

THE NUTRITIVE STATUS IN TWO DIFFERENT
SOSIO-ECONOMIC GROUPS IN HANANG AND MBULU
DISTRICT AND INTRODUCTION OF DAIRY PRODUCTS FROM
GOATS AS A FOOD SOURCE IN TANZANIA

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**The nutritive status in two different socio-economic groups in
Hanang and Mbulu district and introduction of dairy products
from goats as a food source in Tanzania**

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Ås 2012

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Abstract

This study has been designed to investigate whether there is a difference in nutrition and livelihood in two socioeconomic groups in Hanang and Mbulu district, Tanzania. The two groups consist of modern people working as nurses at Haydom Lutheran Hospital, and traditional people with foremost farming as occupation and income. The focus in this survey is on children and youth, since they need nutritious food to develop well. The other aim of the study is to look at the interest in using goat milk yoghurt among adults in Hanang and Mbulu district. The analysis in this study is based on data collected through two questionnaire surveys. The data collected through the nutrition survey was used to identify the households, collect information about nutrition and livelihood status and the use of milk and milk products in the two groups. The data from the yoghurt survey was used to look at the marked possibilities for goat milk yoghurt at Haydom and Mulbadaw area.

Every household in the nutrition survey was asked for daily, weekly and monthly choice of foodstuffs to get a view of what people were eating in this area. The food intake for an average child was recorded and results were used to look at the amount of calories consumed. Questions about the use of milk and milk products were asked to get a picture of the importance of milk. For the marketing test of yoghurt every respondent was asked to taste three types of goat milk yoghurt and answer questions concerning the survey.

The results of the nutrition survey show that there is a slightly better livelihood and nutrition for people defined as modern compared to the traditional group in this study. The results of the marketing test of goat milk yoghurt show that there is a huge potential in selling the product in this area.

Sammendrag

Denne studien har blitt designet for å se på om det er en forskjell i ernæring og levevilkår i to sosioøkonomiske grupper i Hanang og Mbulu distriktet, Tanzania. De to gruppene består av moderne mennesker som jobber som sykepleiere ved Haydom Lutheran Hospital, og tradisjonelle landsbyfolk som først og fremst er bonde til yrke og har det som inntektskilde. Fokuset i denne undersøkelsen er hovedsakelig på barn og unge, siden de trenger næringsrik mat for å kunne utvikle seg godt. Det andre formålet med dette studiet er å se på interessen blant voksne i Hanang og Mbulu distriktet for å kjøpe og/eller produsere yoghurt laget av geitemelk. Analysene i denne studien er basert på data samlet gjennom to spørreskjema. Dataene samlet gjennom ernæringsstudiet ble brukt til å identifisere husholdninger, samle informasjon om ernæring og levevilkår og bruken av melk og melkeprodukter i de to gruppene. Dataene fra yoghurt studiet ble brukt til å se på markedsmulighetene for yoghurt laget av geitemelk i Haydom og Muldbadaw områdene.

Hver husholdning i ernæringsundersøkelsen ble spurt om daglig, ukentlig og månedlig valg av matvarer for å få et bilde av hva folk spiser i området. Matinntaket for et gjennomsnittlig barn ble målt, og resultatene ble brukt til å finne ut hvor mange kalorier som blir inntatt. Spørsmål om bruken av melk og melkeprodukter ble spurt for å få et bilde av viktigheten av melk. For markedsundersøkelsen av yoghurt ble hver deltager spurt om å smake på tre forskjellige typer yoghurt laget av geitemelk, og svare på spørsmål i forbindelse med undersøkelsen.

Resultatene fra ernæringsundersøkelsen viser at det er en liten bedring i levevilkår og ernæring for mennesker som er definert som moderne, sammenlignet med landsbyfolk i denne oppgaven. Resultatene fra markedstesten av yoghurt laget av geitemelk viser at det er et stort potensiale i å selge produktet i disse områdene.

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1. Introduction

“Lack of access to and availability of food – the key factors behind food insecurity – remain central concerns in Africa” (Benson, 2004).

The recommended calorie intake per person per day is 2100. While in Tanzania the average intake is 1970 calories per day. This means that each day the average person in Tanzania has a shortage of 130 calories and cannot maintain a healthy BMI (Body mass index). This is substantiated by the fact that forty-four percent of children in Tanzania age of six month to five years are stunted and twenty-nine percent are underweight (Benson, 2004). Tanzania is a country where malnutrition is a major problem and is reported to be one of the main causes of death among children below the age of five. Diarrheal diseases, malaria and maternal death are some of the diseases of which malnutrition is an important contributing factor (Mondal et al., 2006) (Shirima et al., 2005).

In tropical areas of the world, malaria is a significant public health problem. A general improvement in dietary intake through improved child nutrition is likely to have a very large impact in reducing this disease. The staple foods to children usually consist of cereals. Ugali has high carbohydrate content, but lacks adequate amount of protein and minerals notably iron (Fe) and zinc (Zn) especially. According to World Health Organization (WHO) a person needs 20 grams of animal protein daily. While the average Tanzanian person gets less than five grams each day (WHO). Milk is important in the diet for children as it consists of a high amount of protein, minerals as iodine, zinc, calcium, magnesium and vitamin A and B. Goat meat also contribute to a higher intake of quality protein. Therefore small scaled farmers have been encouraged to start milk production on smaller ruminants such as goats to avoid malnutrition problems. It has been found that milk production from goats is a cheaper way to improve living standards compared to cows. Though it may not increase income significantly, it is a way to cover some of the nutritional demands and reduce the risk of malnutrition (Benson, 2004).

Results from the PANTIL-program (Programme for Agricultural and Natural Resources Transformation for Improved Livelihoods) indicate that introduction of dairy goat keeping leads to increased house-hold income and reduced vulnerability (Eik et al., 2008). In a pilot-

trial initiated in Mgeta during PANTIL, it was found that there was high market-potential for processed milk such as yoghurt, and that milk may play an essential role for improved human nutrition, especially in children's diet (Kifaro et al., 2007). A pure breed Norwegian dairy flock of goats was established at Haydom during PANTIL to improve the milking capacity of the Small East African meat goat. The flock has been multiplied for sale as well as production of milk and milk products for Haydom Lutheran Hospital and its surrounding township (EPINAV, 2011).

In Mgeta yoghurt is a product that has gained much popularity (Lie, 2011). Individual farmers bring milk to a centre that was established in 2009, where it is sold either fresh or processed into yoghurt. It is the first place in Tanzania where farmers process goat milk (EPINAV, 2011).

This study has been designed to investigate whether there is a difference in nutrition and livelihood in two socio-economic groups with emphasis on children in Hanang and Mbulu district. The other aim of the study is to look at the interest in using goat milk yoghurt among respondents in Hanang and Mbulu district.

2. Literature review

2.1 Agriculture in Tanzania

For Tanzanians natural resources are most important both for the present and future generations. These resources include forests, wild animals, fish, minerals, biodiversity and wetlands. The area cultivated/planted in Tanzania is only five percent of the total of 939,700 square kilometers (TNW- Tanzania National Website).

Agriculture is the most important source of national income, export, food security and employment. About eighty percent of all Tanzanians work within the agricultural sector. Smallholders dominate this sector and have an average farm size between 0.9 and 3 ha. The most common way to cultivate the crop area is by hand hoe (70 %), followed by ox plough (20 %) and tractor (10 %) (TNW- Tanzania National Website).

Major challenges in the agricultural sector are decreasing labor and land productivity due to poor technology, unreliable and irregular weather conditions. Prolonged droughts have devastating effects such as crops failures and livestock losses that are causing food shortages (Kijazi & Reason, 2009).

2.2 Animal husbandry and poverty reduction

Livestock production is one of the major agricultural activities in Tanzania with about thirty percent of the agricultural GDP (Gross domestic product). Farm animals contribute to national food supply, converts rangelands resources into products suitable for human consumption and is a source of income and alternative savings to banks. About forty percent from the animal sector of the agricultural GDP comes from beef production, thirty percent from milk production and the remaining thirty percent from poultry, goat and other small stock production.

Crop production and especially maize which is grown extensively by smallholders, is the key sector for reducing both poverty and undernourishment in Tanzania (Pauw & Thurlow, 2011).

“The goat has been a servant of mankind for generations and today offers huge potential for transforming the lives of some of the poorest people in the world” (Peacock, 2005)

Goats are possibly the most important animal to reduce poverty in Africa. The animals can play a vital role in supporting families since they are more resistant to crises such as droughts and floods. Compared with cows goats are smaller and are easier to move and they also have a faster reproduction rate than the cow (Peacock, 2005). Goat milk and products are feeding more malnourished people in the developing world than cow milk (Haenlein, 2004). It is estimated that over eighty percent of the world's goat population is located in developing countries in Africa and Asia (Silanikove et al., 2010).

2.3 Milk and milk products as an important nutrient in the diet for Tanzanians

Traditionally, milk has been considered to be a fundamental food in the diet of many cultures. Milk provides easy digestible proteins with balanced amino acid profiles, minerals and vitamins important for maintaining bodily functions (Silanikove et al., 2010). Milk and milk products are an important source of protein, energy, calcium, potassium, phosphorus and riboflavin (Qiao et al., 2011).

Tanzania consumes a small amount of milk compared to their East African neighbors even though the number of cattle and dairy goat are higher. A Tanzanian person consumes in average 39 liters a year (2007) compared to 100 liters in Kenya and 50 liters in Uganda. The recommended consumption by The World Health Organization is 200 liters per year. The reason for the low milk consumption is mainly due to low purchasing power and cultural reasons. The most popular milk products are fresh milk (98 %) and fermented milk like sour milk and yoghurt. A part of the reason for this is that most milk is consumed locally (90 %) and is mostly unprocessed (RLDC, 2010).

Studies have shown that fermented milk products, such as yoghurt, have good nutritional and health value. Especially when it comes to probiotic fermented milk products which contain A-, B-, and/or C- bacteria¹. Probiotic bacteria are living microorganisms who contribute with both health and welfare to the host, because they have influence on the gut flora and intestinal

¹ A, B- and C bacteria is different type of lacticacid bacteria that naturally exist in the intestine and acts as a part of the digestive system. Probiotic bacteria are the general term for this type of bacteria.

mucosa. Without A²-, B³- and C⁴- bacteria the intestine function is poor, because these bacteria are lactic acid bacteria which exist naturally in the human intestines acting as a part in the digestive system. If people consume products containing these bacteria, it can help to achieve a good gut flora (Hemmer et al., 2001).

Milk fermented products can give many health- promoting effects. In the early 20th century, Nobel price winning scientist Ellie Metchnikoff came up with the theory that people increased their longevity when consuming large amounts of yoghurt. Today there is much research on the topic “probiotic health benefits” and how probiotic bacteria positively affect the human body. It is claimed that probiotic bacteria help maintaining a normal gut- and urinary tract flora, decrease lactose intolerance and blood cholesterol, protecting against intestinal cancer and helps stimulating the immune system. Organisms that are capable of fermenting lactose, like in yoghurts, may diminish the lactose content of the diet, therefore increasing the digestibility of milk products in children with diarrhea. Because of this effect, yoghurt may be better tolerated than nonhuman milk in children suffering from diarrhea (Hemmer et al., 2001).

Flavored yoghurt can be an easier way to provide children with important nutrients. Plain yoghurt added some fruit and sugar will get a better and sweeter taste. But it is important that it does not consist of too much sugar.

2.4 Goat milk vs. cow milk

The content of fat in cow milk and goat milk are very similar. But there are a few characteristics in goat milk fat that differs from cow milk fat. Goat milk fat has a higher percentage with smaller size of the fat globules than cow milk fat, which results in the softer texture of goat milk products. Those smaller fat globules of goat milk make a better dispersion and a greater surface area of the fat for better digestion by lipases (Silanikove et al., 2010). Goat milk contains a higher proportion of medium-chained fatty acids; caproic

²A bacteria = *Lactobacillus acidophilus*.

³ B bacteria = *Bifidobacterium bifidum*

⁴ C bacteria = *Lactobacillus GG*

(C6:0), caprylic (C8:0) and capric (C10:0). These fatty acids are partly responsible for the “goaty” odour of goat milk and are also known to be anti-bacterial, anti-viral, inhibiting development and dissolve cholesterol deposits and being absorbed rapidly from the intestine (Silanikove et al., 2010). The greater amount of the β -casein protein in goat milk compared to cow milk makes goat milk closer to human breast milk. This protein is important for the structural and nutritive differences between goat and cow milk. Goat milk proteins are more digestible than those of cow milk, which seems to be due to the higher levels of α_{s2} -casein in relation to α_{s1} -casein (Haenlein, 2004).

