications of Central Government, Ministry of Agriculture, Livestock and Fisheries, Ministry of Education, publications of non-governmental organizations, research institutions, Internet publications and newspapers as well as other unpublished material.

### **3.7 Data Analysis and Presentation**

Data obtained from the questionnaires were coded and summarized prior to analysis. Quantitative data obtained from the study was analyzed using descriptive statistics which helped describe and summarize data in a meaningful way for easy interpretation. This was done through the following:

**Frequency distributions:** whereby results were depicted as tables/bar graphs and percentages (through pie charts).

**Central tendency:** This helped describe/estimate the central position of a frequency distribution for a group of data. Data was presented using a number of statistics including mean, median and mode.

**Dispersion:** This helped summarize a group of data by describing how spread out the scores/ values were around the Central Tendency. Range was used in the presentation of data.

Qualitative data from interview and observation schedule was harmonized and analyzed in correspondence to the major themes and sub themes of study as they emerged.

The computer applications that were used for data analysis were SPSS version 15 and Excel.

## CHAPTER FOUR

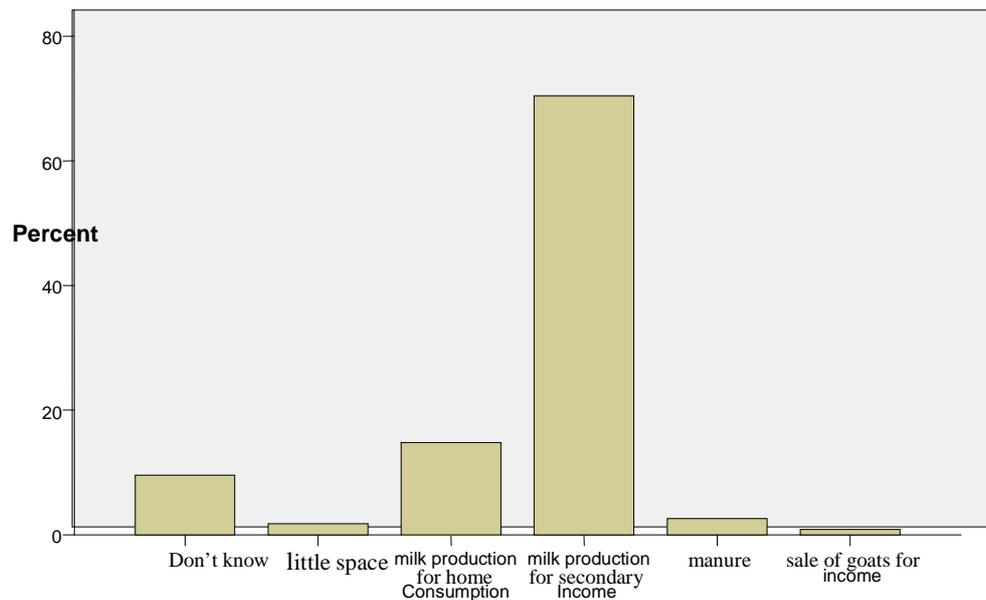
### RESULTS AND DISCUSSIONS

#### 4.1 The Contribution of Dairy Goat Farming to Household Income

This section addresses the first specific objective of the study, ‘to establish the contribution of dairy goat farming to household income in Thurdibuoro’ as revealed by the findings of the study.

##### 4.1.1 Reasons for Keeping Dairy Goats

A majority of the respondents (70.4%) kept dairy goats expecting it would add secondary income to their families mainly through sale of milk (see figure 5).



**Figure 5: Reasons for Keeping Dairy Goats**

The remaining 14.8% used the milk for home consumption. Other reasons for keeping goats included: manure production which could be channeled to kitchen gardens to increase yields in food production, sale of goat meat for income and the fact that goats occupied little space as compared to cattle, hence favorable due to limited land ownership. The farmers had a tendency to rear dairy goats for generation of savings, as a security against emergencies requiring quick cash, and/ or asset protection, implying a possibility of maximization of animal numbers even if individual productivity was low. According to the Focus Group Discussions with the farmers and community members, most of the goats sold were less than one year old, implying a shortage of the dairy goats in the market or a quick need for cash. This was in agreement with Alam (2000) who found that landless and resource-constrained farmers sold their goats at an early age, and with low market weight as they largely depended on income from them. A study by Teufel et al (1998) in Punjab (Pakistan)) reported similar findings.

A study by Kosgey et al (2008), in general, strongly featured regular income and an insurance against emergencies as reasons for rearing goats. Overall, the goats were being raised for milk and income, a scenario that favored adoption and easy sustainability of the project.

#### **4.1.2 Household Income**

Most of the respondents (47%) sold agricultural produce as their source of income while 28.7% of them relied on nonfarm self-employment. An increase in income from agriculture was noted by 15% after the project inception (table 3). This according to the FGDs could be attributed to the participation by the farmers in the Thurdibuoro Dairy

Goat Farming Project which had not existed before therefore limiting viable economic options for improving income.

**Table 3: Source of Income before and after the project**

Source of income	Before the project		After the project	
	No. of respondents	Percent	No. of respondents	Percent
Employment for cash	15	13	16	13.9
Employment in kind	2	2	1	0.9
Nonfarm self-employment	27	23	33	28.7
Selling agricultural produce	37	32	54	47
Selling fish	34	30	9	7.8
Rent	0	0	1	0.9
Total	115	100	115	100

The monthly average income per farmer before the project was Kshs 6392 increasing to Kshs 8258 after the project. Hence a comparison between average income before and after the project revealed a slight increase in income by 23% (table 4). Most of the respondents claimed to earn around 6000 shillings each month.

**Table 4: Average monthly income in Kshs**

	Before the project (Kshs)	After the project (Kshs)
Mean	6392.165	8258.1818
Mode	5350.00	6000.00
Minimum	.00	.00
Maximum	29000.00	36000.00

According to the Focus Group Discussions, a majority attributed an improvement in their level of income to the Thurdibuoro Dairy Goat Farming Project. Proceeds from sale of milk from the project accounted for 34% of the average income (kshs 8258) attained, hence farmers would, therefore, be expected to demonstrate a greater ability to participate and benefit from the dairy goat project all of which was advantageous to the enterprise in boosting its income.

Informal discussions with respondents indicated that they were willing to spend money from other sources on the dairy goat enterprise. Dairy goat farming is profitable to small scale farmers and this is in agreement with the findings of Panin and Mahabile (1997) who reported that small ruminant enterprises are profitable and economically viable. According to Ahuya *et al* (2005) dairy goat enterprises are profitable and have contributed significantly to the improvement of livelihoods of the rural communities in medium to high potential areas of Eastern Kenya.

Dairy goat farming is seen as a reliable source of earning a livelihood and enabling one meet the needs of his/her family. This is also in agreement with the observation made by Peacock (2008) that goat development projects have significant impact on farmers' incomes and can raise their annual income. This increase in income and asset value represents a significant step out of poverty for thousands of families benefitting from the dairy goat projects.

According to the Kenya Integrated Household Budget Survey 05/06' basic report on well-being in Kenya, the overall poverty lines in monthly adult equivalent terms were computed at Kshs 1562 and Kshs 2913 for rural and urban areas respectively which was lower than the average income earned by the farmers from the dairy goat project as revealed by the study findings; Hence rendering the dairy goat farming project as a sustainable and reliable means of livelihood. Poverty line is the estimated minimum level of income needed to secure the necessities of life.

On average 1.6 litres which accounted for 59.5% of the milk produced was allocated for sale (table 5). The highest amount of milk that had been allocated towards marketing among the farmers was 20 litres where as that which had been allocated towards home consumption was 4 litres.

**Table 5: Milk produced for sale**

	Average amount of milk allocated for sale in litres	How much does a 300 ml bottle of goat milk cost in Kshs	Average milk production per day in litres
Mean	1.6010	17.5000	2.4531
Mode	.00	15.00	2.00
Minimum	.00	15.00	.00
Maximum	20.00	30.00	9.00

On average, a 300 ml bottle of milk cost 18 shillings but this could go as high as 30 shillings depending on the season and scarcity of milk. This was slightly higher than cow's milk which on average cost 10 shillings. A litre of milk therefore cost 58 shillings on average. A farmer therefore earned an average of 93.33 shillings per day from the project taking into consideration the fact that 1.6 litres was the average amount of milk allocated for sale per day. This amounted to 2,800 shillings as the average amount earned from the Thurdibuoro dairy goat farming project per month which accounted for 34% of the average monthly income earned (Table 4).

The greatest challenge in marketing of milk was the competition from local cows, especially during rainy seasons. They indicated that the dairy goat milk supply was more consistent and denser than that of local cows, which favored their rearing.

#### **4.1.3 Milk production and sale**

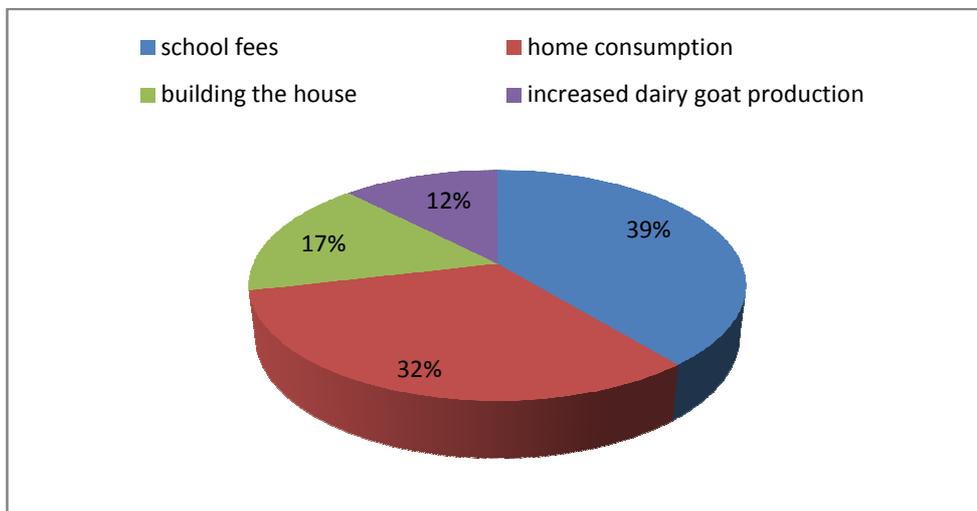
The study further revealed that 41.7% of those who sold milk received their milk payments on a monthly basis (see Table 6).

