A Cost of the Diet analysis in Turkana district of Kenya

Location: Central Pastoral Livelihood zone, Turkana
Date of collection: June 2012
Date of Report: March 2013
Date of HEA data collected: June 2012
Lead agency: Save the Children with support from Oxfam
Funded by: ECHO

Save the Children

Oxfam

Acknowledgments

The Cost of the Diet analysis was led by Amy Deptford with support from Rachel Evans and Catherine Louis.

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The analysis and this report were written by Amy Deptford with support from Andrew Hall.

The analysis was funded by ECHO as part of the 'Filling the Gap' grant.

Thanks to Oxfam for their warm welcome and for making the practical arrangements for the analysis to take place.

Last but by no means least, this analysis would not have been possible without the willing help of the market traders of the central pastoral livelihood zone and of the women who participated in the focus group discussions. Their time, hospitality and insights are greatly appreciated.

Suggested citation:

Save the Children UK, (2013). *A Cost of the Diet analysis in the central pastoral livelihood zone of Turkana.* London.

Executive Summary

Introduction

This Cost of the Diet analysis has been conducted as part of an integrated study with a Household Economy Approach (HEA), funded by the ECHO 'Filling the Gap' grant and Save the Children UK. The aim of this analysis was to assess the degree to which economic constraints might prevent households in the central pastoral livelihood zone of Turkana district from having access to a nutritious diet.

The data collection and analysis set out to answer the following questions:

- What is the cost of a nutritious diet for a typical household in the central pastoral livelihood zone of Turkana?
- What nutrients have the greatest influence on the cost of a nutritious diet?
- Are there any neglected or underutilised foods that could decrease the cost of a nutritious diet?
- How affordable is a nutritious diet for a typical household in different wealth groups?

In addition, the Cost of the Diet software was used to assess how nutrition, food security and social protection interventions might contribute to improved access to a nutritious diet by households.

Turkana County is the poorest county in the country with 94% of the population living below the poverty line (Kenyan Government, 2006). Turkana is an arid area with temperatures as high as 40°C during the dry season. The HEA study in the central pastoral livelihood zone found that there is a lack of sustainable self-employment, which is limited to selling firewood, fodder grass and handicrafts. Consequently the study described the central pastoral livelihood zone as a self-contained, poor rural economy with little diversity of income or commercial dynamism (FEG, 2012).

The Household Economy Approach (HEA) study, estimated that 35% of households were classified as very poor, 30% poor, 20% in the middle category and 15% were considered better-off. Livestock ownership is the main factor determining wealth with better off wealth groups having a larger, more diverse herd compared with very poor households who own a small herd of goats.

Turkana experienced a serious drought in 2011 as a result of failed rains. As a result, the prevalence of wasting was 24% in central Turkana in May 2011 (MoPHS *et al.,* 2011a), a critical public health problem (WHO, 1995). In response, many agencies scaled up their emergency nutrition interventions which, coupled with a heavy rainfall at the end of 2011, reduced the prevalence of wasting to 17% in December 2011 (MoPHS *et al.,* 2011b). Data from a nutrition survey in July 2012 indicate that the prevalence of wasting has reduced further to 11% but is still classified as a serious public health problem (WHO, 1995). The prevalence of stunting is 22% (MoPHS *et al.,* 2012), which is classified by WHO as medium severity (WHO, 1995).

The HEA (FEG, 2012) found that the most important source of food for very poor households was food aid which provided 37% of energy requirements. Milk and meat played a greater importance in the other wealth group's diets and accounted for 34%, 51% and 57% of energy requirements for poor, middle and better-off households respectively. As the middle and better off households received less food aid, they relied on markets to purchase 45% and 47% of their energy requirements respectively (FEG, 2012). The HEA found that energy requirements were met by 100%, 106%, 106% and 107% for very poor, poor, middle and better off households respectively.

Methods

Six market surveys and four dietary pattern surveys and focus group discussions were conducted. The market price, seasonal availability and consumption patterns of all local foods was collected, excluding herbs, spices and condiments. For the purpose of the training, retrospective price data were collected to cover a period from June 2012 – July 2011.

With these data the cost of three theoretical diets were estimated using the Cost of the Diet software for a typical household of 7 individuals, which represented very poor households as identified by the HEA: a lowest cost diet that only meets recommended average energy requirements; a lowest cost diet that meets recommended intakes for energy and nutrients (MNUT); and a lowest cost diet that meets recommended intakes for energy and nutrients based upon typical dietary habit of households in the central pastoral zone of Turkana (LACON).

A nutritious diet for the typical family was defined as one which provides the total of the estimated average requirement (EAR) for energy; the safe individual intake of protein; 30% of total energy intake from fat; the reference nutrient intake (RNI) of vitamins and minerals; and the safe intake for vitamin A, all specified by the World Health Organization (2004; 2007; 2008).