Goat milk contains less of the main carbohydrate lactose than cow milk (4.1 % vs. 4.7 %) and more of the minerals calcium, phosphate and potassium (Silanikove et al., 2010).

2.4.1 The Twasowe project

A dairy goat project was conducted in three villages in Mgeta division in Morogoro. In 1988 Norwegian dairy goats were introduced with the aim of improving livelihood of small hold farmers by improving their nutritional status and increase income level. It started with a group of ten goat keepers who called themselves Twawose which mean, let us go together. By 1999 the number of goat keepers had increased to 50 and by 2009 there were approximately 380 keepers, owning 1538 goats of a dairy breed. This project was considered a success when studies in the 1990s showed that the aims of the project were fulfilled (Eik et al., 2008).

Twawose who was from the beginning a farmers’ association joined a group and became co-operative in January 2010. Twawose developed a project in 2007 with the aim of add value to the goat milk. The goal was to process and sell goat milk yoghurt. A case study done by Lie (2011) showed that goat milk increased by fifty percent in value when being processed into yoghurt. In Mgeta the farmers bring fresh goat milk to the shop where it is processed and sold on the market. This was done twice a week when the market was open.

In this thesis yoghurt was chosen as the marketing product for several reasons. Milk deteriorates rapidly in hot environments and conditions. If farmers want to benefit from milk production beyond home consumption, processing is necessary to have a long longevity. If the yoghurt temperature and quality is good, longevity can extend up to one week. Secondly, fermented products are claimed to be more nutritious and healthier compared to fresh milk

(Bille et al., 2000). And not at least, the project done in Mgeta got successful results, hoping this yoghurt project will do the same if conducted in a similar way.

2.5 Lactose intolerance / allergy

Lactose intolerance is present in persons who are lacking lactase enzyme. In that case will not lactose split to galactose, and glucose is causing flatulence and diarrhea in the colon (Nes et al., 1998). Approximately eighty percent of adults in the world have lost their ability to split the glycosidic bond in lactose (Adolfsson et al., 2004). Milk and milk products are often eliminated from the diet for these persons who may lead to nutrition-related diseases caused by calcium deficiency (Qiao et al., 2011).

It is indicated that lactose intolerant adults can adapt metabolically to tolerate a certain amount of milk with long-term milk consumption (Qiao et al., 2011). This can decrease flatulence (gas) and diarrhea. Qiao et al. (2011) suggests that the amount of milk per sitting should be less than 250 ml.

Yoghurt has many benefits for lactose intolerant persons. During fermentation, the lactose content of milk is reduced by up to thirty percent. The reduction of lactose and the active enzymes released from the cultures have been shown to improve the digestibility of the milk and yoghurt for lactose intolerant individuals (Adolfsson et al., 2004).

Cow milk allergy is an abnormal immunological reaction to cow milk proteins. Reactions not involving the immune system are defined as cow milk intolerance. Cow milk is one of the most common food allergies in children (El-Agamy, 2007). Allergy to cow milk is caused by proteins where the most common are casein, α -lactoglobulin, β -lactoglobulin, bovine serum albumin and γ -globulin. These compounds are postulated to be allergenic and can cause an immune-mediated response. Goat milk lacking α -s1 casein, which is the main casein in cow milk, is proven to be less allergenic and more like human casein (El-Agamy, 2007).

Milk allergies and gastro-intestinal disorders is a significant segment in many populations of developed countries. Goat milk is proven to be a useful alternative to cow milk for rehabilitating undernourished children and to give less allergenicity and better digestibility in children allergic to cow milk (Haenlein, 2004). Although it is found that some children with cow milk allergy did not tolerate goat milk (Bellioni-Businco, 1999) and caution is needed

before considering goat milk as suitable and safe substitute for feeding children allergic to cow milk (Ballabio, 2011).

2.6 Food availability, eating habits and nutritional status

For some Tanzanian diet consists mostly of maize and other starchy food where preparation involves pounding and boiling. High-starch foods can sometimes be mixed together with relish in small amounts. Tea with sugar is often consumed together with food or as snack in-between meals. The average eating frequency is three times per day. A study performed by Mazengo et al. (1997) show that the Tanzanian diet consist mostly of carbohydrates and lack both fat and protein. Protein- energy malnutrition is a common problem in Tanzania.

Tanzania is a country where a large number of the population suffers from malnutrition and micronutrient deficiency, especially children under the age of five years, child bearing and lactating women (Abdulai et al., 2004). Deaths as a result from chronic malnutrition among children below five years has a percentage of 43.8 (Mohammed et al., 2009). Inadequate food and factors that influence nutrient utilization in the human body is usually causing malnutrition (Abdulai et al., 2004). It is believed that there is a correlation between income growth and nutritional status, and that increased income and nutritional intervention is needed to adequately tackle malnutrition. But a study done by Alderman et al. (2006) did not see any evidence available to support this claim.

Meat, milk and other animal products or fruits and vegetables is often consumed in insufficient quantities. Mainly two reasons are causing this, either because they are given low preference due to lack of knowledge about nutrition, or because they are not affordable (Abdulai et al., 2004). According to Mohammed and Spyrou (2009) another problem is poor access to nutritious food, a decreased bioavailability of the elements in food, excessive loss due to infectious diseases or a combination of these factors. In countries, such as Tanzania, depended on cereals as their staple food, Iron (Fe) and zinc (Zn) deficiencies occur mostly as a nutritional deficiency. This is because cereals contains chemicals called phytates which binds up with minerals such as Fe and Zn then forms insoluble salts thus hindering their absorption in the gastrointestinal tract. The severity of malnutrition especially among young children is further aggravated by the prevalence of parasitic infections which increase both the

morbidity and mortality rates in children (Mohammed & Spyrou., 2009). Detailed knowledge about the interaction between food prices, household socioeconomic characteristics, food and nutrient choice is therefore required by food and nutritional policies (Abdulai et al., 2004).

According to Abdulai et al. (2004) there are very few published studies who examined household food and nutrient demand in Sub-Saharan Africa.

Another problem people in Tanzania faces is the seasonal climate changes. A study done by Rowhani et al. (2011) showed that changes in climate between and within season have a significant impact on crop yields. The results from the study with mixed model analysis show that there is a significant relationship between yields in the cereals sorghum, rice and maize, and seasonal mean precipitation, with an increase in precipitation favoring yields.

3. Material and Methods

3.1 Description of the study area

3.1.1 Location

The research area was conducted in Hanang District and Mbulu District of Manyara Region. The interviews took place in 4 different villages which included Gawidu, Darjameda, Ngalangala and Haydom Lutheran Hospital farm and development LTD (Malbadaw farm) where we also had our base. Haydom Lutheran Hospital is the only study area in Mbulu district; the other villages are located in Hanang district.

Haydom Lutheran Hospital is situated on a highland plateau at an altitude of 1650 - 1850 meters. West of Haydom lays a branch of the Great Rift Valley that forms the Yaeda valley (1300 meters) and to the east close to the other study areas is the extinct volcano Mt Hanang (3480 meters) (Patil, 2004).

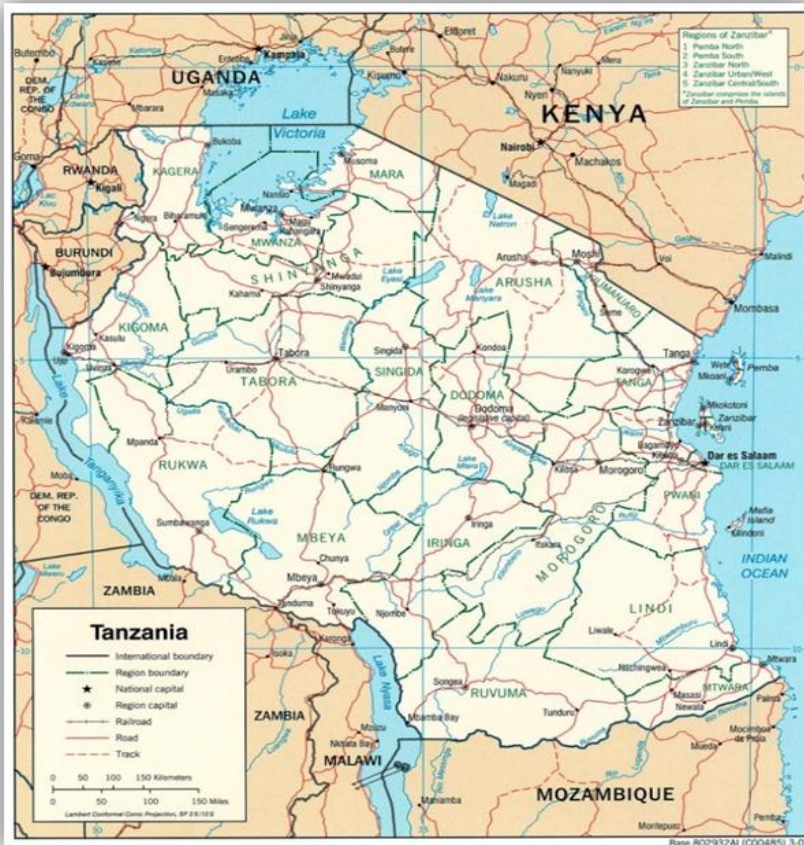


Plate 1. Tanzania

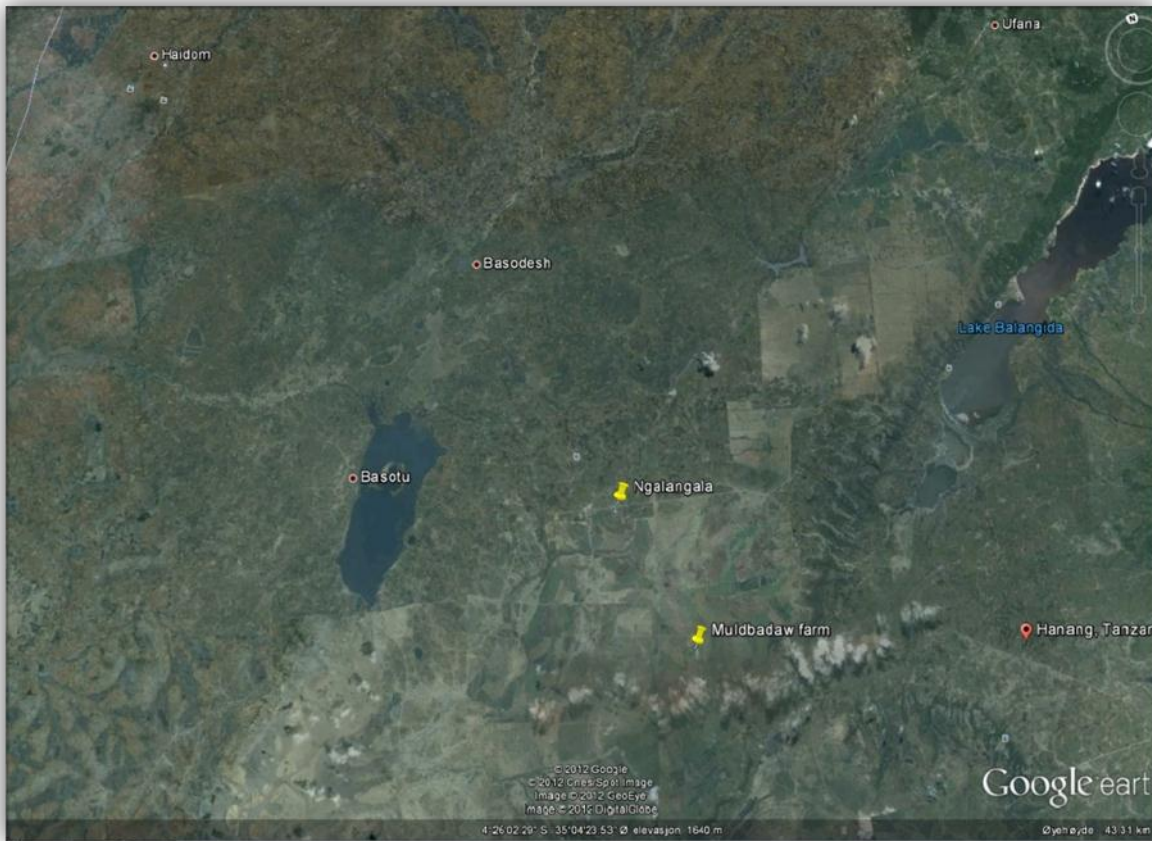


Plate 2. Satellite picture showing Haydom in Mbulu district and Ngalangala, and Mulbadaw farm in Hanang district.