**Table 6: Frequency of Sale of Milk**

Frequency	No. of respondents	Percent
daily	17	14.8
weekly	10	8.7
monthly	48	41.7
Don't know	40	34.8
Total	115	100.0

This could be as a result of low income levels on the part of the community members/ milk buyers; hence they found it convenient to do so once in a month.

Much of the proceeds from sale of milk were spent on fees (39%) which could indicate an effort by the community members to improve their literacy levels hence improve their living standards(see Figure 6).



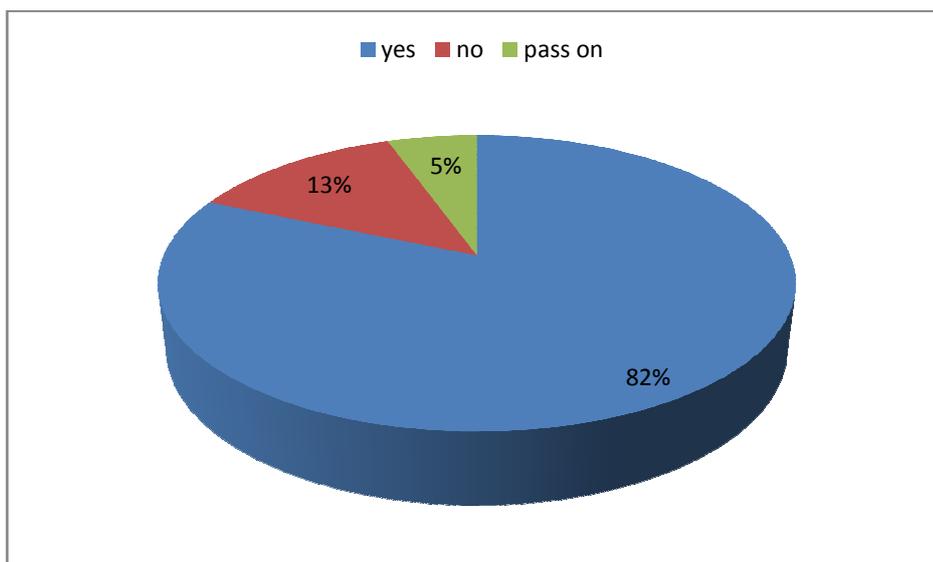
**Figure 6: Use of proceeds from sale of milk**

However, this could still indicate a good effort by the farmers in attempting to improve their nutrition, since 32% of the farmers channeled this towards buying more variety of foods for dietary diversification.

Kosgey *et al* (2008) established use of income from small ruminants as follows: fees 32%, purchase of food 22%, farm investment 18%, medical expenses 10%, off-farm investment 9%, social activities 5% and restocking 4%. The values observed in this study are higher compared to those observed by Ogola *et al* (2010) who reported 16.7% of income being spent on school fees. However, the observation in this study is in further agreement with Shirima (2005) who reported that more children are sent to school due to extra income from dairy goat enterprise.

Moreover, the findings by Nordhagen (2003) indicated that introduction of dairy goats in Tanzania has contributed significantly to the education of children. Gihad and El-Bedawy (2000) reported that keeping goats lowered financial risks and overcame periods of cash shortage. The latter study inferred that goat keeping would remain attractive for the small-scale rural producer with limited alternative ways of earning cash income. Many farmers who keep dairy goats have been able to invest in their farms, for example by buying land and some have invested in small businesses in rural centers (Laker & Omore, 2004).

Most of the farmers (82%) sold their dairy goats; where as 13% did not (see figure 7). This had a positive effect on improving household income of the farmers.



**Figure 7: Sale of dairy goats**

The average price of a female goat was 9006 shillings where as that of a male goat was 9397 shillings (see Table 7).

**Table 7: Average price of a goat**

	price of a female goat(Kshs)	price of a male goat(Kshs)
Mean	9006.5789	9397.2603
Mode	10000.00	12000.00
Minimum	.00	.00
Maximum	12000.00	15000.00

The difference could be as a result of high demand and scarcity of bucks. Does were on the other hand more marketable than their male counterparts due to their increased availability and reliability. The price was higher than that of indigenous goats, which on average, according to the FGDs, cost 3000 shillings. The prices of goats however differed

from place to place and varied depending on the age of the goats as well. The above statistics applies to goats over the age of six months.

#### 4.1.4 Training of Farmers

A large number of 78 farmers who accounted for 67.8% of the respondents had learnt about dairy goats through their fellow group members during their weekly group sessions (see table 8) while others had learnt the same through word of mouth (16.5%).

**Table 8: Farming experience of the respondents and how they learnt about dairy goats**

Attribute	No. of respondents	Percent
<i>Learn about dairy goats</i>		
word of mouth	19	16.5
farming magazines	1	.9
Radio	1	.9
group members	78	67.8
project official	4	3.5
donation through pass on	1	.9
Don't know	11	9.5
Total	115	100.0

Apparently, personal contact in the rural context is a more important method of reaching the farmers than either the electronic or the print media (Ogola et al 2010). This means

that direct contact of the extension personnel with the farmers would greatly boost the adoption and success of the project in terms of its outcome on income.

#### **4.1.5 Housing and health of goats**

A majority of the respondents (90.4%) confined their goats almost all the times, with feed and water brought to them (see figure 8) which contributed towards improved hygiene and health, improved milk production hence an improved income.



**Figure 8: A typical structure of a dairy goat stall**

On the other hand, 6.1% of them preferred to have them tethered in an open area (see table 9). The latter could have been as a result of the high cost of materials needed in the construction of the stalls.

**Table 9: Confining of Dairy Goats**

Confining of dairy goats	No. of respondents	Percent
Stall	104	90.4
tethered in an open area	7	6.1
Don't know	4	3.5
Total	115	100.0

On average, the construction of a stall in the area cost Kshs 9500 whereas the average income of a farmer in the area was Kshs 8258 (See table 10). The highest amount spent on the construction of a stall among the farmers was 23000.

**Table 10: Average stall cost in KES**

	How much did you spend on the construction of the stall (Kshs)
Mean	9500.0000
Mode	10000.00
Minimum	.00
Maximum	23000.00

Despite the fact that the stalls were expensive to construct, the benefits outdid the expenses incurred thereby boosting the project. The stalls were constructed entirely from locally available materials. This assisted in clean milk production, prevented goats from eating crops, controlled flies and biting insects, and provided a good and clean physical environment (e.g., shelter against heat stress and rain, allowed for disposal of pellets, urine and remnant feed) all of which had a positive effect on the health of the dairy goats thereby favoring the project.

Cases of destruction/breakage due to poor construction and fighting amongst the bucks were reported necessitating repair once in a while. The open walls, together with the slatted floor, were beneficial in the ventilation of the house but also contributed to cases of pneumonia during cold season's hence affecting milk production seasonally which in turn affected income. Cardboards and/ or sacks could be used to reduce draught through the stalls.

Problems associated with the stalls included high costs and poor construction due to use of unskilled carpenters both of which were a big blow to the project in terms of income reduction due to the expenditure involved during maintenance. Optimal utilization and maintenance of properly constructed stalls was, therefore, desirable to improve safety and welfare of animals, and clean milk production, factors that would boost and enhance sustainability in the dairy goat project.

#### **4.1.6 Production practices**

##### **Number of Goats owned**

The goat flocks comprised different categories of sex (Table 11).

**Table 11: No of goats owned per farmer**

	no of male goats owned per farmer	no of female goats owned per farmer	total no of goats owned per farmer
Mean	1.58	1.78	3.32
Mode	1	1	2
Minimum	0	0	0
Maximum	6	7	9
Total	171	192	359

The total numbers of goats owned among the farmers were 359, 53% of them being female and 47 % of them being male. The probable reasons were the existence of a

market for the bucks, which were bought and introduced in other areas for breeding or a higher mortality or simply by chance. Most of the farmers sold the bucks at the age of 6 weeks and above because they were more interested in income generated and milk production from the remaining does (females). However, bucks were still valued since they were faster in growth and development than their female counterparts, hence a boost to the project due to income attained from their quick sale. On average, farmers owned at least a buck and a doe. Most of the farmers tended to keep two goats each of different sex. The highest no of goats owned among the farmers was 9, with some having none at all.

### **Improved pasture and Milk production**

Most farmers (55.7%) used normal fodder to feed their dairy goats while 37.4% of them had established improved pastures of Napier grass and fodder trees (Table 12). Those that did not use improved pasture attributed this to non-conducive weather (29.6%), inadequate land (20.9%), unavailability of seeds (2.6%) and difficulty in growing improved pastures (1.7%). This had a negative effect on overall production of milk since low uptake of improved pasture implies lower levels of production leading to lower income from dairy goat keeping.

About 23.5% of the farmers fed concentrates but mainly during milking to calm down the goat. The quantities and frequency of concentrates fed depended on the farmer's purchasing power and the distance to point of purchase. Apparently, supplementary feeding was a major cost item. Due to cost and the perception that feeds available were sufficient to provide the necessary nutrients, 71.3% of the farmers did not feed concentrates whose impact on the project was negative.