The annual cost of the foods selected by the software were expressed as a percentage of the estimated annual cash income and expenditure from the HEA (FEG, 2012) undertaken in the same livelihood zone, to estimate the affordability of a nutritious diet for households in each wealth group.

Key Findings

A nutritious diet based upon typical food habits is twice as expensive as a diet that only meets energy requirements. The minimum cost of an energy only diet was estimated at between 418 – 463 KSH (4.90 -5.40 USD[1]) per day, depending on the season, and included seven of the 40 foods found in the markets. The minimum cost of a MNUT diet was estimated at 640-745 KSH (7.50 -8.70 USD) per day, depending on the season, and included nine of the 40 foods found in the markets. The minimum cost of a LACON diet was estimated at between 862 – 897 KSH (10.10 -10.50 USD) a day, depending on the season, and included 14 of the 40 foods found in the markets.

[1] Exchange rate used was 1 USD = 85.44 KSH

It is important to note that the recommended requirements used as targets by the software are greater than the actual needs of 97% of all individuals, which is why the cost of the diets are high.

It is possible to obtain a nutritious diet using local foods for a typical poor family. However, vitamin C, iron and calcium are the most difficult nutrients to meet requirements for. These nutrients are also the most expensive and increase the cost of the diet substantially as the software includes large quantities of expensive foods such as liver, dried fish and avocado to meet requirements. This is emphasised by the analysis of the food groups that contributed the most to a nutritious diet which for both the child aged 12-23 months and the rest of the family were meat, fish, poultry and eggs, dairy and vegetables.

The availability of nutritious foods in the market is constrained by poor road infrastructure. The software included large quantities of kale and avocado in the LACON diet to meet essential nutrient requirements. However, one of the most striking findings from the market surveys was the lack of fruit and vegetables. Several focus group discussion participants reported that this was due mainly to poor supplies as the distances to the main markets and transport costs meant that traders only collected fruit and vegetables once a week, but they were often too expensive for poor families to purchase. Furthermore, many fruit and vegetables perished quickly, affecting what traders bought back to the village.

Even with food aid, very poor households cannot afford a nutritious diet based upon typical food habits plus their non-food expenditure. The results from the estimates of affordability found that poor, middle and better off households can afford a LACON diet plus expenditure on essential non-food items but would use 93%, 92%, 86% of their income respectively. However, very poor households would require an additional 50% of their current annual income or 115,000 KSH (1,300 USD) a year to purchase a fully nutritious diet.

Breast milk provides essential nutrients in a young child's nutritious diet. In the analysis of the LACON diet for a 12-23 month old child, breast milk met over half the child's need for of fat and vitamin C, and contributed substantially to energy, vitamin A, vitamin B1, vitamin B2, niacin, folic acid and calcium requirements.

The options for models were limited by what can be grown in the environmental, the lack of livelihood opportunities and the market and road infrastructure in this zone. Of the five interventions modelled, to increase the availability goat or camel's milk for very poor households had the biggest potential to reduce the cost and improve the quality of the diet.

The Hunger Safety Net Programme potentially improves very poor household's ability to afford the LACON diet by 11% however, an additional 96,700 KSH (1,100 USD) a year would still be required to meet all nutrient requirements to 100%.

Recommendations and conclusions

Investment in improving road and market infrastructure in this livelihood zone is one of the most important recommendations. This was also one of the main recommendations made by the HEA study (FEG, 2012). Currently, roads are either non-existent or in a very poor condition. There is a lack of markets in this zone in general and those that do exist in remote villages sell mainly cereals, pulses and oil and are almost devoid of fruit, vegetables, dairy and animal products, the most nutritious foods available in this livelihood zone as identified by the Cost of the Diet software. Until access to remote villages by road is improved, it is unlikely that the availability of these nutritious foods in the market will improve and access will remain poor.

Promoting the benefits of exclusive and continued breastfeeding until the age of 2 years is essential, as emphasised by the cost of the diet results for the 12-23 month old child. However, breast milk is not a rich source of iron. Making iron rich foods such as meat and offal more accessible in terms of their price and physical presence in the market needs to be undertaken so that the consumption of these foods can be advocated for.

It is recommended that market surveys of the key 40 foods are done in each season to better understand the seasonal cost and availability of foods found on the market and the potential impact on households that purchase the majority of their food from the market. The seasonal fluctuations in the daily cost of a nutritious diet have not been effectively captured in this study because retrospective data collection methods during the market survey were used for training purposes only.

1. Introduction

1.1 Kenya

Since independence in 1960, Kenya has been one of the most successful countries in Africa with steady economic growth and a growing tourism industry. However, since 1996 it has suffered from 12 disasters, mostly due to internal and cross border conflicts over terrorism, natural resources, economics and the environment (FAO and WFP, 2010). The most recent crisis was the 2011 horn of Africa famine which affected approximately 3.75 million people in north east Kenya (WFP, 2012).