3.1.2 Climate and geology

The climate in this area is semi-arid and brings two seasons of rain each year. Mid-March to the end of May are known as the long rain season, in November and parts of December comes the short rain season, making major parts of the year dry. The temperature ranges from 20°C to 30 °C and varies throughout the year. January is usually the warmest month and July the coolest, but this is closely related to altitude (Patil, 2004). The relative humidity ranges from fifty-five to seventy-five percent (Safari et al., 2011).

The vegetation type in the study area is mainly wooded grassland with soil that is characterized by clay loam, silt clay to clay textures (Safari et al., 2011).

3.1.3 The people

In the area where the research took place, Datoga and Iraqw people dominates. Iraqw also called Mbulu, originates from the Cushitic people (Winkler et al., 2010). The Barbaig is a

tribe of the Datoga people who originates from the Noetic people (Sieff, 1999). These two tribes are mainly living in the northern parts of Tanzania and both have low average income. Iraqw are subsistence farmers (Pantil, 2004) and Datoga is agro pastoralist dependent on livestock keeping as their main source of income (Sieff, 1999). Zebu cattle, goat, sheep and donkey are the species most common kept, animals suitable for herding. Many people also keep chicken, ducks, dogs and some own pigs. For the Datoga and Iraqw people, cattle have the highest economic and social value (Winkler et al., 2010). Iraqw people also get a lot of their earnings from selling agriculture products (Pantil, 2004). Difference between tribes is getting smaller as the tribes no longer live that separated. Over the last decades intermarriage has become more common (Pantil, 2004).

3.1.4 Socioeconomic groups

In this study two different socioeconomic groups are investigated. The grouping was based on a combination of three variables; occupation, income and education. The options of occupation in the questionnaire are; grow crops, livestock keeping, wage employment, trade or a combination of them. Main income earning activity has the same response options. In the question concerning education will separate those with no formal education from respondents with college education. Based on these variables two groups are designed; the traditional group and the modern group. Education higher than primary one to seven, wage employment as main occupation and as main income earning activity are criteria set to be part of the modern group. To make sure we got a modern group, twenty women working at Haydom Lutheran Hospital were asked to participate. Because of lack of staff, tight schedule and few female doctors, only nurses were asked to answer the questionnaire.

3.1.5 Haydom Lutheran Hospital

Haydom Lutheran Hospital (HLH) was established by Norwegian missionaries in 1953 (Attebery et al., 2010). HLH is located in Mbulu district of the Manyara region. After the German defeat in 1918 it led to the establishment of the British administration (Kilonzo & Simmons, 1998). When the planning of building Haydom LH started, the British Protectorate government requested placement of the Hospital in the southern highlands of the Mbulu District. The chosen area was sparsely populated at the time of the building, it is recorded that only one family lived in the vicinity of the hospital. The reason for that was the tsetse fly

(Patil, 2004). Infected tsetse fly can transmit a parasite in humans that can result in a disease called “African sleeping sickness” when bitten (WHO, 2012). As a problem solver the government tried to destroy the vector’s habitat by clearing the bush; which worked successfully for both human and cattle (Patil, 2004).

Today the hospital has 350 beds but usually there are 400 patients each day. Around 400 000 people in the four closest districts are relying to this hospital. In 2005 Haydom Hospital bought the 5300 hectare big Mulbadaw farm from the government. Over time the farm is supposed to cover a great deal of the expenses from the hospital (Haydom.no).

3.2 Data collection

For the first questionnaire (appendix 1) sixty women representing their household were interviewed in five different villages representing two different groups. In this thesis only woman were participating. Naturally the head women of the household answered the questions since she knows most about eating habits and nutritional status in the household.

The first group consists of people living in small rural villages and the second group are living and working at Haydom Lutheran Hospital.

The second questionnaire (appendix 2) regarding the yoghurt project, thirty-five people participated from two villages, respectively Mulbadaw farm and Haydom Lutheran Hospital. At the hospital the interviewing took place in the cantina and other random places outside. The participants were randomly picked, but the target group was first and foremost wage employees and people with a steady income, capable to buy yoghurt.

The questionnaires were either taken in English or in Kiswahili, the latter being the main language in eastern Africa. The main assistant/translator had a Bachelor degree from Sokoine University of Agriculture, and had done a similar survey before. But some other people were also used to question the respondents.

3.2.1 Sampling procedure

The investigators went to Tanzania for seven weeks to do the fieldwork. The fieldwork was carried out in the end of February 2012.

A questionnaire survey for the nutrition mapping was made and sixty households were interviewed. Households were chosen randomly in the neighborhood with help from the key informants. The first two days were spent in Gawido, the following day in Mulbadaw and Darjameda that lies just outside the farm, and the last day was spent in Ngalangala village. Data were obtained by interviewing households that took approximately forty-five minutes for each interview.

A questionnaire for the yoghurt project was designed in collaboration with Helene Lie and the yoghurt was made at Mulbadaw farm. The products for marketing included plain yoghurt, yoghurt added sugar and yoghurt added vanilla extract for better flavor. The goal with this marketing test was to make local people more aware of goat milk and goat milk products. Until to now goat milk and goats milk products are not well known in the northern parts of Tanzania. A similar project has been performed earlier in Mgeta, southwest in Tanzania. The marketing test was done in three days and performed as a blinded sample test. The forty-six test persons were chosen randomly and interviewed separately to avoid influence from others when answering. Three bottles, each containing the different yoghurt types, where used to pour the content into a glass witch the tester drank from. Because of lack of glasses and washing possibilities, all three products where poured into the same cup without washing in-between. We assume that this did not affect the results. After trying all three products the respondent answered the questionnaire. Sample testing and answering the questionnaire took approximately ten minutes per respondent.

3.3 Tools for data collection

3.3.1 Food frequency questionnaire

The food frequency questionnaire was used to obtain information on variety of foods and food intake (appendix 1). The interviewer went through a long list of foodstuffs noting if the household used the food daily, weekly or monthly. The respondents were also asked if they cultivated or traded food crops. The results from the food frequency questionnaire was summarized and viewed in a figure (figure 4.1).

3.3.2 “24-hour recall questionnaire”

A 24-hour recall questionnaire was used to record what type of food the household had consumed for breakfast, lunch and dinner during the last 24 hours (appendix 1). The respondents were asked to list the average amount of food their child had consumed. This was used to estimate the average intake of calories for a child in this study.

3.4 Accounting

All information collected from both questionnaires was plotted in a statistical program (SPSS 12. for Windows) and calculations were done for data which could be quantified. Excel 2003 was used to make simple calculations and figures.

3.5 Limitation

Because of ethical reasons anthropometric measurements like weight and height could not be done in the nutrition part of this study. This affects the nutrition mapping results since the calorie intake could not be compared with the nutritional status of the children.

Misunderstandings between the supervisors and between the supervisors and the authors of the study delayed the fieldwork and objectives were shifted several times. This caused some problems that were eventually solved.

3.6 Reliability and validity

Reliability is based on the consumption that the answers from the respondents are accurate. Results reported in this study reflect the information collected from respondents. Based on the results in this study respondents have sometimes given inaccurate information not matching other information they have given. The use of several interviewers and translators can also cause misunderstandings and inaccurate results. This is taken in consideration.

Validity is based on answering the objectives in this research.

4. Results and discussion

The purpose of this chapter is to present the results of the data relevant to the three objectives for this research work: (1) Food consumed by the two different groups, (2) The importance of including milk in the diet and (3) Results from the marketing test of goat milk yoghurt. The first two objectives have focus on children. The general characteristics of the study population will be presented first.

4.1 The people

The modern households had a mean of 1.2 ha, and the traditional households had a mean of eight acres. This difference may be caused by the fact that the modern group is wage employed and the traditional group is more dependent on their land to get income and food. Forty-five percent of the land that traditional respondents own is hundred percent cultivated compared to thirty percent of the modern group.

4.1.1 Education

There is considerable evidence that a correlation exists between the nutritional status of the children and the education level of their parents, and especially with their mother. Mothers with more education are more knowledgeable about the care they need to provide their children. Therefore ensuring that girls attend their full educational potential and introducing nutrition in primary education as soon as possible is most important (Benson, 2004).

Table 4.1 show that there is a difference between the two groups regarding education level.

Table 4.1. Education level in each group (%).

Education level	Traditional	Haydom
No formal	25	
Adult education	2,5	
Primary 1-7	55	5
Secondary	12,5	35
Collage	5	60
Total	100	100

Among the traditional respondents 25 percent has no formal education and only five percent has college education, while 55 percent have primary education. All of the modern respondents are nurses with a higher education. This is reflected in the results as 60 percent of the respondents have college education.

4.1.2 Occupation and main income

As mentioned before agriculture is the economic mainstay of people living in rural areas. Crop production and keeping livestock is meant to both give an income and to supply the household with food. However some people, like nurses, have the possibility of stable employment with a monthly salary.

Table 4.2. Occupation and main income earning activity in each group (n).

	Traditional	Haydom
Main income: (n)		
Grow crops	3	0
Livestock keeper	3	0
Wage employment	4	15
Grow crops and livestock keeper	27	0
Grow crops and wage employment	1	1
Wage employment, grow crops and livestock keeping	1	4
Trade, grow crops and livestock keeping	1	0
Total	40	20
Occupation: (n)		
Grow crops	6	0
Livestock keeper	7	0
Wage employment	4	17
Grow crops and livestock keeper	20	0
Grow crops and wage employment	1	0
Wage employment, grow crops and livestock keeping	1	3
Trade, grow crops and livestock keeping	1	0
Total	40	20

Main income earning activity and occupation is growing crops and livestock keeping among the traditional group (table 4.2). Wage employment was as expected the main income and profession amongst the modern group. Some of the nurses were also dependent on growing crops and livestock keeping as earning activity beside their employment at the hospital. Some of the households in the traditional group fit the description of the modern group, because they were traditional officers or had other jobs instead of farming as main source of income.

4.1.3 Household composition and size in this study

In this study a household is defined as site where a group of people residing together under the same roof, independent if there was kinship to one another, but dependent on each other socially and financially. Table 4.3 present the household age- and gender distribution in the two different groups.

Table 4.3. Household composition of each group (%).

		Traditional	Modern
Male (%)			
Age group	0-5 years	14	8
	6-14 years	32	29
	15-30 years	34	29
	31-40 years	10	21
	41-60 years	9	13
	>60 years	1	
	Total	100	100
Female (%)			
Age group	0-5 years	12	7
	6-14 years	34	11
	15-30 years	26	53
	31-40 years	14	18
	41-60 years	10	11
	>60 years	5	
	Total	100	100

Table 4.4. Household size in the two groups.

	Modern	Traditional
Min	1	4
Maks	8	17
Average	4	8

The average household size consists of six individuals, including adults and children, ranging from one and up to 17 members. The traditional group has overall more members in the household compared to the modern group. The numbers include both children and adults, and age is varying between one and more than 60 years. The household size for the traditional group is larger than the 4.8 average obtained by Tanzania National Bureau of statistics in their 2007/2008 survey (NBS, 2008). The household size of the modern group is below average. Table 4.4 shows that the average number of the household is larger in the traditional group than the modern group. There can be several reasons for this. For example that there are many of the nurses at Haydom Lutheran Hospital who are single and not have their own family yet. Some nurses live alone or in houses by the hospital together with other employees. In the villages it is more common for women to get married at a younger age. Some men also have more than one wife, all living in the same household. There is also a problem with lack of knowledge around the consequences about unprotected sex, and women get more children than they possibly would have had if protection was available. However in Tanzania a decline in population growth is observed both in urban and rural areas in recent years (NBS, 2008).

The majority of the respondents in the traditional group were married. Half of the women in the modern group were also married, while the other half were either single, divorced or cohabits. Cohabits meaning an unmarried couple living together in a long-term relationship. The relatively high numbers of single women in the modern group maybe due to the fact that many of them are students.

4.2 Customs

4.2.1 Food consumed daily, weekly and monthly

The major subsistence staple crops in this area are maize, rice, sweet potato and cassava (figure 1).