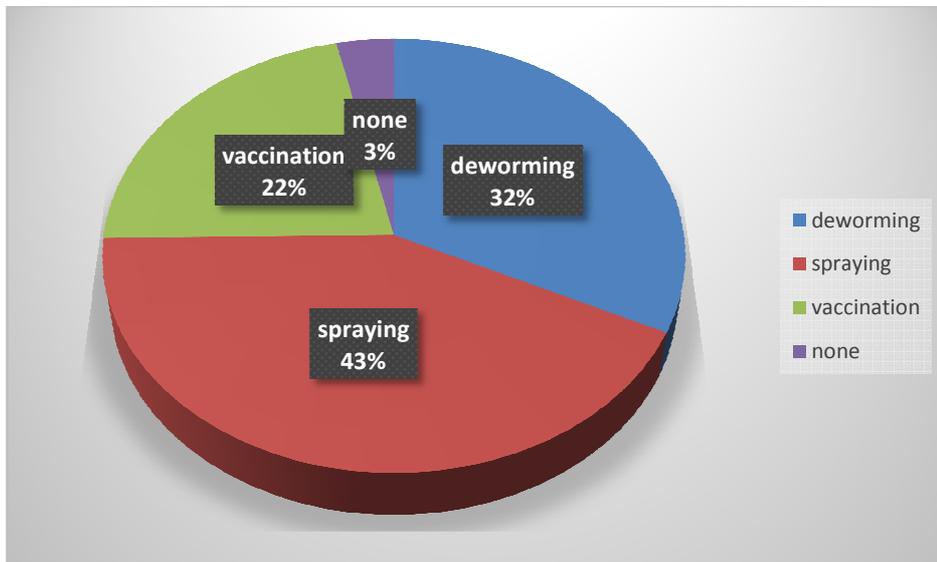
Efficient utilization of the feed is, therefore, required to achieve maximum returns. About 25.2% of the respondents did not use feed concentrates because they felt it was too expensive. Another 25.2% of them felt it was not necessary due to adequate minerals from the fodder, 10.4% felt the distance to the purchase point was too far and 8.7% did not know if minerals should be given.

**Table 12: Dairy goat feeding practices**

Attribute	No. of respondents	Percent
<i>Feeds used</i>		
Don't know	8	6.95
Normal fodder	64	55.7
Improved pasture	43	37.4
Total	115	100.0
<i>Reasons for not using improved pasture</i>		
Don't know	52	45.21
Difficult to grow	2	1.7
Non conducive weather	34	29.6
Shortage of land	24	20.9
Unavailability of seeds	3	2.6
Total	115	100.0
<i>Do you use feed concentrates</i>		
Don't know	6	5.21
Yes	27	23.5
No	82	71.3
Total	115	100.0
<i>Why don't you use feed concentrates</i>		
Don't know	25	21.73
Too expensive	29	25.2
Not necessary	29	25.2
No reason	10	8.7
Inaccessible/located far	12	10.4
Total	115	100.0

The adequacy and timeliness of feeding management was found wanting and could eventually contribute to performance below the potential. Farmers needed to understand the nutrient requirements of different classes of goats in order to match them with the chemical compositions of the forage which varied greatly during the year, with the stage of growth and rainfall. Generally, proper feeding would enhance production of the dairy goats and consequently, achieve a sustainable multiplication and future breeding project. Commonly used feeds (normal fodder) included, sweet potato vines, bean stalks and twigs. Apparently, a substantial contribution to feeds came from shrubs, tree leaves, tender shoots and twigs from non-arable land by the roadside and public fields or wasteland. Utilization of a concoction of feeds may signal a strategy by the farmers to address feed constraints. Conversely, it may imply lack of a strategy for the feeding of dairy goats and management of feeds. Some farmers also admitted to lack money needed to hire temporary feed collectors. Onim (1992) found that although inputs for adoption of improved goat technologies, e.g., veterinary drugs, salt licks and concentrate feeds, were generally available, prices proved prohibitive for most farmers.

Most farmers applied proper healthcare practices, especially in the control of internal and external parasites which had a positive outcome on the project by boosting returns (see figure 9). Only 3.4% of the respondents did not undertake any health care practice as recommended. Spraying was the most commonly observed practice, being undertaken by 42.6% of the respondents. Deworming was undertaken by 32.2% of the respondents where as 21.7% opted for vaccination. Most respondents were unable to identify causes of mortalities within their flocks.

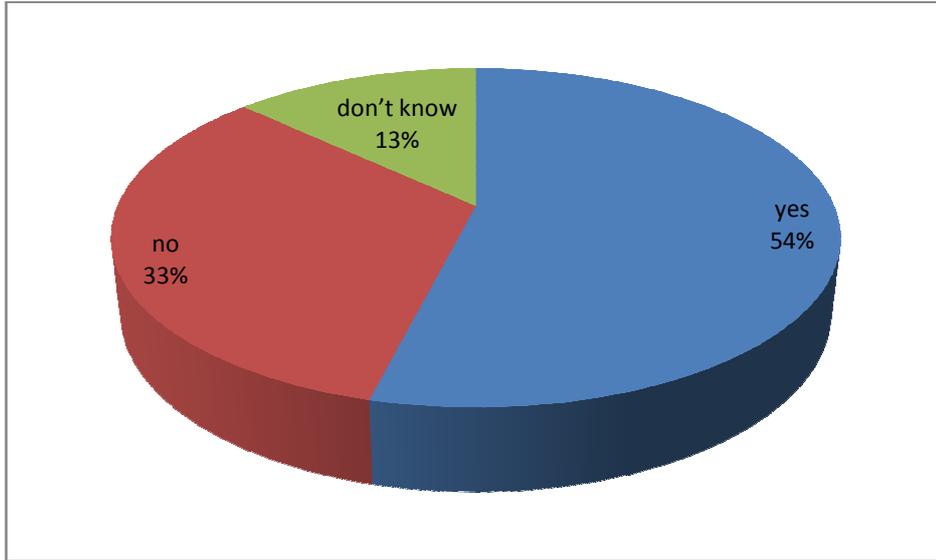


**Figure 9: Health Practices applied**

Healthcare is essential to reduce production losses that arose from diseases or parasites and mortality of animals. Interventions like improving nutrition or genetic improvement would be effective only if infectious diseases were curbed through preventive and curative measures (Ayalew *et al* 2003). To ensure increased milk production in future, healthcare should be improved. Where there is shortage of veterinarians, community-based animal health workers need to be engaged (Mugunieri *et al* 2004).

#### **4.1.7 Goat Keeping as a Commercial Enterprise**

Most of the respondents (54%) kept records whereas 33% did not see the need to do so (see figure 10). Recording was, however, erratic and farmers inconsistently updated records as required; some even lost their notebooks.



**Figure 10: Record keeping**

A total number of 51 respondents (44.3%) kept records for planning purposes. 5.2% of them doing so to improve production of milk and 1.7% of them hoping to impress donors through the same (Table 13).

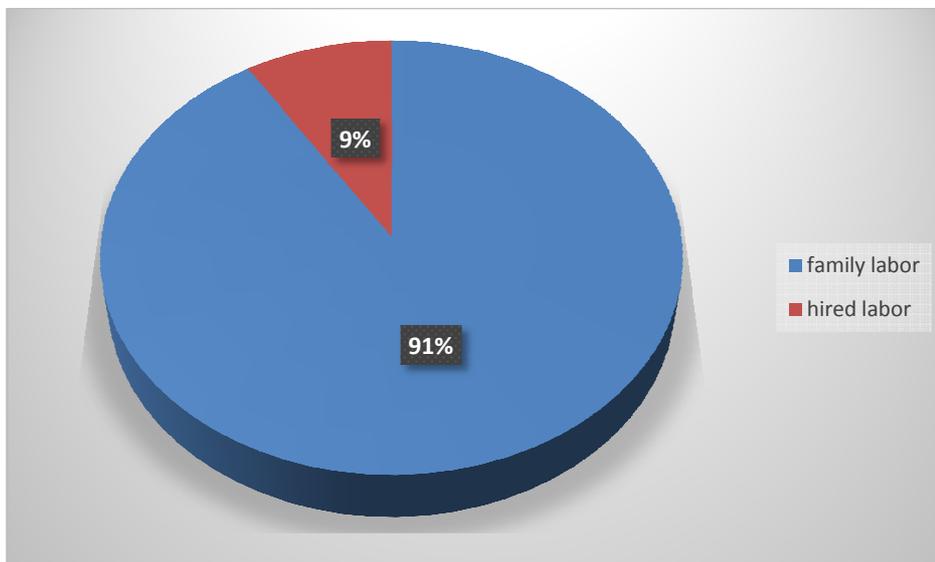
**Table 13: Importance of record keeping**

Importance	No. of respondents	Percent
Don't know	56	48.7
planning purposes	51	44.3
production improvement	6	5.2
impress donors	2	1.7
Total	59	100.0

Inability to regularly keep and update farm records posed the greatest challenge in monitoring progress and assessing economic performance of the dairy goat project. Lack of ownership and therefore poor record keeping was a production and a viability

constraint. To ensure sustainability of the dairy goat project, farmers should be trained on the importance of recording and use of simple recording systems emphasized.

Family labor was mostly used (91%), with only 9% hiring it (figure 11). The extensive use of family labor reduced expenses which would have otherwise been spent on hire of labor which in turn had a positive effect on the dairy goat farming project. The average cost, for example, charged by those hired to look for feeds ranged from 100 to 120 shillings per a 90kg bag.



**Figure 11: Source of labor used**

The main tasks were cleaning the stall, milking and feeding. Most activities were carried out by women or children. Majority of the decisions on activities, however, had to be undertaken after consultation with their husbands.

#### **4.2The Contribution of the Dairy Goat Farming Project towards Household Dietary Diversity**

The section below addresses the second objective of the study, 'to determine the contribution of dairy goat farming towards household dietary diversity'. It examines

diversity in household diet and how the Thurdibuoro dairy goat keeping project contributed towards it.

#### 4.2.1 Milk Production and Consumption

A 300 ml bottle was used to measure milk production. The daily average milk production was 2.4 litres with an average lactation period of 6 months; the highest amount of milk produced among the farmers being 9 litres. Most of the farmers produced an amount of 2 litres on a daily basis (see table 14).