The typical African diet consists of these starchy staple foods accompanied by a “side dish”. The most common way to serve staple food is in the form of a porridge called “ugali” made of maize. This dish provides a lot of energy but is low in nutrients. The side dish is called “mboga” and consists of a mixture of onions, tomatoes, green leafy vegetables and peas or beans. The availability and content of mboga changes with season. Fish and meat are included when available and affordable. Green leafy vegetables known as mchicha represent a big part

of the diet. These wild plants are especially rich in nutrients like calcium and vitamin A. As cereal-based foods often contain less of the amino acid lysine, wild vegetables can complement this as they are richer in this amino acid. (Vainio –Mattila, 2000)

Food availability varies through the year. Households from the modern group are more food secure than the traditional group. Half of the traditional respondents denote the food availability as sufficient and thirty percent do not consider themselves as food-secure throughout the year.

Results from the food frequency questionnaire show that the households eat around sixty different foodstuffs. The composition of different foodstuffs discussed here originates from Tanzania food composition tables by Lukmanji et al. (2008).

Maize is the most important staple food in Tanzania and about sixty percent of cultivated land planted is maize. It was introduced from the West Indies via Europe in the 16th century. Seventy-five to eighty percent of the maize produced is consumed at household level (Mushi et al., 2007). Maize flour contains 360 Kcal per 100 gram of food, 8 gram of protein, 3.6 gram of fat and 77 gram of carbohydrates. Almost all households in the modern group ate maize daily, only two weekly. The traditional group had the same results with thirty-seven out of forty eating maize daily and only three eating weekly. Most of the households cultivate their own maize crops and some also bought additional maize at the market.

Rice is for most Tanzanians not affordable on a daily basis. The chemical composition of rice grain and maize flour may vary depending on their genetic factor, on the environmental conditions and degree of milling and conditions of storage. Phytic acid is high in these foods which implies low absorption of Fe and Zn and possible deficiency (Mohammed and Spyrou, 2009).

Thirteen of the traditional respondents are eating rice weekly and eleven monthly. In the modern group more respondents are eating rice daily and fifteen of twenty are eating rice weekly. All respondents buy rice.

Sorghum is only eaten by a few of the respondents. This cereal contains a bit more protein of better quality than maize but less of the other macro-nutrients. Maize-, rice- and sorghum-flour are generally low in essential amino acids.

Cassava is a root fruit that contains very little protein and therefore is unsuitable as main food source for children. The crop is generally grown by poor farmers living in areas with difficult

climatic and soil conditions. It is exceptional tolerant to drought and acid soils, and therefore suited in areas where others crops fail to grow (Hillocks et al., 2002).

Only one respondent from the traditional group consumed cassava once a month. Among the modern respondents one eats daily, four weekly and six monthly. Most of them buy the crop. Cassava leaves are also eaten and have a nutritional value similar to other green leaves from pumpkin, sweet potato and other wild green leaves. An increase in the consumption of these leaves would reduce vitamin A and iron deficiency and supply additional calcium and vitamin C (Latham, 1997). Home grown cassava leaves are eaten mostly monthly by the traditional households. In the modern group five respondents are eating weekly and three monthly, both purchased and home-grown.

Sweet potatoes are very similar to cassava and contain little protein. But they are quite rich in vitamin C. and carotene. Sweet potato leaves are eaten and are similar to cassava leaves and other green leaves. Both groups consume sweet potatoes mostly on a weekly and monthly basis, purchased.

Beans and peas are an important source of protein (22 %) in African households where meat and fish not are affordable on a daily basis. They are richer in calcium and iron than most of the cereals, and the protein content is of a higher biological value.

Twenty-seven traditional households consume beans daily mostly from own production. Thirteen modern household consume beans daily, mostly from own production. Cowpeas and pigeon peas which are consumed are also homegrown.

Groundnuts contain a lot of fat (45 %) and more protein than animal meat (27 %). They also contain rich amounts of vitamins and minerals, and are energy-dense. If these nuts could be included in the average African diet malnutrition could be avoided (Latham, 1997). Nine respondents of the Traditional group eat groundnuts on a monthly basis. In the modern group seven are eating weekly and six monthly. Both groups are buying the nuts.

Tomatoes and onions are vegetables that play an important role in the diet. They are rich in vitamin C and A, and contain a significant amount of minerals. Thirty traditional household use onions daily and twenty-one tomatoes, both foodstuffs are mostly purchased. The modern households also use these vegetables daily, and mainly bought from the market.

Fruits are available in a rich variety. The availability depends on the climate, the local tastes for fruit, the species cultivated and the season. Citrus fruits like oranges, tangerines, grapefruits and lime contain a lot of vitamin C. Papaya and mangoes contain both vitamin C and carotene. Guavas are widely grown and contain five times more vitamin C than citrus fruits. Avocado is very rich in fatty acids with is lacking in many African diets (Latham, 1997). Mango and oranges are most eaten in the traditional group. The results from the modern respondents show a much more frequent fruit intake and variety compared to the traditional households.

Meat contains about 19 percent high quality protein in addition to a high iron content. The energy value of meat varies with the fat content. Meat provides useful amounts of riboflavin, niacin, thiamine, small quantities of iron, zinc and vitamin A and C. Hygienic practices are essential for meat to be safe for human consumption thus is a challenge in countries like Tanzania where refrigerators are seldom available. Traditional households are eating meat weekly and monthly and beef, goat and chicken are equally often consumed. Poultry meat is mostly from own production while goat and beef is also bought. Pork is rarely consumed by traditional households but seven modern households eat pork monthly. More modern households eat meat daily and weekly and are purchasing most of it.

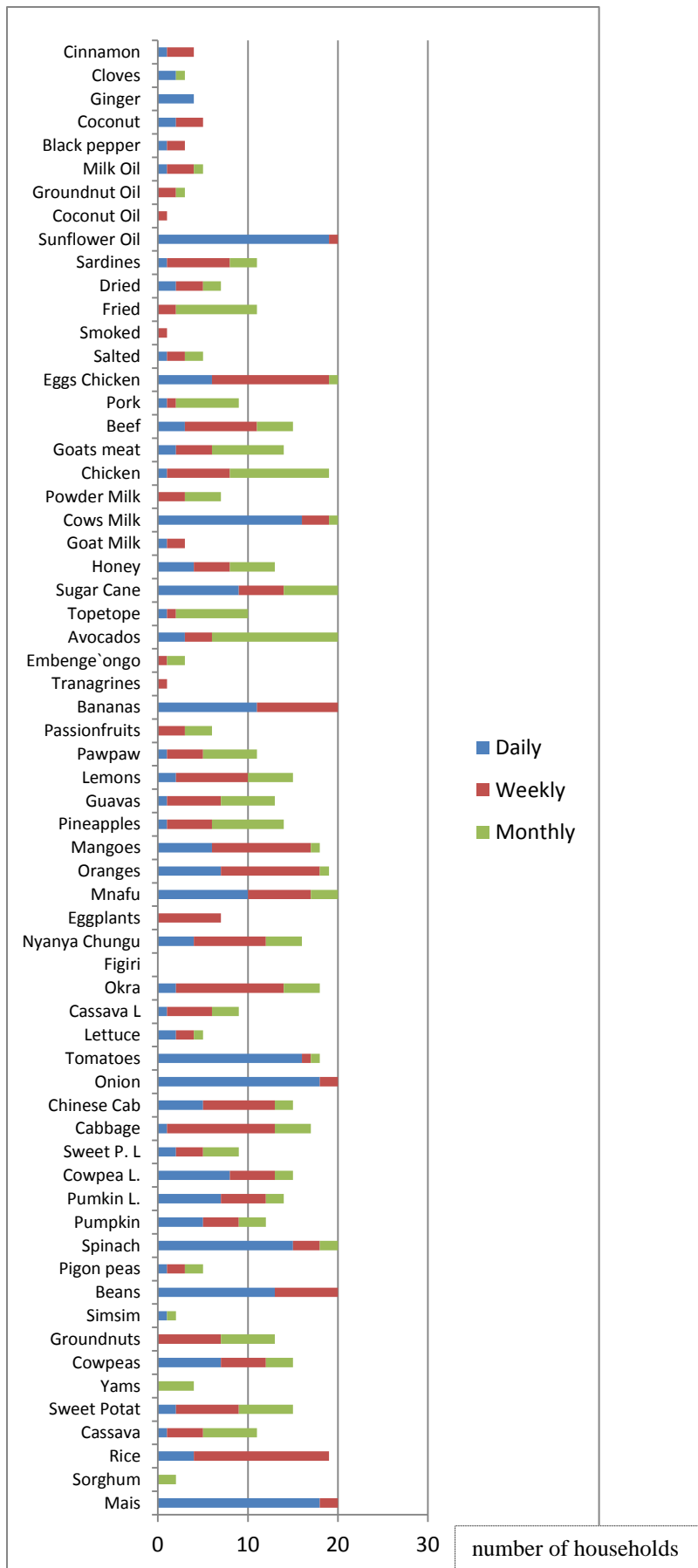
Fish is also a valuable source of good quality protein and contain seventeen percent or more. Fish contain much of the same nutrients as in meat. Where water is available fish provides a simple way of increasing the protein consumption. Fried fish is most frequently consumed by both groups, and modern households also eat substantial amounts of sardines.

Milk as mentioned before, is highly nutritious and therefore important in the diet of both children and adults. Thirty-three of forty traditional households drink cow milk daily and two drink goat milk daily. Sixteen of twenty modern households drink cow milk daily and one household drink goat milk daily. The reason for goat milk being less popular than cow milk is that there are few dairy goats in this area. But the taste also has an impact. Powder milk is more commonly used by modern households.

Eggs are rich in fat, contain protein of excellent biological value, calcium, iron, vitamin A and D, riboflavin and thiamine. Eggs are small, frequently laid, easily prepared, easily digestible and are often more easily available than other high-quality food. Eggs are eaten mostly weekly in both groups. Traditional households have their own production while modern households buy them.

Oils are made from different oil seeds like sunflower, sesame, coconut, groundnut and milk. In the study area sunflower oil is most popular.

Spices are used for tea and in food. Black pepper, cloves and ginger are most used by Traditional households, and modern households also use coconut and cinnamon.



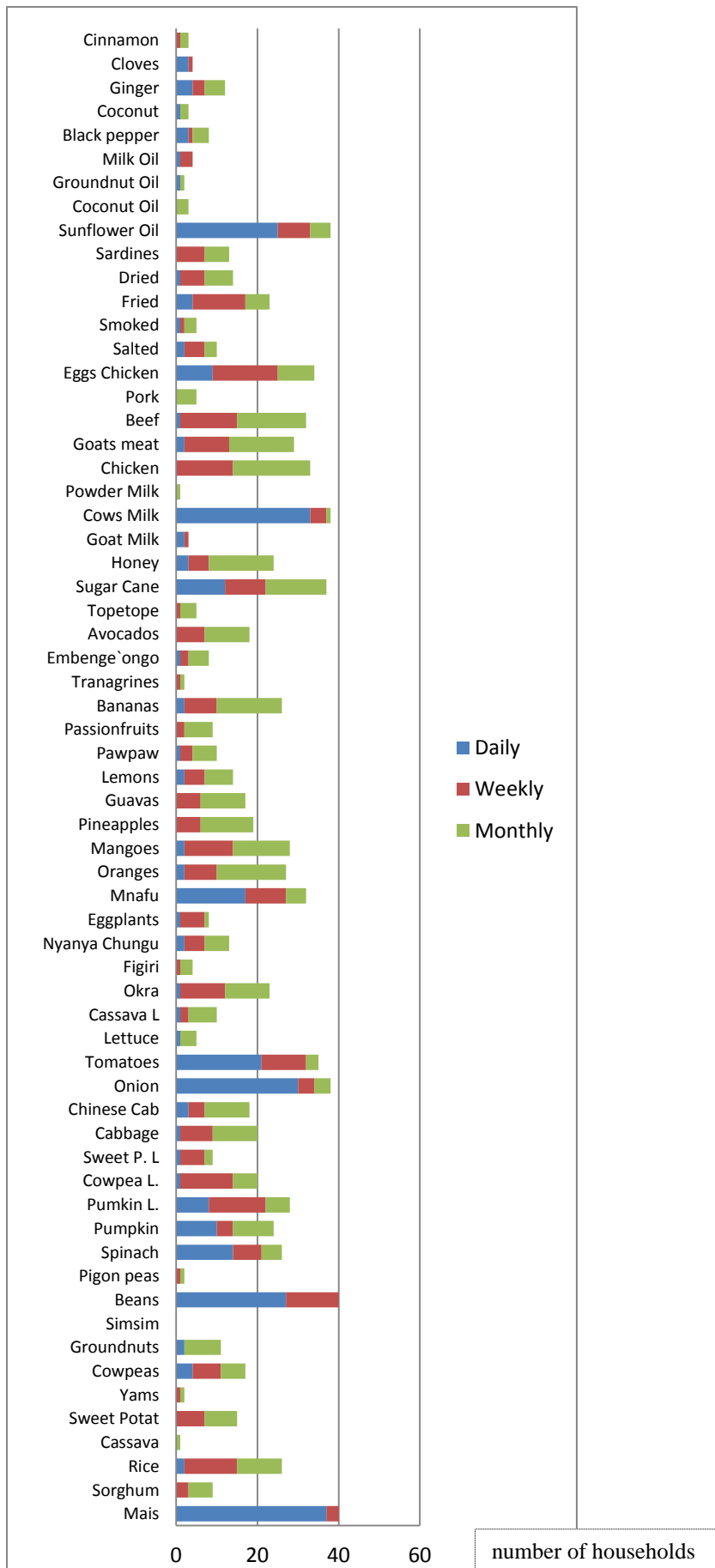


Figure 4.1. Food intake daily, weekly and monthly in respectively modern households and traditional households, given in numbers of households.

From figure 4.1 the main differences in the use of different foodstuffs are shortly described here. Both groups have maize as their main staple food and sorghum is more consumed by traditional households. Rice is more used in modern household maybe because this group can afford to buy it more often. Beans are often eaten instead of meat in a meal and both groups consume equally much beans daily. Respondents from the modern group use more cultivated green leaves like spinach and cowpea leaves, and has a much higher daily intake of fruits. In both groups eighty percent of the households drink cow milk daily and five percent drink goat milk daily. Two respondents from the traditional group answered that they did not drink milk at all. If an average person in this survey drinks one cup of milk daily this becomes 70 liters a year, which is below the 200 liters recommended by WHO but above the average consumption in Tanzania of 39 liters.

Modern households eat more meat and more different types of meat daily than traditional households. Beef is more consumed in the modern group and goat is the main meat eaten in the traditional group. Eggs are more used in the modern group.

Modern households consume more varied foodstuffs on a daily basis. They eat more meat, cultivated leaves and fruit, and therefore get a higher intake of protein with good biological value, minerals and vitamins. Wild leaves were not taken in consideration in this questionnaire, and it is possible that traditional households have a higher intake of this leaves since they are more available at the countryside.

4.2.2 Intake of nutrients for an average child

In this study the households were asked to describe what type of food and the amount of food their children consumed the last twenty-four hours. The amount of food was often measured in plate, cup, table spoon and in pieces. According to Tanzania food composition tables of Lukmanji et al. (2008) one plate is 500 ml, one cup is 200 ml, one tablespoon is 15 ml and a small piece of for example chicken is 50 gram. From the traditional group, seventy-three percent of the households answered this question and forty percent from the modern group. Calorie intake is very important for maintaining a good bodily function. Especially for

children who have less volume than adults, it is important that the diet provides enough energy. The diet should also meet the requirements needed for different amino acids, vitamins and minerals.

Table 4.5. Composition of some nutrients of the ingredients mostly used in meals (Tanzania food composition tables).

Ingredients	Calorie s ⁵	Protein s ⁶	A- Protein s ⁷	Fat ⁸	Carbohydr ates ⁹	Fe(mg)	Ca(m g)	Zn(mg)	Vit.A(mikro gr RE)
Tea with sugar	45.4				9.1				
Milk whole	60	3.2	3.2	3.3	4.5	0.1	115	0.4	28
Maize ugali	123.8	2.7		1.2	25.6	1.2	2	0.6	
African-Donut	316.6	5.2		10.5	50.6	0.6	7.6	0.4	
Chapati with oil	372.6	5.9		19.5	43.9	0.7	9.9	0.4	
Kidney beans boiled	127	8.7		0.5	22.8	2.9	28	1.1	
Rice fried and boiled	174	2.6		7.4	24.6	0.6	7	0.4	87
Spinach, cooked	23	3		0.3	3.8	3.6	136		819
Beef, cooked	323	24.9	24.9	24		1.7	4	4.1	
Chicken, raw	200	18.8	18.8	13.2		1	9	1.3	27
Fish, sardines	112	21.4	21.4	2.3		0.9	48	0.4	43
Tomato, ripe	21	0.9		0.3	4.6	0.5	5		87
Maize porridge with milk and sugar	130	1.2	0.8	1	30	0.4	61.2	0.4	55
Cashew nut	589	20		52.2	20.4	3.7	266	2.9	
Sunflower seed	588	26.4		54.8	9.4	7.8	131	10.3	7

From the results of this study an average child eats between 200 to 400 ml of porridge and drinks 200 ml of tea for breakfast, around 250 ml of ugali and 50 grams of beans for lunch and the same for dinner. The amount of energy consumed from breakfast varies from 91 calories from one cup of tea with sugar to 566 calories from three donuts and one cup of tea with sugar.

For lunch the calorie intake varies from 120 from one cup of milk to 934 calories from 500 grams of rice and 50 grams of beans. Calorie intake for dinner varies from 212 from 120 grams of ugali and 50 grams of beans to around 900 calories from 500 grams of ugali, 100 grams of chicken, some tomato and sauce. The average calorie intake consumed for a child in

⁵ Calories per 100 grams of food

⁶ Proteins per 100 grams of food

⁷ Animal protein per 100 grams of food

⁸ Fat per 100 grams of food

⁹ Carbohydrates per 100 grams of food

this study is around 260 for breakfast, 373 for lunch and the same for dinner.

The average calorie intake recommended for children from the age of four to fourteen years old are around 1670 to 2100 calories (Nes et al., 1998). In this study the average calorie intake is around 1000 which is the recommended value for one to four year old children. The children in this study are from different ages from zero to fourteen years old, but the main group are children from six to fourteen years old. This means that according to Nes et al. food tables (with the same values as the American food tables), the children of respondents are consuming less calories than required. Consuming too little energy over time leads to malnutrition and nutrient deficiencies. Additional vegetables, sauce, some meat and a cup of milk will increase the calorie intake and make the meal more nutritious.

Common deficiencies in Tanzania are lack of protein, vitamin A, iron, iodine and zinc.

Vitamin A deficiency causes eye damage and can lead to blindness. Table 4.5 shows that green leaves like spinach are very important to add adequate vitamin A to the diet, also containing a lot of other important micronutrients like iron and calcium.

Iron deficiency weakens the immune system and physical performance caused by a reduced capacity for oxygen transport. Meat, liver, blood, bread, cabbage and green leaves are good sources of iron (Nes et al., 2008). As mentioned before milk is an important source of protein, energy, calcium, potassium, phosphorus and riboflavin. The results show that it is common to drink a cup of milk or sour milk beside the meal and to have milk in porridge and tea. Some of the children have nuts, milk and sugar in their porridge, providing a nutritious meal. Nuts like cashew from table 4.5 are extremely high in energy and fat, and contain good levels of most minerals. Pulses and nuts are also high in vitamin B₉ important for pregnancy and fetus development.

Of all the three meals, maize dominated the main course of the meal; in porridge and as ugali for lunch and dinner. This result confirms previous studies (Patil, 2004).

More children from the modern group consume porridge for breakfast and eat more meat and vegetables for lunch and dinner, indicating a higher intake of calories. The children from the modern households consume more different foodstuffs and a higher intake of micronutrients than children from the traditional group. These results agree well with the results from the food frequency questionnaire.

4.2.3 Eating habits

Breakfast has been labeled the most important meal of the day. A study done by Rampersaud et al. (2005) show that children eating breakfast on average basis, tend to have better nutritional profile than those who skip breakfast.

Children start school early in the morning and many of them have to walk or cycle a long way first. The long way to school for some and to be alert and concentrate during a long school day requires a lot of energy. In a study carried out by Simeon and Grantham-McGregor in 1989 they found out that foremost malnourished, stunted and wasted children were adversely affected on cognitive functions when they missed breakfast. Other studies done in European countries also show that breakfast consumption may improve memory, test grades and school attendance. A healthy breakfast can positively impact children's health and well-being (Rampersaud, 2005).

Table 4.6. Breakfast for children going to school.

	Traditional	Modern
Tea	16	5
Ugali and beans	1	
Cow milk	6	5
Porridge	7	8
Ugali	4	
Leftovers	5	
Chapati	3	1

Of the sixty households, sixteen did not have children in their household. Table 4.6 shows that tea, cow milk, porridge and chapati are eaten for breakfast by the children in both groups. Porridge is the food mostly consumed in the modern group. In the traditional group tea is given as only source of energy to the children in sixteen of the households. In some households tea or milk was served as a drink beside for example porridge or leftovers. Bread or other type of food such as fruits, where also sometimes served as a secondary food.

More children from traditional households eat lunch at school. Almost $\frac{1}{4}$ of the children in both groups that do not eat lunch at school live nearby and walk back home to eat. Other children bring food with them to school or by food at school. Children from five traditional

households (46 %) and one modern household did not eat at all. Ugali and beans are the most common food consumed at school among the children to the households participating in this test. In one modern household, children only drink tea at school. Research undertaken on school feeding indicate that this intervention can help children`s educational progress, particularly if children are malnourished. If the school meal provides a well-balanced diet it can improve children`s nutrition status and establish good dietary habits (Grantham-McGregor, 2005).

Three meals a day or more is the recommended meal frequency. 77.5 percent (31 people) of the traditional group are eating three meals per day and 22.5 percent (nine people) of those surveyed reported that they eat twice daily. Dinner seems to be most important. The reason can be, in some cases the mid-day meal or breakfast is exchanged with tea which in some cases is seen as a meal. Members of households in the modern group are used to eat three meals per day and one person eats four meals per day.

4.2.4 Water

In sub-Saharan countries, water availability is considered as a great challenge. With only two periods of rain, Tanzania lays dry big parts of the year. At the time the fieldwork was done the rain season was just around the corner after a long drought period and water availability was not to good. In many of the villages where the study was carried out, the residents had access to a well. Some had a short walk and others had to walk several kilometers. In bigger villages such as Haydom, tap water was available. Only few people were forced to get water from river or dam. When water availability is good water can be extracted from near-by well, in dry periods these sources may dry out and other more distant water points are used.

The modern households are more satisfied with the water availability when the research was conducted; eighty percent answered the question with good or sufficient compared to forty-five percent of the traditional group.

Preparation of drinking water is very important to achieve a good hygiene and avoid contamination. More knowledge about this is essential and can also be the reason why there is a big difference in the method of preparations between the two groups.

Table 4.7. Water preparation.

	Traditional	Modern
Boiling	20	11
Add water guard	1	0
No preparation	18	1
Other	1	8
Total	40	20

According to table 4.7 boiling was the significant choice for water preparation in both groups. Almost half of the Traditional group did not prepare the water at all compared with one household in the modern group. Some households use boiling or adding water guard or other combinations of the different water preparations.

4.3 Animal information

Increased poverty and food insecurity in agriculture based countries requires productivity revolutions in a smallholder farming (World Bank, 2007). In sub-Saharan Africa (SSA), sixty-six percent of the total population lives in rural areas and approximately ninety percent of them depend on agriculture for their livelihoods (Asfaw, 2012).

The modern households had on average 1.2 ha of land, while the traditional households had a mean of three ha. This difference may be due to the modern group are wage employees and the traditional group are more dependent on their land to harvest food for own use and sell or exchange surplus crops for income. Forty-five percent of the land owned by traditional respondents, is hundred percent cultivated compared to thirty percent of the modern group.

4.3.1 Animals kept and their purpose

Many residents in Tanzania own animals. The animals may be kept for several reasons like social obligations, income or animal products. In table 4.8 the animals most commonly kept is shown. Ninety-two and a half percent (37 people) of the traditional group own animals and in the modern group fifty-five percent (11 people) keep animals.

Table 4.8. Type of animals kept in the different groups.

Animals	Traditional (%) N = 37	Modern (%) N = 11
Goat	73	91
Sheep	46	55
Cattle	89	91
Chicken	84	100
Donkey	32	9
Ducks	11	18
Other	22	0

Table 4.8 shows that among the traditional household's cattle are most popular, followed by chicken and goats. Other animals are for example dogs, cats and pigs. In the modern group all the households who keep farm animals have chicken, followed by goats (91 %) and cattle (91 %). The number of animals of each species was higher in the traditional group. The reason why poultry is a popular animal to keep is that they are cheap to purchase and easy to maintain, and providing eggs and meat.