**Table 14: Average milk production per day in litres**

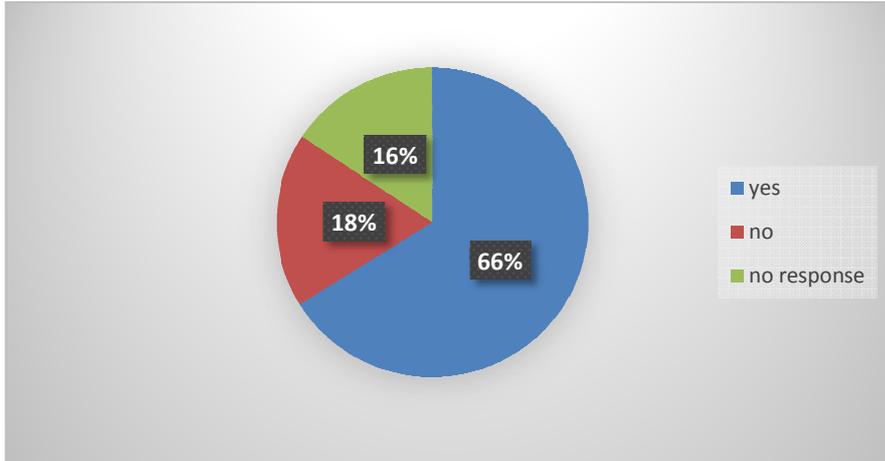
Mean	2.4531
Mode	2.00
Minimum	.00
Maximum	9.00

Of this, an average amount of 1.09 litres was allocated for home consumption (see table 15).

**Table 15: Milk allocation for sale and home consumption**

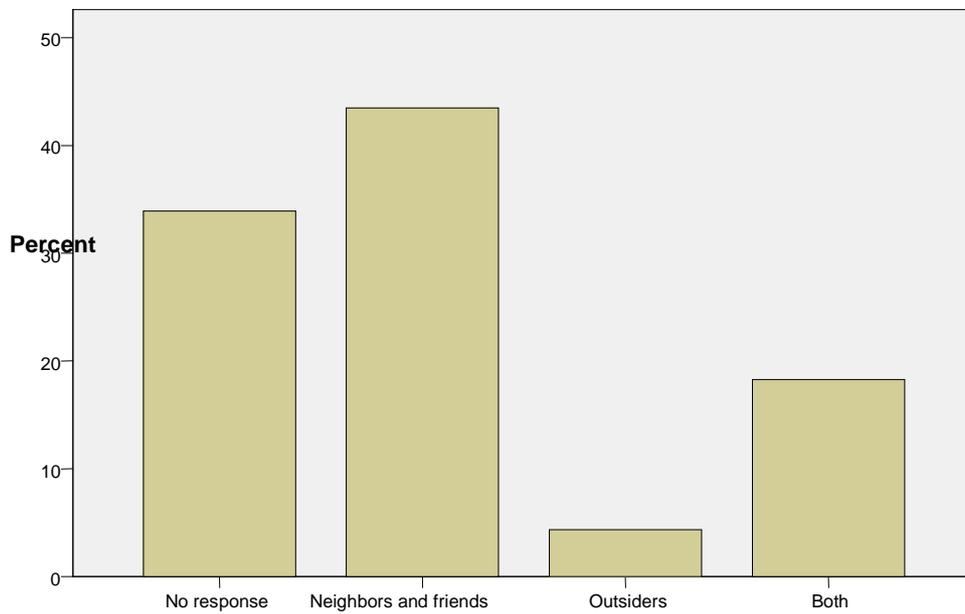
	Average amount of milk allocated for home consumption in litres	Average amount of milk allocated for sale in litres
Mean	1.0921	1.6010
Mode	1.00	.00
Minimum	.00	.00
Maximum	4.00	20.00

A majority of the respondents (66.1%) sold milk (figure 12).



**Figure 12: Sale of milk**

Of the amount sold, a large portion (43.5%) was sold to neighbors and friends where as 4.3% of it was sold to outsiders. 18.3% was sold to all neighbors, friends and outsiders (Figure 13).



**Figure 13: Milk buyers**

The increased effort by the neighbors and friends to buy milk could indicate a positive gesture towards improving nutrition. It could also indicate the willingness by the respondents to increase their diversity in diet indirectly through the purchase of more varieties of food out of proceeds attained from the sale of milk.

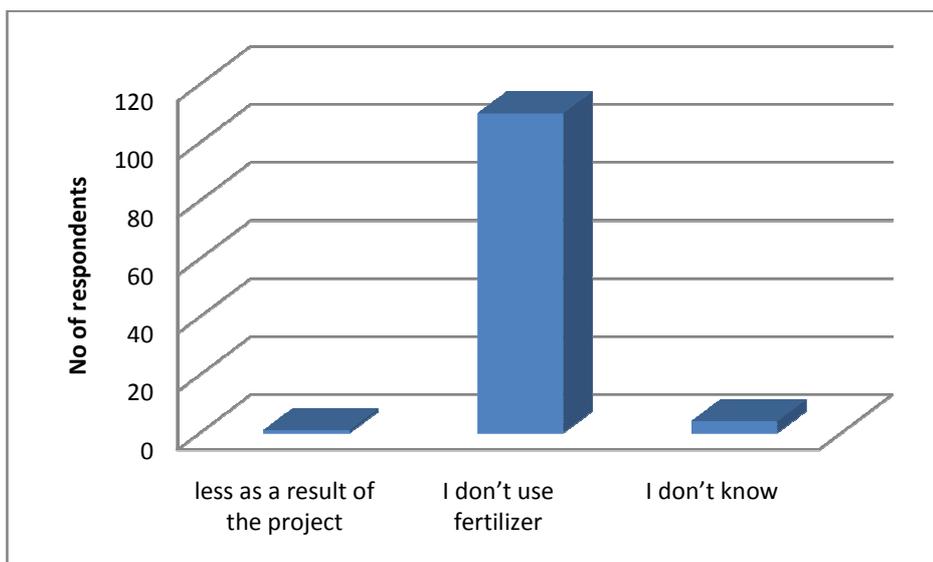
#### 4.2.2 Use of Manure for Improved Agricultural Production

A total of 86 farmers (74.7%) directed the manure from dairy goats to their kitchen gardens for subsistence farming and only 21.7% to the fodder plots (Table 16). This indicated a good gesture by the farmers towards attempting to improve their diet and nutrition.

**Table 16: Waste Management**

Manure disposal	what is the impact of the manure on crop production		
	improvement	No improvement	Total
where do you dispose of manure from the goats			
fodder plot	25	0	25
crop field	61	0	61
both crop and fodder plots	25	0	25
No response	0	4	4
Total	111	4	115

About 0.9% of the respondents needed less inorganic fertilizer due to use of manure, and 3.5% used the same quantity. About 95.7% previously did not buy inorganic fertilizer, and had believed manure would spoil their soils. Almost all the farmers (96.5%) realized an improvement in yields upon use of the manure from the goats; whereas only 3.5% did not see any change. Similar findings were observed by Shirima (2005).



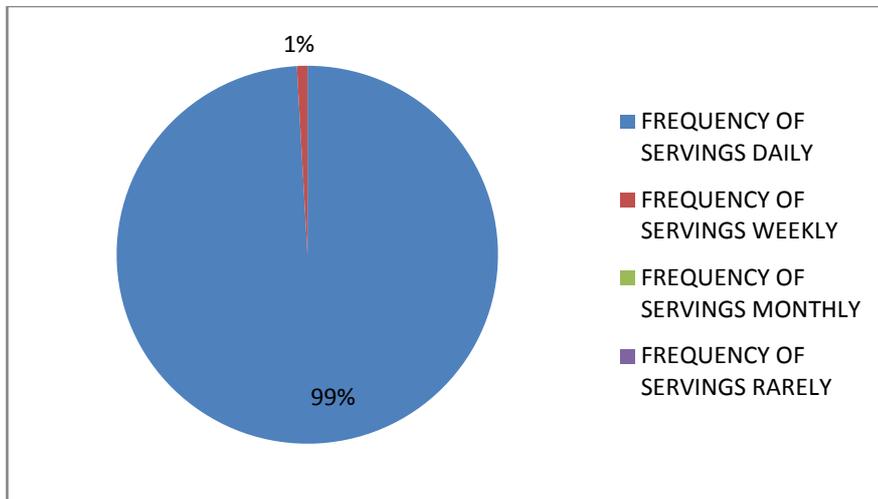
**Figure 14: Effect of manure on purchase of fertilizer**

Generally, application of goat manure enhanced food security and a further diversity in diet due to the availability of more varieties of food from enhanced soil fertility through increased nutrient recycling. This was consistent with Onim (1992) who observed that manure had a positive environmental effect when used on either crop land or fodder.

#### **4.2.3 Household Dietary Diversity**

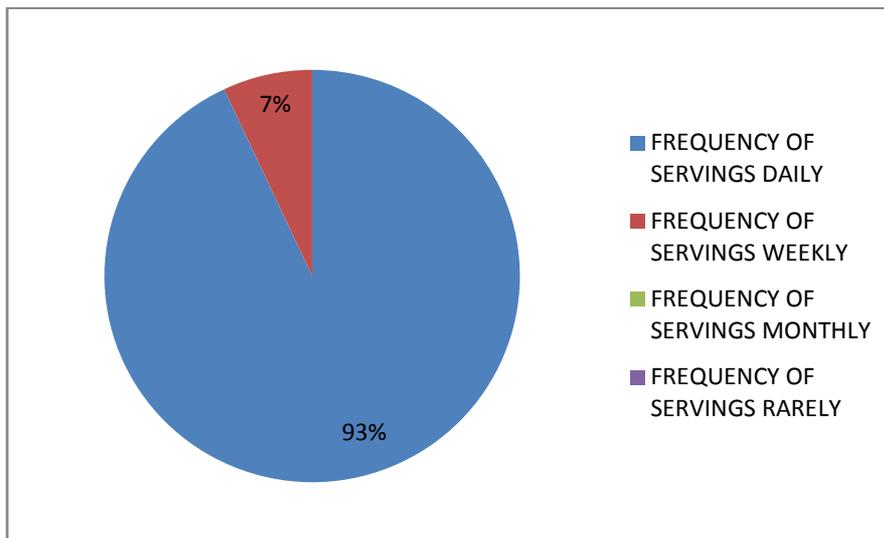
This section examined the content of household diet and the frequency with which different food components were served. A comparison to determine change in frequency of servings of various food groups before and after the project was undertaken. Five different food groups were examined. This included: vegetables, fruit and fruit juice, milk and milk products, meat, beans, fish and grains & ugali.

**Before the project**



Daily vegetable intake reduced by 6% after the dairy goat farming project.

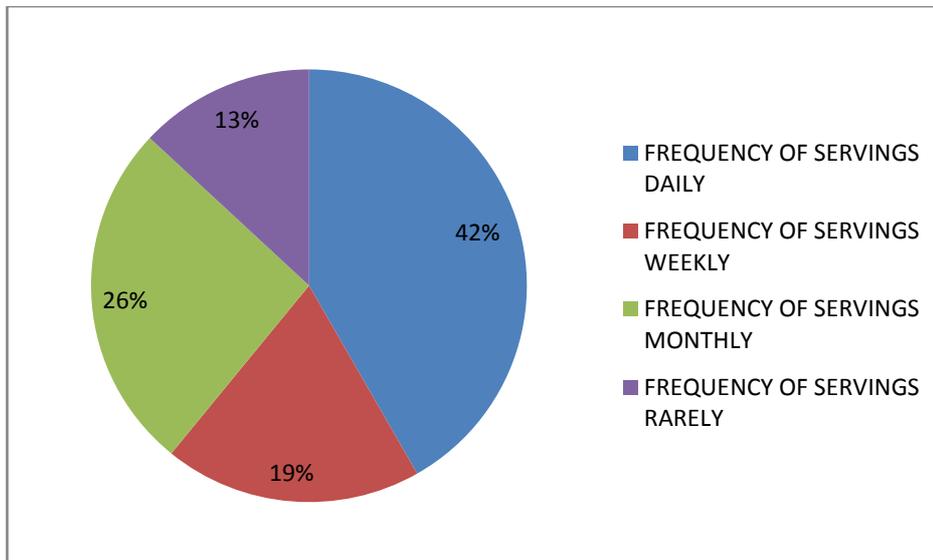
**After the project**



**Figure 15: Vegetables frequency of consumption before and after the project**

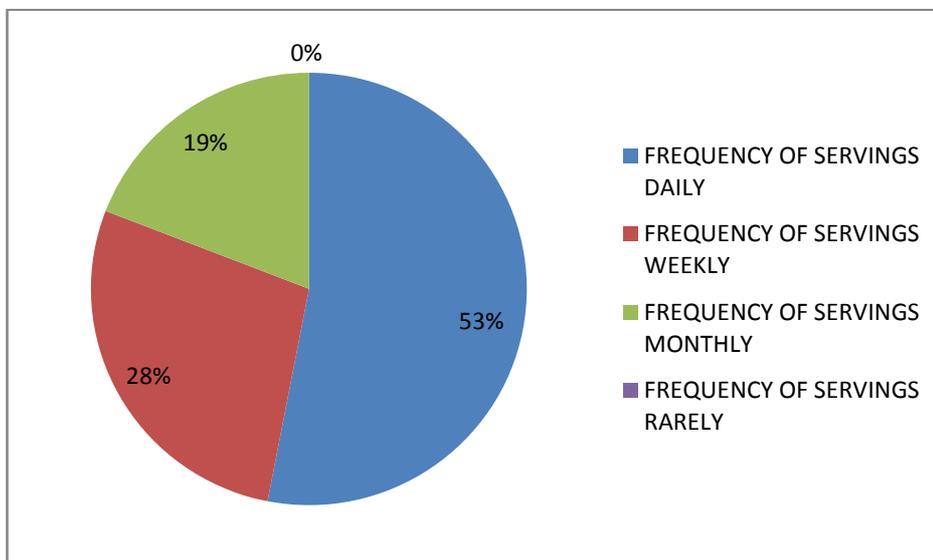
This could be attributed to the sudden availability of other kinds of food owing to the extra income from the dairy goat farming project.

### Before the project



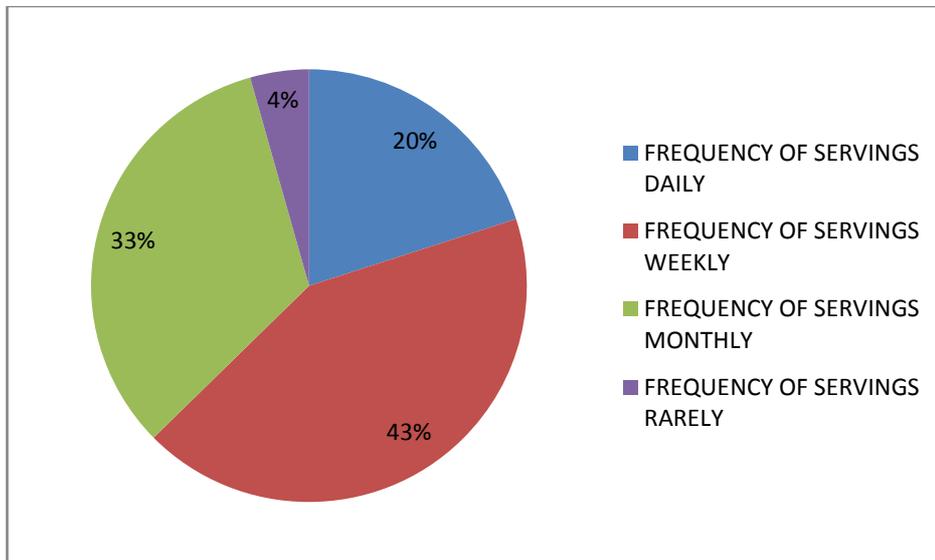
The daily consumption of fruit and fruit juice however, increased by 11% after the dairy goat farming project. The minimal increase could be attributed to lack of knowledge on the part of the farmers on the nutritional benefits of fruits or prioritizing of needs depending on income level.

### After the project



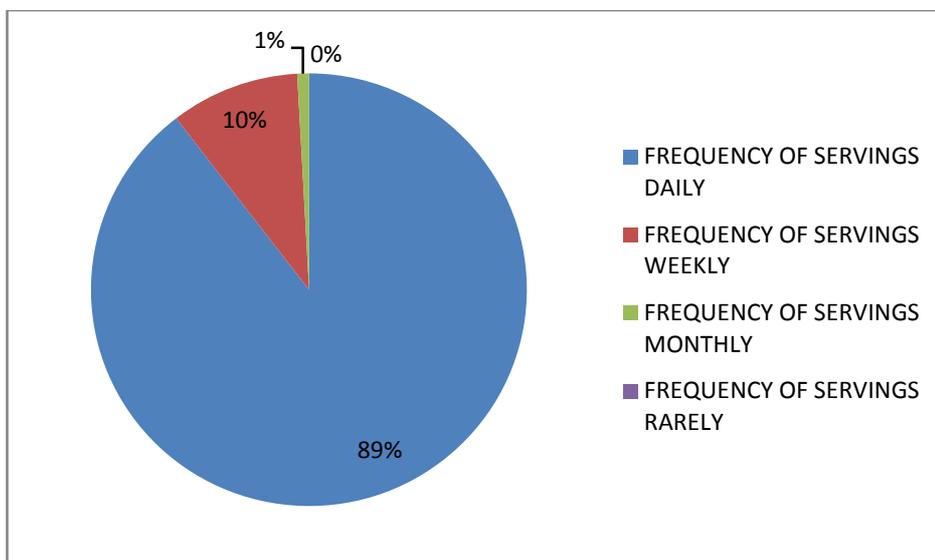
**Figure 16: Fruit and fruit juice frequency of consumption before and after the project**

**Before the project**



An increase in daily consumption of milk (46%) was also noted after the project.

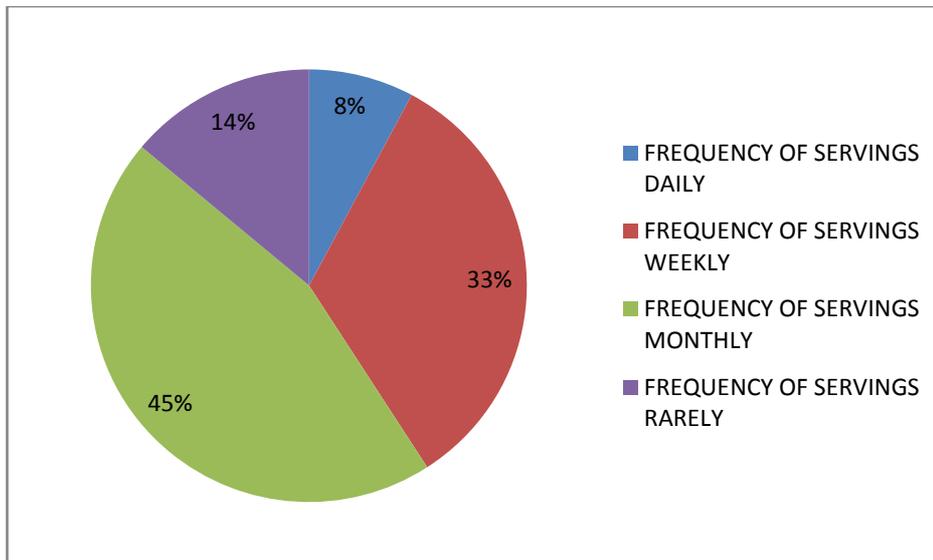
**After the project**



**Figure 17: Milk and milk products frequency of consumption before and after the project**

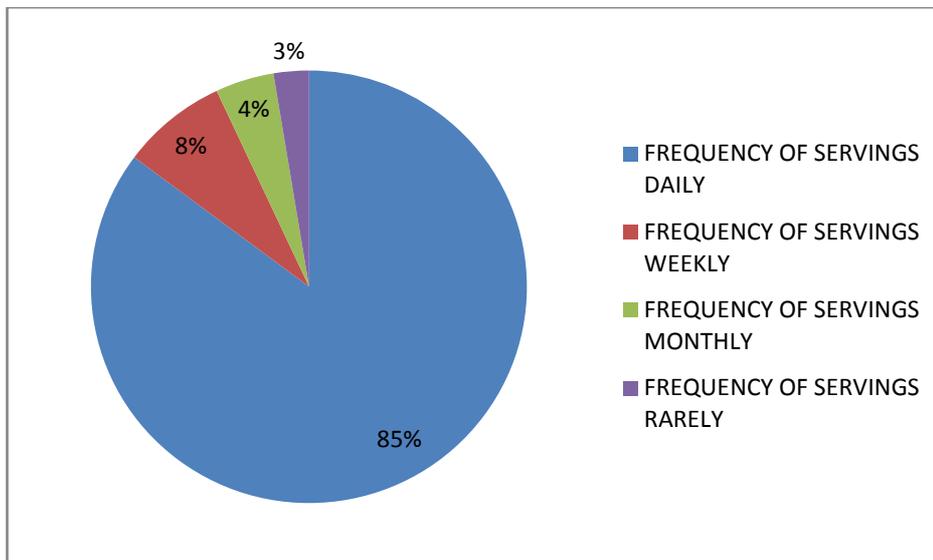
This could be attributed to the availability of milk from the dairy goat farming project.