The respondents kept the animals for all the different purposes, but a higher percentage in the Traditional group had animals for social obligations compared to the modern group, respectively thirty-two percent (12 households) and twenty-seven percent (3 households). It is hard to say if this is truthfully answered since it is an intimate question. A higher percentage of the modern group keeps animals for income.

All of the respondents in the modern group are keeping animals for meat and egg purposes, and ninety percent (10 households) keep them for milk. Only twenty-seven percent (3 households) keep animals for draft power. Animals used for this purpose are mainly donkeys but also cattle are used. Only nine percent (1 household) in the modern group owned a donkey.

Traditional households keep animals for milk (86 %), egg (84 %) and meat (86 %). The reason why the sum is not a 100 percent can be because of the social obligations. A large number of animals, especially cattle, are traditionally a sign of wealth.

Seven household only eating meals twice a day, answered that they do not keep animals for social obligations or income. But they exploit all of the animal products their animals give them. They may have few animals and in general little money since they eat twice a day and only use the animals within the household.

Almost every household from the traditional group keep animals, compared to only half of the modern group. As mentioned before, the entire modern group has wage employment. Because of this they are not that depended entirely on animals for food or income. Some nurses are students with a low income, and still need animals and their products for money and food. The households in the modern group also own less acres of land and therefore cannot keep large herds of cattle.

4.3.2 Lactating animals

Cattle are a good source for both meat and milk. Crossbreeds of local breeds and European dairy cattle are very suitable in tropical countries like Tanzania. The number of improved cattle for milk or meat has increased three times from 1995 to 2008. But Manyara region has the lowest milk production in Tanzania due to the keeping of unimproved Zebu cattle (NBS, 2008). Crossbreeds of goats are more used for milk, and much more effective than the local goat. Two point eight percent of the goat population in Tanzania are dairy goats, counting for one percent of the milk produced during the wet season (NBS, 2008). As mentioned before goats are easier to keep than cattle, and important for reducing poverty and improving human nutrition.

Table 4.9. Average numbers of lactating animals and average amount of milk produced per day.

	Lactating animals		Amount milk (liter)	
	Cow	Goat	Cow	Goat
Traditional	3,3	2,9	2,0	2,0
Modern	2	2	4,0	0

The average number of lactating cows in traditional households was 3.3 and 2.9 in the modern households (table 4.9). The highest number of lactating cows in one household was ten, and they gave in average one liter milk per day. One respondent in the traditional group had a cow who gave ten liters of milk in average each day. She was also the only one who had lactating goats and used their milk for drinking or making goat milk products. This respondent had participated on a project done on Mulbadaw farm some years earlier with cross breeding milking cows and goats. The average milk production for goats in Tanzania is one liter during wet and dry season (NBS, 2008).

The average milk production per cow per day in Tanzania is three liters during wet season and two liters during dry season (NBS, 2008). This agrees well with our findings in the traditional group, since the fieldwork was carried out in the end of the dry period. The average amount of milk is higher among modern households which can be due to that they have more crossbreeds.

Of the thirty-three traditional households with cattle thirty households had cattle in milk at the time the field work was carried out. Ten modern households own cattle and eight of them were producing milk.

4.3.3 Watering frequency and distance to water point

Water is the main nutrient requirement for humans and animals and is essential for survival. A lactating cow of a dairy breed needs up to a hundred liter of water each day to produce a high amount of milk (Cardot et al., 2008). In Sub – Saharan countries this is hard or impossible to accomplish, especially in the dry seasons when water availability is low. The Tanzania Shorthorn Zebu (TSHZ) and the local goats are well adapted to this type of climate, but milk and meat production is low because of the harsh environment (Hansen, 2004). In this survey the respondents were asked how many times per day and week the animals had access to water and distance to nearest water point in dry and rain season.

A higher percentage of the traditional group give water to their animals continuously in rain season (78.4 %) than the modern group (40 %). For the modern group there is not a big difference between dry and wet season. In the traditional group there is a bigger change. In dry season a higher percentage of the traditional group are only watering their animals every other day (45.9 %), 18.9 percent have continuously access to water and 32.4 percent get water once per day. One household give their animals water less than once per day.

Average distance in kilometers is almost the same for the two groups in both rain and dry season, but the traditional group had a bit longer average distance both seasons. Maximum distance was twenty-five kilometers for both groups in dry season. In rain season the traditional group had a maximum distance of twelve kilometers and the modern group only two kilometers.

Animal health is often a problem in developing countries. Veterinary services are often not available or expensive, and the animals are more often slaughtered instead of treated or living in pain without getting treatment (Kambarage et al., 1995). One of the questions in the

questionnaire referred to health problems within the livestock. Fifteen (44 %) of the respondents in the traditional group answered that their animals had some health problems. In the other group four respondents (44 %) had animals with health problems, which give the same percentage in both groups. Some of the diseases on the livestock seen in this survey are coughing, skin infections, ECF (east coast fever), BB (Bovine Babesiosis) and anaplasmosis, which is a tick born disease like BB. Manyara region has the highest proportion of livestock infected with tick problems in Tanzania (NBS, 2008).

4.4 Milk information

Milk is healthy and beneficial for humans and consists of nutrients important for the body. It is estimated that seventy percent of the total milk production in Tanzania comes from smallholder dairy farmers (Njombe & Msanga, 2009). Due to cultural beliefs that milk is a children's drink, there is traditionally low milk consumption in Tanzania. Ninety-eight percent of people drink fresh milk and the remaining consume fermented milk (RLDC 2010). Milk from cows is most common consumed in developing countries and goats are mostly kept for meat. It is seen in other studies that dairy goats are gaining popularity, particularly to the poor (Njome & Msanga, 2009).

The questionnaire contains questions concerning if the respondents use of milk and milk products from both cows and goats. The aim of this study was also to increase the awareness of goat milk and goat milk products since this is new knowledge for many people, making some of the questions a follow up to the yoghurt project (chapter 4.5).

4.4.1 Milk to children

All of the respondents with children in both groups answered that they gave milk to them. Three households in the traditional group gave milk from both cows and goats, the rest of the households used only cow milk which is much more common to use than goat milk. Preparations of fresh milk where in almost all cases boiling. Five respondents from the modern group also prepare the fresh milk by adding water and sugar. One respondent from the Traditional group prepared fermented milk by adding water and sugar. Another question asked was if the respondents were aware if any children or adults in the

household had milk intolerance. Only one household from each group were aware of that they had a case of cow milk intolerance.

4.4.2 Processing milk products

Goat milk products were not processed by any of the groups. Sixty-seven and a half percent (27 households) of the traditional group and seventy percent (14 households) of the modern group processed cow milk products. The products processed were yoghurt, ghee, butter and sour milk. The latter being the most popular product in both groups with respectively 74.1 percent in the traditional group and 57.1 percent in the modern group. Fourteen households made more than one product, and the most common combination was butter and sour milk. Only one respondent from each group made yoghurt. Seven (25.9 %) and three (21.4 %) households from respectively the traditional group and the modern group processed ghee. There were no big differences between the two groups when it comes to what kind of cow milk products being processed.

4.4.3 The interest in buying cow milk products

Many households keep cattle and produce some cow milk products for own use. But families without the ability to produce milk must rely on buying from farmers or from the local market.

Table 4.10. Frequency of buying cow milk and cow milk products in both groups (%).

	Traditional (%) N = 40	Modern (%) N = 20
Yes, daily	10	25
Yes, weekly	12,5	40
Yes, monthly	15	5
Less than monthly	17,5	5
No	45	25

The higher percentage of traditional respondents owning animals than the modern group, indicates that traditional households are more self-sufficient. Seventy-five percent of traditional households have lactating cows compared with forty percent of modern households at the time the fieldwork was done. This means that traditional households do not have to buy milk as often as modern households (table 4.10). There are some other reasons why some of

the traditional group do not buy milk; too expensive, hard to get or not interested in buying. The majority from the traditional group and the modern group who do not buy milk or milk products state it is because of sufficient own production.

Seventy-five percent of the modern households buy milk or milk products; forty percent buy weekly, twenty-five percent daily and five percent monthly or less than monthly.

Fresh milk is most commonly bought by both groups. In the traditional group, 45.5 percent of the respondents buying milk products (22 households) buy sour milk compared to 13.3 percent in the modern group (15 households). Approximately twice as high percentage in the traditional group buy butter compared to the modern group, and two participants from the modern group buy cheese. One household from each group purchases ghee, which is a type of milk oil.

RLDC (2010) reported that the product range in the market from Tanzanian processors, sell a relatively small amount of fresh milk (5 %). However the intake of sour milk is high with 54 percent followed by UHT (long lasting) milk (23 %), yoghurt (12 %) and cheese (11 %). Also a small percentage (2 %) consists of products like ghee, butter, sour cream and cottage cheese. Most milk is consumed locally and sold through informal markets. Due to the costs, milk is sold unprocessed. This supports the results found in this study.

4.4.4 The interest in buying goat milk products

To increase the awareness around the use of goat milk and goat milk products, the nutrition questionnaire contained some leading questions (appendix 1). The respondent was asked if the household would be interested in buying goats milk products if introduced. The options they could choose from are shown in table 4.12.

Table 4.11. Interest of buying goat milk products in the two groups (%).

	Traditional (%) N = 40	Modern (%) N = 20
Yes	17,5	10
Yes, if I could afford it	15	5
yes, if I could get some information about the advantages	20	20
Yes, if it is healthy for my family	5	5
No, not interested	42,5	60

The traditional group was more positive about introducing goat milk products, but lack of money is a bigger issue in this group. Not many households cared about the health benefits (5 %) for their family, but a larger percentage (20 %) in both groups would be interested in some information about the advantages as shown in table 4.11.

Without any tasting like in the yoghurt marketing test (see chapter 4.8), the respondents were asked if they would like to buy one or more of the following goat milk products; yoghurt added sugar or flavor, yoghurt without sugar, butter, all of the alternatives or other products. Yoghurt without sugar was the most favorable product (52.2 %) in the traditional group, followed by butter and “other products”. Almost seventeen percent of the traditional households would buy yoghurt added sugar and 8.7 percent would buy yoghurt added flavor. One participant was interested in buying all the different products.

The percentage distribution was different in the modern group. The majority of the respondents would buy other goat milk products (37.5 %), followed by yoghurt without sugar, butter and yoghurt added flavor.

Another question asked was if the household would be interested in keeping dairy goats and selling goat milk products. The answer options here were also leading in the meaning to increase some awareness around the benefits with dairy goats.

Table 4.12. Interest in keeping dairy goats and selling goat milk products (%).

	Traditional (%) N = 40	Modern (%) N = 20
Yes, dairy goats supply with good milk for my children	42,5	5
Yes, I can produce milk products which I can sell or utilize	17,5	5
Yes, it is cheaper and easier to keep dairy goats than dairy cows	7,5	10
No, I don't know enough about dairy goats and products, but I would like to know more	22,5	25
No, not interested	25	60

Table 4.12 shows that the traditional group has a greater interest in keeping dairy goats than the modern group. The majority of the modern group and twenty-five percent of the traditional group were not interested in dairy goats and products. The majority of the traditional group was interested in keeping dairy goats if it supplied with good milk for their children compared with only five percent of the modern group. Some of the respondents

answered more than one of the positive options. Since the modern respondents work at the hospital and own less animals than the traditional group, it makes sense that they are less interested in keeping dairy goats.

4.5 Result marketing test of goat milk yoghurt

Many people are skeptical to buy goat milk products shown from the results of the nutrition survey. Dairy goats are known in this area among some groups. They are kept at Mulbadaw farm and the milk produced is sent to Haydom, and given to malnourished children at the hospital. The future goal is to increase the milk and yoghurt production at Mulbadaw farm to meet a bigger market. To accomplish this it was necessary to increase the knowledge around goat milk products by having a small marketing test. Any profit in the future will go Haydom Lutheran Hospital. If this project succeeds, hopefully local small holders will see the benefits of keeping dairy goats and start their own production.

As mentioned before, keeping goats is easier than other lactating animals like cattle; they are small of size and are tolerant to infrequent water and food supply. The indigenous goat is especially easy to keep since they are not in need of much maintenance and work, but milk yield is minimal (Peacock, 2005). When improved dairy goats are introduced to small holders, education in husbandry is required because dairy goats need more care and attention than local goat breeds to avoid health problems.