### Before the project



The most significant increase noted among the food components was that of daily intake of meat beans and fish (77%).

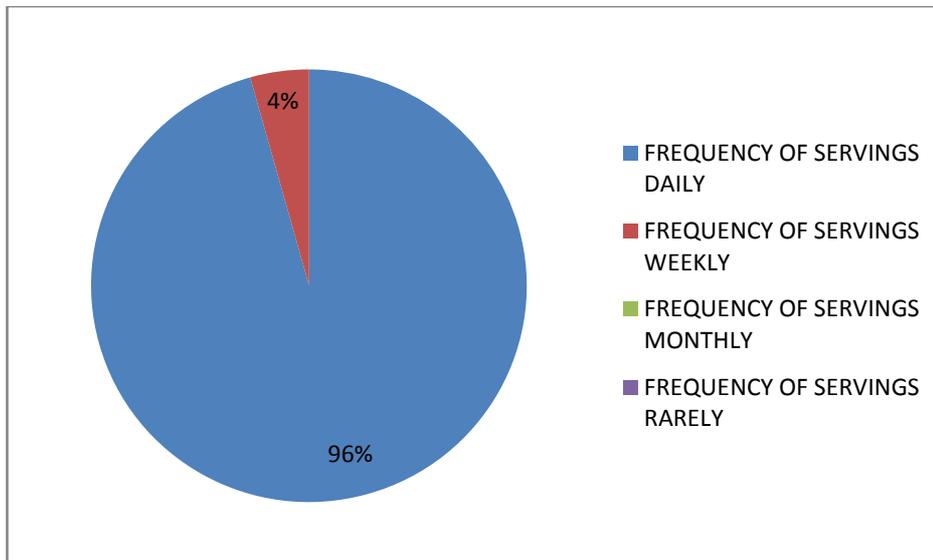
### After the project



**Figure 18: Meat, beans and fish frequency of consumption before and after the project**

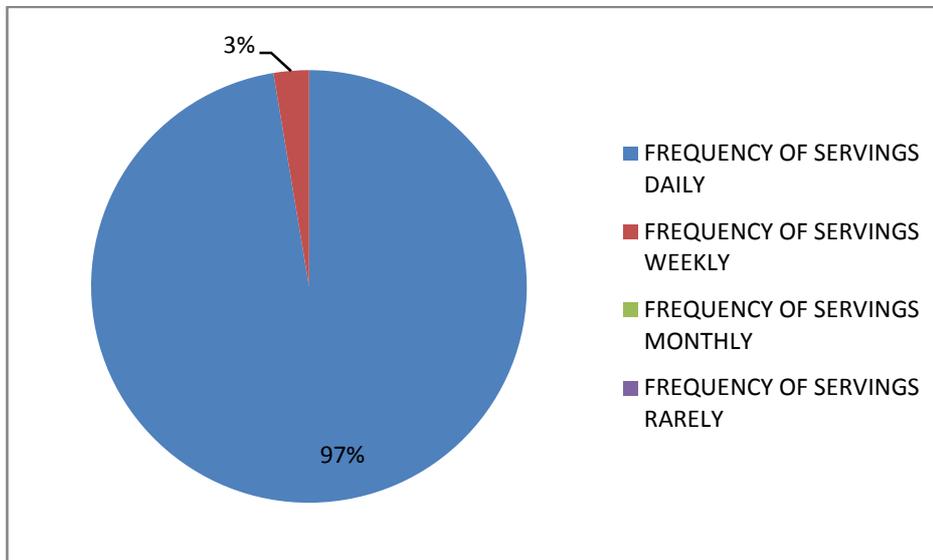
This could be as a result of more interest on fish being a staple food in the region, owing to extra income attained from the project. It could also be due to an increase in yields of beans from manure applied.

### Before the project



Not much difference was noted in the daily intake of grain and ugali. Consumption increased by 1% only after the project. This could be due to the fact that ugali being a staple food, unlike fish is easily available and affordable; hence they can't do without it.

### After the project



**Figure 19: Breads, grains and Ugali frequency of consumption before and after the project**

From the comparison, there was an improvement in consumption of all food groups except vegetables. According to the FGDs, this was attributed to an indirect contribution

from the extra income attained through the sale of milk and goats from the dairy goat farming project which enabled them buy additional varieties of food that they wouldn't have otherwise afforded before. Increase in yields of some foods was also noted as a result of manure from the project.

According to the Kenya National Guidelines on Nutrition and HIV/AIDS (2006), a balanced diet for a day for a healthy adult consists of six servings of energy foods (grains and ugali), one serving of a body building food (meat/fish), one serving of milk or milk products, five servings of vegetables and two servings of fruit and/or fruit juices. According to the study, 93% of the respondents were able to meet the recommended frequency of servings for vegetables, 53% for the fruit and fruit juice category, 89% for the milk and milk products category, 85% for meat, beans & fish and 97% for ugali and grains after the project. Hence on average, 83% of the respondents were able to meet the recommended servings for a balanced diet as per the Kenya National Guidelines on Nutrition and HIV/AIDS; thereby terming dairy goat farming as a reliable economic activity for improving livelihoods in Thurdibuoro.

A more diversified diet is highly correlated with such factors as caloric and protein adequacy, percentage of protein from animal sources (high quality protein) and household income. Even in very poor households, increased food expenditure resulting from additional income is associated with increased quantity and quality of the diet (Marie, 2002).

Vegetables represent a major portion of our diet, both quantitatively and qualitatively. A varied diet, including at least five portions of fruits and vegetables per day, is indispensable for acquiring and maintaining good health. It is primarily the non-caloric fraction of these foods that provides the health benefits. Fibre, minerals, vitamins and antioxidant substances are the principal contributors to the nutritional value of vegetables. The 2010 Dietary Guidelines for Americans (DGA) recommends increasing consumption of key nutrient-dense food groups, including milk and milk products, fruits, vegetables and whole grains, to build nutrient-dense dietary patterns. Consumption of milk, cheese and yogurt helps meet recommendations for calcium, vitamin D, potassium, magnesium, and other nutrients. Not only are dairy foods important contributors of key nutrients, the DGA states that dairy food consumption is associated with better bone health, especially in children and adolescents, reduced risk for cardiovascular disease and type 2 diabetes, and lower blood pressure in adults. Foods in the meat, fish, and beans group supply protein, B vitamins, iron, and zinc. They are primarily responsible for building and repairing muscles and tissues, digesting nutrients, and improving immunity and blood quality. The Grains Group is important in our diet. This is where much of the energy that our bodies need is found. Our bodies convert carbohydrates to blood glucose, the form of energy that our bodies use to do work. Whole grains, bread and ugali contribute B vitamins and iron, particularly if they are enriched. Whole grains are also an excellent source of the fiber that our bodies need to keep food moving through the digestive system. Because grains come from plant foods, they are naturally low in fat and cholesterol (University of Illinois Extension, 2014).

The above is in agreement with Muriuki, Mwangi and Thorpe (2001) who conclude that small holder dairying contributes to food security and poverty alleviation of most small holders in many areas of Kenya, directly through milk consumption and indirectly through income generation.

Studies have shown that an increase in dietary diversity is associated with socio-economic status; household food security and household energy availability (Hoddinott & Yohannes, 2002). According to FAO (2004), small holder production stimulates rural development in both developing and developed countries by creating on-farm employment and income opportunities beyond the farm gate.

In 2005, the World Bank *Agricultural Investment Sourcebook* reported that smallholder dairying was cost effective and a key source of nutrition, diverse diet and income to 300 million farm families globally. An ILRI study in Ethiopia and Kenya supported these findings (Staal, Nin Pratt, & Jabbar, 2008).

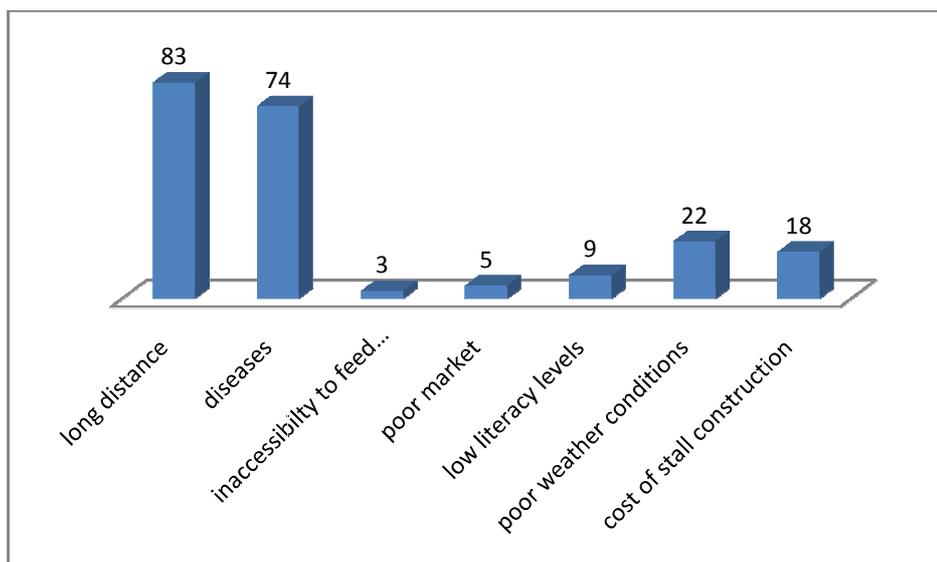
Dietary diversity has long been recognized by nutritionists as a key element of high quality diets. Increasing the variety of foods across and within food groups is recommended by most dietary guidelines in the US (US Department of Agriculture Human Nutrition Information Service 1992) as well as internationally (WHO/FAO, 1996) because it is thought to ensure adequate intake of essential nutrients and thus to promote good health.

Onim (1992) found that the contribution of milk to the improvement of protein-poor diets of small-scale farmers was significant, particularly for children. The fact that some of the respondents kept goats for milk was a good sign that they were keen on supplementing and improving their diet in terms of nutrition. The positive impacts would contribute greatly to the sustainability of the project. However, low milk production at certain times of the year, especially during dry spells of weather impacted negatively on their health leaving a deficiency in the necessary nutrients provided in milk. Furthermore, farmers did not follow recommended regimes for feed supplementation which had a negative effect on milk production. In future, this could be addressed through the training and educating of more extension officers on good animal husbandry and ensuring their accessibility to all geographical locations within their areas of jurisdiction. Overall, the dairy goat farming project had a positive outcome on food security through improving dietary diversity and adequacy of food intake among the farmers.

#### **4.3 Challenges Faced by Farmers Rearing Dairy Goats in Thurdibuoro**

The section below addresses the third specific objective of the study, 'to identify challenges faced by farmers rearing dairy goats in Thurdibuoro'. Challenges identified from the study and suggested solutions are outlined as follows:

Majority of the respondents (72%) cited long distances to be covered in obtaining food/pasture for the animals as one of the major challenges affecting the dairy goat farming project (see figure 20).



**Figure 20: Challenges Faced by Dairy Goat Farmers**

In addition to this, poor/erratic weather patterns were cited as another major challenge affecting the dairy goat farming project. Due to the harsh weather conditions in the study area, pasture could only be obtained at the shores of Lake Victoria. This was a limitation in that most of the farmers resided far away from the lake. As a result, farmers were forced to walk long distances to the lake shore to obtain feeds since areas adjacent to the lake were generally fertile and could easily be irrigated. An alternative was to hire other community members looking for casual work to do the chore at a fee but this proved costly to the farmers considering their low income. Thus alternative feed sources through feasibility studies should be identified and findings made available to dairy goat farmers. Goat milk production in Nyakach is typically very seasonal. Significant farm management changes are necessary to facilitate year round milk production (Meat and Livestock Australia, 2005). The government has a role in making small-scale loans available to enable dairy goat farmers maintain their flocks during the dry season or to

restock afterwards. Governmental and other agencies should monitor and research the pressures on land use in pastoralist zones to be able to provide support to pastoralists under pressure. Water availability may also be a serious constraint to flock survival during the dry season, especially to lactating does. Better utilization of crop residues and improved nutrition through crop residue improvement, as well as the use of fodder trees all offer hope to provide feed supplies during drought periods (Salem & Smith, 2008). However, the technologies for such simple methods to alleviate the impacts of drought and water shortages have been known for several decades, but the resource-poor farmer is often unable to implement them in severe droughts, leading to serious welfare concerns for the animals. Government assistance is vital to support the welfare of the goats as well as the farmers.

Diseases were another hindrance to good health service delivery of the project. 64% of the farmers had lost a number of their herds to diseases, the most common ones being coccidiosis and dermatitis among others. Furthermore, treatment involving the same was found to be too expensive to the farmers. There were several challenges identified which faced Animal Health service delivery in the study area. The major challenges included; inadequate trained personnel and transport at the grass root level, inadequate funds and facilities for disease control, high cost of inputs, poor management and maintenance of communal dips, irregular dipping of animals in some areas and treatment of livestock by laymen and herbalists. The dairy goat industry in Nyakach is predominantly pasture based. This represents a potential threat to the industry as it increases susceptibility of goats to intestinal parasites and foot rot (Prydon & Barreto, 2007). A recent survey has

indicated that the two most significant health problems affecting dairy goats in Kenya as identified by the Dairy Goat Association of Kenya (DGAK) are heartwater and intestinal parasites. Poor animal health and diseases are usually related to the cause of low farm productivity and indirectly to low profit margin. Farmers should be encouraged to practice good bio security standards through the adoption of good animal husbandry practice at farm level. They should also be trained to identify any abnormality that may surface in their herds and promptly report to the relevant authorities. While at the state level, efficiency in diagnosing diseases at an early stage by competent authority could also help in reducing economic losses (Jamaluddin, et al, 2012).

As much as some farmers obtained good quantities of milk, as high as 9 litres per day and were willing to obtain income from the same through sale to outsiders at a higher price, this proved difficult since the existing market favored cow's milk more. The study revealed that out of the 52% who were willing to sell their milk to outsiders, only 4% did so. Hence they ended up selling it to neighbors and friends at a much lower price. The market according to them was already saturated with buyers and sellers trading in cow's milk. Most people lacked knowledge on the benefits associated with goat's milk, hence preferred to maintain the old culture of using cow's milk which they trusted more. Furthermore, the demand for goat's milk is still low compared to that of a cow because of its goaty odor. Grading of goat's milk should be implemented to eventually deliver the quality of milk that meets customer satisfaction. A supply chain in the marketing of goat's milk from farm gate to consumer should be developed engaging wholesalers, retailers and customers. The Kenyan government can play a critical role in enhancing

these pro-poor supply networks by supporting grassroots producer cooperatives and extension services and maintaining a general environment that is congenial to small enterprise development. Among other elements, this would include strengthening animal health services, improving existing market infrastructure and developing small wholesale markets with registered slaughterhouse facilities in strategic urban locations (Chen & Ravallion, 2008).

Poor education/low literacy levels affected the dairy goat farming project in many ways all of which had a negative outcome on the community's income levels. The greatest effect perhaps was that on training of the farmers and community members on good animal husbandry and overall management of dairy goats, which required literacy. The study findings indicate that 14% of all the respondents who attended training on dairy goat farming did not make practical use of whatever they had learnt, a larger percentage of them quoting failure to understand whatever they had been taught as the reason behind it. This impacted negatively on the project since the skills taught were necessary in enhancing the success and sustainability of the project. In future, farmers should take advantage of the free primary education system in Kenya and enroll their children at a low/ no cost' to enable them get basic education.

The cost of constructing a stall for the dairy goats was quite high owing to the shortage of timber in the area. The average amount spent in constructing a stall was Kshs 9500. This could have been attributed to minimal number of trees in the study area which perhaps may have been the reason behind the poor climatic conditions facing the area. This

discouraged more farmers from getting involved in the rearing of dairy goats since they found it difficult to afford constructing and maintaining a stall at the same time. In addition, regular fights among the bucks tended to weaken the stalls easily thereby necessitating constant repairs which were costly. In future, this could be addressed by the government educating the community on afforestation and its benefits through key agricultural organizations such as the World Agro forestry Center and VI agro forestry.

Feed concentrates were inaccessible and located far away which proved another challenge to the farmers. Farmers admitted to having to travel all the way to Katito, a centre located 15 km away from the study area, to obtain feed. This proved costly due to high transport costs involved. Taking a Nissan commonly known as 'matatu' from the project area to Katito would cost a farmer an average of Kshs 100 totaling to an amount of Kshs 200 to and fro. This was slightly lower than the daily average income of a farmer of Kshs 275. Furthermore, the feeds were costly too considering the low income levels of the farmers hence the more reason why many opted to stick to natural feeds back at home. In future, this could be addressed by the government offering its support to farmers through offering them loans to develop their farming businesses and establishing agro-veterinary centers in strategic urban areas.

## **CHAPTER FIVE**

### **SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS**

#### **5.1 Summary of Findings**

The first objective of the study was to establish the contribution of dairy goat farming to household income. According to the study, a majority (70.4%) kept dairy goats expecting it would add secondary income to their families through the sale of milk and dairy goats. Most of the goats sold were less than a year old, implying a quick need for cash. A comparison of sources of income before and after the project indicated that there was a 15% increase in income from agriculture. Average monthly income for goat farmers was found to be Kshs 8258. The sale of goat milk accounted for 34% of this income. The monthly income is well above the poverty line of Kshs 1562 established by the Kenya Integrated Household Budget Survey basic report on well-being in Kenya. Most of those who sold milk (41.7%) received their milk payments on a monthly basis.

The second objective of the study was to determine the contribution of dairy goat farming towards household dietary diversity. The study established that the dairy goat farming project had a nutritional impact through increased milk consumption and environmental impact through improvement of soil fertility, which led to crop productivity (also a nutritional impact). It also had an indirect effect on diet diversification as a result of extra income attained through the sale of milk and goats, which was channeled towards the purchase of a more diverse food package which had earlier not been affordable. A balanced diet is a core part of food security. A comparison of frequency of servings of various food groups before and after the project revealed an increase in all components

except vegetables. Intake of certain foods, for example milk and milk products, meat, beans and fish, which had not been included much in the diet before the project came along, increased significantly. This was attributed to the extra income attained from the project through the sale of milk and/or dairy goats. A comparison of the frequency of servings with the recommended guidelines as per the 2006 Kenya National Guidelines on Nutrition and HIV/AIDS report revealed that 83% of the respondents had met the requirements thereby rendering dairy goat farming as a reliable economic activity for improving diversity in diets.