4.8.1 Basic information

The respondents were randomly picked. Some of the people asked would not participate. The reason why could be that they were employees at Haydom, not having the time or just being skeptical to try new and unfamiliar products. All in all, forty-six people tested the different types of yoghurt and answered the questionnaire. The majority of the participants asked were people working at Haydom Lutheran Hospital, living nearby or people just passing through the hospital area (67.4%). The other respondents live close to Mulbadaw farm. The gender distribution in this test was nearly 50/50 percent of women and men.

Half of respondents in this test are wage employed and 21.7 percent are farmers. Wage employees are the main target group when the cafeteria at the hospital can begin to sell goat

milk yoghurt. The other people participating in this test are self- employed (8.7 %), students (13 %) and part time farmers and employees (6.5 %).

Sixty-three percent of the respondent`s households have children. The number of children in the different households is shown in figure 4.2.

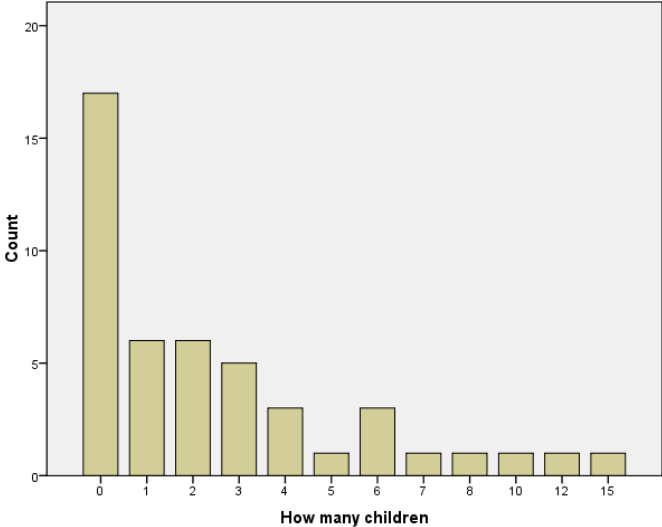


Figure 4.2. Number of children in the households of the participants

The number of children in the different households varies from zero children and up to fifteen. The average number of children in one household is four.

Age distribution of the respondents in the test is illustrated in figure 4.3.

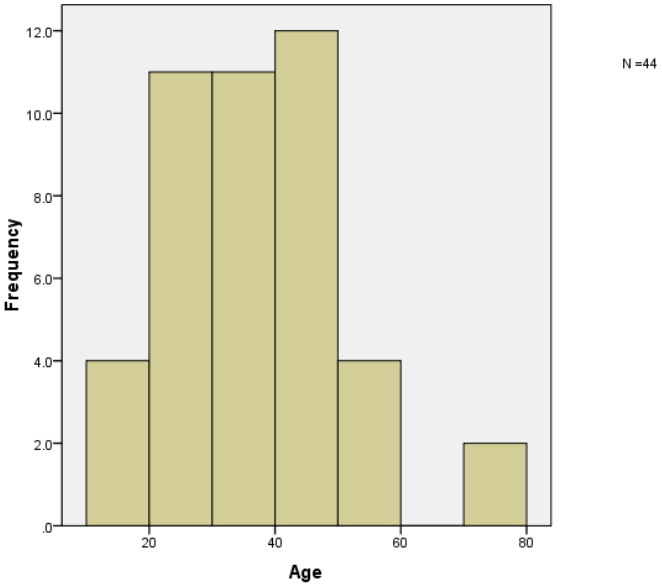


Figure 4.3. Age distribution among the participants

The age of the respondents range from just below twenty years and up to seventy-three years, which gives an average age of thirty-seven years. This makes the age distribution quite wide, including more generations.

Since the participants were randomly picked, it was interesting to see if they lived near Haydom Lutheran Hospital or Mulbadaw farm. Most of the people who participated in the test lived less than a ten minute walk (39.1 %) from one of the two places. Twenty-one point seven percent live less than twenty minutes' walk away, and thirteen percent have a twenty to forty minute walk. Quite a high percentage had to walk longer than forty minutes (23.9 %) to get to one of the two locations.

The aim of this study was to see if there is a market for goat milk yoghurt. And if there is a market for the products, the next step is to establish the sale of goat yoghurt in the cafeteria at the hospital and eventually Mulbadaw farm. But these factors will also rely on the amount of yoghurt produced, since at the time it is limited.

4.8.2 Sampling response

Before the questioning started, participants had to try the three different samples of goat yoghurt. The first question was meant to get a quick response after tasting, describing the yoghurt as very good, good or tolerable. The responses were very positive since almost all the participants liked the yoghurt, and only 6.5 percent described the yoghurt as tolerable. Nearly half of the people participating said the yoghurt was very good and almost the same percentage answered that the yoghurt was good.

The respondents gave an evaluation of the three different yoghurt tastes and could add some suggestions on improvement. Better taste of the yoghurt was suggested by 21.1 percent of the participants, and two people (4.3 %) would like a better consistency. Altogether the majority of the participants (67.4 %) said that the yoghurt did not need any improvement. Seven people who answered that the yoghurt was very good stated that they wanted better taste, and two people who said the yoghurt tasted tolerable answered that the yoghurt was good as it was. This makes the results not entirely credible. The questioning was performed by two translators, the authors of this study and the head of the marketing test Helene Lie. With many different interviewers, noise in data may occur due to misunderstandings with translating and questioning.

The respondents tasted yoghurt natural, yoghurt added sugar and yoghurt added flavor, in this case vanilla extract was used. Yoghurt with flavor was a bit more popular (39.1 %) than yoghurt added sugar (37 %), followed by yoghurt natural (19.6 %). Four percent of the respondents would like both sugar and flavor, a mix not tried out in this test. Two people that did not like the yoghurt answered that they did not want sugar or flavor added.

Table 4.13. Preferences in the choice between fresh milk and yoghurt (%).

Fresh goat milk or yoghurt?	Percent (%)
Fresh milk only	15.2
Yoghurt only	39.1
Both	43.5
Missing	2.2

Table 4.13 show that the highest percentage of the people asked would like to buy both fresh milk and yoghurt (43.5 %). In the choice between fresh milk and yoghurt, yoghurt was preferred. Ten respondents that said the yoghurt tasted very good would prefer to buy only yoghurt. The majority of the respondents that said the yoghurt samples tasted good, would prefer to buy both yoghurt and fresh milk.

Customers have a big degree of power in the value chain¹⁰ like this. If the customers do not want to pay for the product or do not like it in any way, the chain will fall apart. In hope of meeting the marketing demands a question about the willingness to pay for 250 ml yoghurt was asked. What kind of container the consumers would like, and if 250 ml is a reasonable size was also asked. The majority of the respondents (30.4%) would be willing to pay 500 TZH (Tanzanian Shilling, 1000 TZS = 4.06 NOK¹¹, 1000 TSZ = 0.64 USD¹²) for 250 ml of yoghurt, and almost the same percentage (26.1 %) would be willing to pay half of that price. Thirteen percent said they would be willing to pay more than 500 TZS, and the highest price offered was 2000 TZS. Seventeen percent meant a price under 250 TZS was reasonable. Among the different occupations, the employees are the group willing to pay the highest

¹⁰ Value chain is the full range of activities that are required to create a finished product or service. This refers to all stages in the production.

¹¹ <https://www.dnb.no/valutakalkulator> (Accessed 10.08.12)

¹² <http://www.xe.com/ucc/convert/?Amount=1000&From=TZS&To=USD> (Accessed 10.08.12)

amount of money for 250 ml of goat yoghurt. Farmers and combined farmer and employees set their paying limit on 500 TZS.

Sachets are the most popular type of container among 41.3 percent of the respondents. This container was also brought along on the testing as an example, and this could have affected the results. Sealed bottle and the possibility to bring own container had a percentage on respectively 28.3 percent and 21.7 percent. In Mgeta a bad package solution has been used. Yoghurt was sold in used water bottles, and if not returned for reuse, extra 100 TZS was claimed. In Morogoro cow milk yoghurt is sold in sachets. Sachets give the cheapest price per unit if container is needed. If sachets are used the price will be maximum 100 TZS more expensive. Though, bringing own container will give the cheapest price because of the extra cost of the container. This will possibly widen the market out to poorer people. Yoghurt bought on glass is the least popular option among the respondents.

Ten respondents (21.7 %) answered that 250 ml was a good size for a container, but the rest would like a bigger size. 500 ml (43.5 %) and one liter (30.4 %) were most preferable. Two employees working at the hospital were the only ones who would have bought two or five liters of yoghurt.

The buying frequency had very similar responses between the four options. The majority (39.1 %) would buy yoghurt every day. Thirteen people from Haydom area would buy every day and five from Mulbadaw farm would do the same. Thirty percent of the respondents would buy yoghurt one to three times a week and 26.1 percent would buy once a week. In the market in Mgeta, the yoghurt is successfully sold twice a week when the market is open (Lie 2011). If transportation options and storage facilities are upgraded it can be possible to sell yoghurt every day. The same problems are faced in this project. The distance between Mulbadaw farm and the hospital is forty-five kilometers and too far to walk, so vehicle or bus to transport yoghurt must be used. Without storage facilities at Haydom, yoghurt must be transported when needed. Yoghurt should stay cool in a refrigerator to last longer without being destroyed, although lasting longer than fresh milk. Today fresh goat milk is delivered to the hospital by bus, with the challenge that the milk not always reaches destination. Results for preferences in location for buying the yoghurt are shown in table 4.14.

Table 4.14. Preferences in location to buy yoghurt (%).

Location	Frequency	Percent %
Cafeteria	24	52,2
Market	10	21,7
Mobile traders	8	17,4
Other	4	8,7

A significant number of respondents would like to buy goat yoghurt from the cafeteria, either at the hospital or at Mulbadaw farm. Four of six students want to buy yoghurt at the market. Quite a few of the respondents are employees at Mulbadaw farm and at the hospital, and fifteen of the employees would like to buy the product in the cafeteria at work. Even though many respondents would buy the product in the cafeteria, 80.4 percent would prefer consuming the yoghurt at home. Only 15.2 percent would like to consume the yoghurt were it is bought.

Dairy goats and goat milk is not that common in the area where the test was conducted, except from Mulbadaw farm and among some people working at Haydom Lutheran Hospital. The hospital receives small amounts of milk from the farm which is given to malnourished children at the hospital.

Table 4.15. Preferred drinking frequency for the two locations (%).

	Haydom (%) N = 31	Mulbadaw farm (%) N = 15
Often	19.4	13.3
Occasionally	45.2	60.0
Never tasted goat milk	35.5	26.7

From table 4.15 results show that 19.4 percent from Haydom area drink goat milk often, compared to 17.4 percent of all the respondents. Most respondents drink goat milk occasionally (50 %) and the majority were from Mulbadaw farm (60%). Thirty-two point six percent of respondents have never tasted goat milk, 35.5 percent were interviewed at Haydom and 26.7 percent at Mulbadaw. This result differs quit a lot from the nutrition survey, where a larger percentage had not tasted goat milk or goat milk products.

Farmers drink goat milk more often than people with different occupations. Most of the people never tasted goat milk were employees (10 people).

Further it was interesting to see if there were any different preferences between goat milk and cow milk. Most respondents (39.2 %) did not know what they preferred the most. Cow milk got a more positive response with 34.9 percent compared to goat milk with 23.9 percent. Of the three respondents who thought the yoghurt had a tolerable taste, two preferred cow milk and one did not know. There were a few more people from Haydom area who preferred goat milk compared to respondents from Mulbadaw farm.

5. Conclusions

Results from the nutrition survey show that the modern group consume more varied foodstuffs and has a higher intake of nutritious food like eggs, meat and fish. Respondents from the modern group tend to have a higher intake of green leaves and fruit, which is very important for avoiding vitamin and mineral deficiencies. The twenty-four hour recall questionnaire show that the average child in this survey get a lower approximate calorie intake than recommended, for both groups.

The tendency show that the modern group may have an improved livelihood compared to the traditional group due to a more varied food intake, better quality of their drinking water, higher meal frequency and more children having a meal during a school day and eating breakfast. This shows that being wage employed can improve the livelihood for households. Eighty percent of the households in both groups respond that they consume cow milk daily, and all the children in this survey consume milk every day. Although they consume less milk than recommended. Participants from the traditional group show a greater interest in buying goat milk and goat milk products even though they generally buy less milk and milk products than the modern group. They are also more positive to keeping dairy goats.

The result from the marketing test of goat milk yoghurt were positive, and show that there is a great potential for selling milk products at Haydom and Mulbadaw area. Yoghurt with vanilla flavor was the most popular type among the participants.

Some of the challenges yet to overcome are lack of interest in developing dairy goats and goats milk, because many African cultures still associate goats with poverty and cattle with wealth. There are also beliefs that milk is a children's drink. Parts of Tanzania were production and market has already established, challenges like transportation, storage, packing and high cost must overcome in order to meet a bigger market.

Goat milk and goat milk products like yoghurt are nutritious supplements to the daily food intake. Selling goat milk, goat milk products or live goats give an essential income for the small scale farmers, providing for a better livelihood for the household. Improving the milk yield of cattle and goats with dairy breed crosses and better nutrition will benefit both the farmers and the consumers.

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7. Appendices

Appendix A: Nutrition mapping questionnaire

Questionnaire Survey

A. Demographic information

Respondent number:

Group

- Iraq
- Datoga
- Barbaig
- Employee at Haydom
- Other tribe

B. Household social economic statistic

1. Highest level of education attained;

- No formal
- Adult education
- Primary four
- Primary 1-7
- Secondary
- Collage

2. What is your main income earning activity?

- Grow crops
- Livestock keeper
- Wage employment
- Trade

- Grow crops and livestock keeping
- Others;

3. Main occupation;

- Grow crops
- Livestock keeper
- Wage employment
- Trader
- Others;

4. Marital status;

- Married
- Single
- Divorced
- Widow
- Cohabit

5. Table 1: Household composition:

Males:

- 0-5 years
- 6-14 years
- 15-30 years
- 31-40 years
- 41-60 years
- >60 years

Females:

- 0-5 years
- 6-14 years
- 15-30 years
- 31-40 years
- 41-60 years
- >60 years

C. Water

6. Where do you get water?

- River
- Tap
- Well
- Other;

7. How do you prepare your water?

- Boiling
- Add water guard
- Filter
- No preparation
- Other;

8. Water availability?

- Good
- Bad
- Seasonal
- Sufficient

D. Crop production

9. How many acres of land do you own?

10. Are they in one block?

- Yes
 No

11. How much of your land is:

- Cultivated 100 %
 Cultivated 25 % Uncultivated 75%
 Cultivated 50 % Uncultivated 50%
 Cultivated 75 % Uncultivated 25%
 Uncultivated 100 %

12. Food frequency questionnaire

		Daily	Weekly frequency	Monthly frequency	Bought	Own production	Selling	
	Value	1	2	3	4	5	6	
	Grains							
1	Maize (mahindi)							
2	Sorghum(mtama)							
3	Rice							
	Tubers							
4	Cassava (mihogo)							
5	Sweet potato							
6	Yams (vikuu)							
	Legumes							
7	Cowpeas (kunde)							
8	Groundnuts (karanga)							
9	Simsim (ufuta)							
10	Beans (maharage)							
11	Pigeon peas							
	Vegetables							
12	Spinach (mchicha)							
13	Pumpkin (malenge)							
14	Pumpkinleaves							

	(malengemajani)							
15	Cowpealeaves (kunde majani)							
16	Sweet potato leaves (Majaniyaviaziv itamu)							
17	Cabbage (kabichi)							
18	Chinese cabbage (Kichinakabichi)							
19	Onion (vitunguu)							
20	Tomatoes (nyanya)							
21	Lettuce							
22	Cassava leaves (mihogomajani)							
23	Okra (bamia)							
24	Figiri							
25	“Nyanya change”							
26	Eggplants							
27	Spinach Mnafu							
28	Mushrooms (ulala&matusu)							
	Fruits							
29	Oranges(machu ngwa)							
30	Mangoes (maembe)							
31	Pineapples(man anasi)							
32	Guavas (mapera)							
33	Lemons							
34	Pawpaw (mipapai)							
35	Passionsfruits (passion matunda)							
36	Bananas (ndizi)							
37	Trangarines							
38	Jack fruit (jack matunda)							
39	Embeng`ongo							
40	Avocado (parachichi)							
41	Topetope							

	Sugar							
42	Sugar cane							
43	Honey							
	Milk							
44	Goat milk							
45	Cow milk							
46	Powder milk							
	Meat							
47	Domestic;							
48	Chicken							
49	Goats meat							
50	Beef							
51	Pork							
52	Hunted;							
53	Dried							
54	Smoked							
55	Fresh							
	Eggs							
56	Chicken							
	Fish							
57	Salted							
58	Smoked							
59	Fried							
60	Dried							
61	Sardines							
	Oils							
62	Sunflower oil							
63	Coconut oil							
64	Groundnut oil							
65	Simsim oil							
	Spices							
66	Black pepper							
67	Cocunut							
68	Ginger							
69	Cloves							
70	Cinnamon							

13. Last 24 hours, what exactly did your household eat?

Meal	Composition	Ingredient	Amount of each ingredient	Amount consumed each child
Breakfast				
Lunch				
Dinner				

14. What do your children get to eat/drink before school?

- Tea
- Goat milk
- Cow milk
- Porridge
- Rice
- Left overs
- Nothing
- Other;

15. Do they eat lunch at school?

- Yes
- No

If no: do they bring;

- Money to buy a snack
- Food
- Nothing

If yes: what do they get at school?

- Fruits
- Tea
- Soft porridge
- Boiled maize + beans
- Other;

16. How many times per day does your household eat?

- Once
- Twice
- Three
- Four
- More than four
- Other

E. Animal information

17. What kind of animals do you keep?

- Goat
- Sheep
- Cattle
- Chicken
- Donkey
- Other:

18. If you have one or more of these animals, what is there purpose?

- Milk
- Egg
- Meat
- Draft power
- Income
- Social obligation

19. How many lactating goats do you have at the moment?

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. <10.

20. How many lactating cows do you have at the moment?

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. <10.

21. How much milk do your cows produce in average per day (liters)?.....

22. How much milk do your goats produce in average per day (liters)?.....

23. How often do the animals have access to water in the rain season?

- Continuously
- Once per day
- Every other day
- Once per week
- Other:

24. How often do the animals have access to water in the dry season?

- Continuously
- Once per day
- Every other day
- Once per week
- Other:

25. Distance to closest water point?

Rain season (km).....

26. Distance to closest water point?

Dry season (km).....

27. Have the cattle's had any health problems the last month?

- Yes
- No

If yes, what kind of disease:

F. Milk information

28. Do you give milk to your children?

- Yes
- No

If NO, why?

- No money
- Difficult to get
- Don't keep dairy goats nor dairy cattle
- Religion
- Taboo
- Diarrhea
- Stomach ache

If YES, what kind of milk?

- Cow
- Goat
- Sheep

If YES, how is it prepared?

	Boiled	Add water	Add sugar	Flavor	Milk powder	Amounts (ml)
Fresh						
Fermented						
Added in food						

29. Do you process goat milk products?

- Yes
- No

If Yes, what kind;

- Yoghurt
- Ghe
- Butter
- Sour milk
- Other;

30. Do you process cow milk products?

- Yes
- No

If Yes, what kind;

- Yoghurt
- Ghe
- Butter
- Sour milk
- Other;

31. Do you know if any in your household has milk intolerance?

- Yes, they cannot drink cow milk
- Yes, they cannot drink goat milk
- Yes, they cannot drink goat nor cow milk
- No

32. Do you buy milk or dairy products?

- Yes, weekly
- Yes, monthly
- Yes, less than once a month
- No

If Yes, what kind of milk or milk products do you buy?

- Yoghurt
- Butter
- Cheese
- Ghee
- Fresh
- Other;

5.2 If No, why?

- To expensive
- It`s hard to get a hold on in
- Not interested buying milk or dairy products
- Own production

33. Would your household be interested in buying goats milk products if introduced?

- Yes
- Yes, if I could afford it
- Yes, if I could get some information about the advantages
- Yes, if its healthy for my family
- No, not interested

If Yes; Would you buy...

- ...Yoghurt added sugar?
- ...Yoghurt without sugar?

- ...Yoghurt with flavor (orange, mango, melon etc.)?
- ...Butter?
- ...Cheese?
- Other:

34. Is your household interested in using dairy goats and selling goat milk/products?

- Yes, dairy goats supply with good milk for my children
- Yes, I can produce milk products which I can sell or utilize
- Yes, it is cheaper and easier to keep dairy goats than dairy cows
- No, I don't know enough about dairy goats and products, but I would like to know more
- No, not interested

35. How is the food availability at the moment?

- Good
- Bad
- Sufficient

Appendix B: Nutrition mapping questionnaire

Questionnaire – Market Test Goat Yoghurt / Maswari - soko la yogatiyambuzi

Location / mahari:

1. Did you like the yoghurt? Unapendayogati?

- Very good/ nzurisana,
- Good/ nzuri,
- Tolerable/ sawaninzuri,
- Bad/ mbaya

2. Would you like the yoghurt to be mixed with sugar or not?

**Ungependayogatiichanganywenasukari au isiwekwesukari? Flavoured?
Radhambalimbafano vanilla?**

- No sugar / bilasukari
- Sugar / Yenyasukari
- Flavored / Yenyeviungo

3. How can this yoghurt become even better? Kivipiyogatiinakuwahatanaubora?

- Better taste / Ladhanzuri
- Better consistency / Unyumbufuyenyewe
- Other / Nyingine
- It is good like it is / Kama ilivyoyenyewe

Specify / Ainisha

4. Do you drink goat milk? Unakunywamaziwayambuzi?

- Often / mala kwa mala
- Occasionally / mala chache
- Have never tasted goat milk / Kamwesijawhikuonjamaziwayambuzi

5. Do you prefer the taste of goat milk yoghurt or cow milk yoghurt?

**Unapendeleazsidiladhayayogotikutokakwambuzi au
ladhayayogotikutokakwang`ombe?**

- Cow yoghurt / yogotiyang'ombe
- Goat yoghurt / yogotiyambuzi
- I don't know / Sijui

6. Do you drink goat milk? unakunywamaziwayambuzi?

- Often / mala kwa mala,
- b) Occasionally / mala chache
- Have never tasted goat milk / kamwesijawhikuonjamaziwayambuzi.

7. How often do you think you would buy yoghurt?

Kwamarangapiunafikiriutakuwaunanunuayogati?

- Every day / Kilasiku
- 1-3 times a week / Mara 1- 3 kwa wiki
- Once a week / Mara mojakwa wiki
- Less than once a week / Choinaya wiki moja
- Never / Sitawezakununua

8. In what type of container would you like to buy the yoghurt? Ni ainayachombomngependayogotiihifahiwe.

- By glass? Bilauli
- Sachets? / Pakiti
- Sealed bottle? /Chupailiofungwa
- Bring own container / Chombochakobinafsi

9. Which size would you like to buy? / Nikiasigani cha litaungependakununua?

- 250 ml / ¼ lita
- 500 ml /½ lita
- 1 liter / 1 lita
- Other / Pengine:

10. How much would you be willing to pay for 250 ml? / Ni kiasiganiutakuwatayarikulipia ¼ lita?..... TZS

11. Would you like to buy fresh goat milk or only goat yoghurt?

Ungependakununuamaziwa fresh yambuzi au yogotiyambuzi?

- Fresh milk only / Maziwa fresh pekee
- Yoghurt only / Yogotipekee
- Both / Ainazotembili
- Neither / Hapana

12. In what location would you prefer to buy this yoghurt? Ni mahriganimngependakununuayogati?

- Cafeteria / Mgahawani
 - Market / Sokoni
 - Mobile traders / Kwa wasambazaji
 - Other / pengine
- Specify / Ainisha

13. Would you like to bring the yoghurt home or would you prefer to consume the yoghurt here? Ungependakupelekayogatinyumbani aukuinywahapa?

- Home / Nyumbani
- Here / Hapa

14. What is your age? Unamiakamingapi?

15. Male or female? Mwanaume au mwanamke?

- Male / Mwanaume
- Female / Mwanamke

16. Occupation? Kaziyako?

- Farmer / Mkulima
- Employee / Mwajiriwa
- Self – employed / Nimejajirimwenyewe

17. Do you have children? Unawatotona/au wajukuunyumbani

- Yes – number / Ndio – idadi
- No / Hapana

18. Where do you live? Unaishiwapi?

- Less than 10 min walking from here / Chiniyadakika 10 kutokahapa
- 10-20 min walking from here / Mwendowadakika 10-20 kutokahapa
- 20-40 min walking from here / Mwendowadakika 20-40 kutokahapa
- More than 40 min walking from here /Mwendowazaidiyadakika 40 kutokahapa

19. Anything you would like to add to this questionnaire? / Uno maoniganizaida