The fact that 18.3% of the respondents used milk for home consumption was a good sign that they were keen on supplementing and improving their diet. This was further enhanced by their decision to direct manure from the goats to their kitchen gardens which gave way to the availability of more variety of food crops. 74.7% of the respondents used manure as a means of improving crop productivity hence increased yields and a subsequent availability of a more diverse diet in terms of various food groups.

The third objective of the study was to identify challenges faced by farmers rearing dairy goats in Thurdibuoro. Constraints in smallholder dairy goat farming were evident, and translated to difficulty to achieving high levels of performance. Poor/erratic weather patterns affected the growth of pasture. Hence farmers had to walk long distances to obtain feeds for the goats in areas adjacent to the lake. Many preferred to hire local community members to collect the feed which was costly and had the implication of increasing expenditure on the project. Illiteracy highly affected training offered on dairy

goat farming as most of the farmers could not understand and therefore implement what they had been taught, resulting in lower productivity.

Most of the beneficiaries were not capable of purchasing basic dairy goat inputs thereby affecting productivity. The cost of housing was inhibitive to starting up a dairy goat enterprise, increasing expenditure as a result, but it simultaneously contributed to a reduction in disease incidences if achieved. According to the study, the cost of building an average dairy goat stall (Kshs 9500) was higher than a farmer's average income of Kshs 8258.

Limited land offered little potential for expansion for fodder production. This was further inhibited by poor weather conditions. To counter this, the farmer supplemented feed on the farm with normal pasture from food crops such as sweet potato vines.

## **5.2 Conclusion**

The study established that the Thurdibuoro Dairy Goat Farming Project succeeded in increasing household income but full potential was not realized due to a number of constraints such as diseases which affected good health service delivery and erratic weather patterns which limited year round production of milk.

There was increased diversity in household diet due to increased income which expanded access to food. Farmyard manure led to increased farm production which further allowed for production of a wider range of foods enhancing a balanced diet among the farmers.

Dairy goat farming is an activity that can generate income, provide food security and improve the livelihoods of those involved in it. This can only happen if one was to exploit the potential of the animal and apply good husbandry practices. Moreover, the industry can blossom if both the government and private sectors provide support and focus on increasing dairy goat production.

### **5.3 Recommendations**

1. More training on dairy goat farming should be undertaken through self-help groups as a strategy towards faster communication to more people. In addition to this, there is need to train farmers in rural areas develop feeding strategies for dairy goats using locally available feed resources.
2. Record keeping should be encouraged since it has the importance of enabling the farmer evaluate the progress of his farm/business by taking note of both the positive and negative outcomes/challenges and resorting to enhance and/or improve the same respectively.
3. The government should make an effort to send more extension workers to various farming areas in need of farming advice. Furthermore, increased government intervention is warranted to assist small holder farmers through provision of small loans and other benefits that will enable them, and their animals to survive in the face of adversities such as during droughts.

#### **5.4 Area for Further Research**

A number of studies have been conducted on the contribution of dairy goat farming towards the improvement of livelihoods in terms of improving income and reducing food poverty. However, rarely has any research been conducted on the role played by self-help groups, or '*chamaas*' as they are commonly referred to, in the success of Dairy Goat Farming in Nyakach. From the study, it is clear that self-help groups play an important role in spreading important information on key developmental issues occurring within the rural set up. Furthermore, many government agricultural officers and those from the local Community Based Organizations (CBOs) and NGOs prefer to train farmers in gatherings, for instance, in self-help groups because it simplifies their work and makes it easier to communicate to the group members, who normally have an interest in common. Many studies in the past, however, have focused more on working with individual farmers. Further studies should therefore be conducted to determine whether dairy goat farming can actually turn out more successful when undertaken by farmers as a group/in groups rather than individually.

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**MASENO UNIVERSITY**  
**SCHOOL OF PLANNING AND ARCHITECTURE**  
**MASTER OF ARTS IN PROJECT PLANNING & MANAGEMENT**

**HOUSEHOLD QUESTIONNAIRE**

**A. GENERAL INFORMATION**

Household ref. no \_\_\_\_\_

Date of interview \_\_\_\_\_

Sex \_\_\_\_\_ Age \_\_\_\_\_ (years)

**B. SOCIO ECONOMIC AND DEMOGRAPHIC INFORMATION**

1. Marital status \_\_\_\_\_

2. Household size: Male \_\_\_\_\_

Female \_\_\_\_\_

3. Children living in the household

No. of children	< 5 yrs	5-10 yrs	10-17 yrs
Boys			
Girls			

4. Relationship with household head \_\_\_\_\_ Tick sex of hh

sex	F	M
-----	---	---

5. Main occupational status (tick one)

agriculture	fishing	Self employed	Formally employed	Housewife
Housemaid	Casual laborer	student	Retired/ not active	Other

6. What main sources of income were there in your household before the project? (tick all that apply)

Sources of income	Own	others
-------------------	-----	--------

Employment for cash		
Employment in kind		
Non- farm self employment		
Selling agricultural produce		
Selling fish and sea food		
Rent		
Other		

7. What main sources of income are there in your household currently? (tick all that apply)

Sources of income	Own	others
Employment for cash		
Employment in kind		
Non- farm self employment		
Selling agricultural produce		
Selling fish and sea food		
Rent		
Other		

8. What is your average monthly income in kshs?

Monthly income	Kshs (Before the project)	Kshs (After the project )
Own		
Living spouse		
Additional household income		

9. Highest level of education:

- No education
- Primary
- Secondary

- College
- University

10. Size of land owned in acres:

- a) Under pasture \_\_\_\_\_
- b) Under crops \_\_\_\_\_

**C. DAIRY GOAT FARMING EXPERIENCE**

11. Have you attended any training on dairy goat production?

- a) Yes \_\_\_\_\_
- b) No \_\_\_\_\_

12. If yes, have you made practical use of the skills

- a) Yes
- b) No
- c) Partly

13. Reasons for not making practical use?

- a) Could not afford
- b) Not appropriate
- c) Too demanding
- d) Did not understand

14. How did you come to learn about dairy goats?

- a) Word of mouth
- b) Farming magazines
- c) Radio
- d) Others

15. What are your reasons for keeping dairy goats?

- a) Little space
- b) Milk production for home consumption
- c) Milk production for secondary income
- d) Meat production
- e) Others

16. Number of goats owned per farmer?

a) Male \_\_\_\_\_

b) Female \_\_\_\_\_

Total \_\_\_\_\_

17. Feeds used

a) Normal pasture

b) Improved pasture

18. Reasons for not using improved pasture (If respondent answers Yes for 17, b)

a) Difficult to grow

b) Non conducive weather

c) Shortage of land

d) Others.....

19. Do you use feed concentrates?

a) Yes

b) No

20. If no, why don't you use feed concentrates?

a) Too expensive

b) Not necessary

c) No reason

d) Other.....

21. Where do you confine your goats?

a) Stall

b) Tethered in an open area

22. How much did you spend on the construction of the stall?.....kshs (if the respondent chooses option A above.)

23. Where do you dispose off manure from the goats?

a) Fodder plot

b) Crop field

c) Both crop and fodder plots

d) Other

24. What is the impact of the manure on crop production? (If the respondent chooses option B or C above):
- a. Improvement
  - b. No change
25. What effect does the manure have on the purchase of fertilizer?
- a) The same quantity
  - b) Less as a result of the dairy goat enterprise
  - c) I don't use fertilizer
26. What health care practices do you apply on your goats?
- a) Deworming
  - b) Spraying
  - c) Vaccination
  - d) Other.....
27. What is your main source of labour in dairy goat production?
- a. Family labor
  - b. Hired labor
28. What is your average dairy milk production per day in litres? (use 300ml bottle as a unit of measurement).....
29. Do you sell the milk?
- a. Yes
  - b. No
30. Who do you mostly sell it to? (if the respondent answers YES above):
- a. Neighbors and friends
  - b. Outsiders
  - c. Both
31. Of the amount of milk produced daily, what is the average amount allocated (in litres) towards:
- a. Home consumption.....
  - b. Marketing.....
32. How much does a 300ml bottle of goat milk cost?.....

33. Do you receive milk payments:

- a. Daily
- b. Weekly
- c. Monthly
- d. Annually

34. Do you sell dairy goats?

- a. Yes
- b. No
- c. "Pass on"

35. If yes, at what price? (The interviewer to probe further for differences in prices depending on the size/maturity and compare this to that of the indigenous goat).....

.....  
.....  
.....

36. How do you spend income obtained from the sale of milk and/or dairy goats?.....

.....  
.....

37. Do you keep records of milk yields?

- a. Yes
- b. No

38. Why do you think record keeping is important?

.....  
.....  
.....

39. What are some of the challenges you face in dairy goat production?

.....  
.....  
.....

40. Suggest measures to improve dairy goat farming

.....  
.....  
.....

*The section below covers dietary diversity aspect/ contribution of the dairy goat farming project towards a diverse diet taking into account the fact that the project's duration at the study area since its inception had been two years by the time of the study*

41. How frequently do you eat or drink servings from the following food groups each day in the past twenty four months?

1) Vegetables:

- I. Daily
- II. Weekly
- III. Monthly
- IV. rarely

2) fruit and fruit juice

- I. daily
- II. weekly
- III. monthly
- IV. rarely

3) milk/milk products

- I. daily
- II. weekly
- III. monthly
- IV. rarely

4) meat, beans, fish

- I. daily
- II. weekly
- III. monthly
- IV. rarely

5) breads, grains, ugali

- I. daily
- II. weekly
- III. monthly
- IV. rarely

42. How frequently do you eat or drink servings from the following food groups each day in the past thirty six months?

6) Vegetables:

- V. Daily
- VI. Weekly
- VII. Monthly
- VIII. rarely

7) fruit and fruit juice

- V. daily
- VI. weekly
- VII. monthly
- VIII. rarely

8) milk/milk products

- V. daily
- VI. weekly
- VII. monthly
- VIII. rarely

9) meat, beans, fish

- V. daily
- VI. weekly
- VII. monthly
- VIII. rarely

10) breads, grains, ugali

- V. daily
- VI. weekly
- VII. monthly
- VIII. rarely