Kenya has a population of 38.3 million, of whom 46% live below the poverty line and 80% live in rural areas (UNICEF, 2012). It is among the world's 30 poorest countries and ranks 153 out of 177 on the Human Development Index (UNICEF 2012). Income inequalities between the rich and the poor, is also an issue with the top 10% of Kenyans earning 44% of the national income, whilst the bottom 10% earns less than 1%. As a result, the Global Hunger Index for this country falls within the 'serious' category at 18.9 and has only increased by 2 points since 1990 (International food policy research institute, 2011).

Strategies such as the Kenya National Nutritional Action Plan 2011-2017 (Government of Kenya, 2011) have been developed focussing specifically on the improvement of nutrition outcomes based upon needs at different stages of the life cycle. The objectives of such strategies are to improve women's nutrition throughout their lifecycle; promote optimal infant and young child feeding practices; promote appropriate nutrition for school children and adolescents; promote healthy lifestyles across the population; and improve nutrition care and support for the elderly (Government of Kenya, 2011).

1.2 Aim of the analysis

This analysis is the result of a regional Cost of the Diet capacity building training in Turkana and Nairobi, Kenya funded by the ECHO 'Filling the Gap' grant and Save the Children UK. The objectives of the training were to:

- Teach participants how to plan a Cost of the Diet assessment
- Teach participants about what information is required for a Cost of the Diet assessment and participate in practical data collection in the field
- Teach participants how to analyse the data collected using the Cost of the Diet software and how to model potential interventions
- Teach participants about the links between the Cost of the Diet and the Household Economy Approach (HEA)

The aim of the Cost of the Diet analysis was to assess the degree to which economic constraints might prevent households in the central pastoral livelihood zone of Turkana from having access to a nutritious diet. The data collection and analysis set out to answer the following questions:

- What is the cost of a nutritious diet for a typical household in the central pastoral livelihood zone of Turkana?
- What nutrients have the greatest influence on the cost of a nutritious diet?

- Are there any neglected or underutilised foods that could decrease the cost of a nutritious diet?
- How affordable is a nutritious diet for a typical household in different wealth groups?

In addition, the Cost of the Diet software was used to assess how nutrition, food security and social protection interventions might contribute to improved access to a nutritious diet by households.

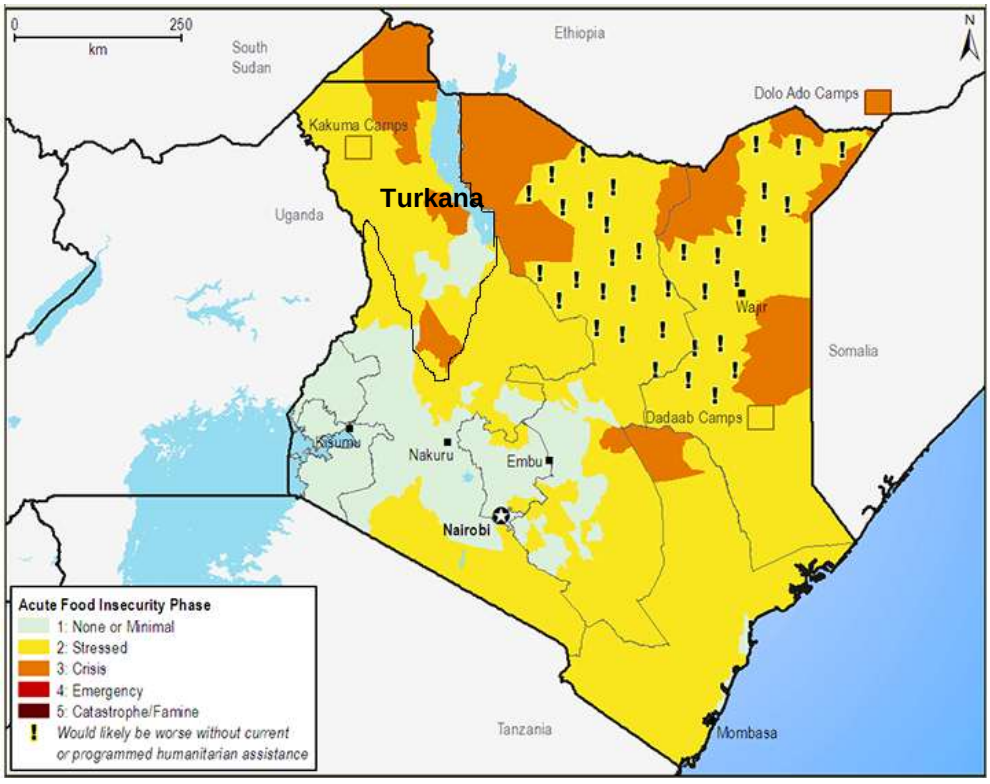
2. Overview of the Study Area

2.1 Introduction to Turkana District and the central livelihood zone

Turkana County is in the Rift Valley province of Kenya, situated in the north western region of the country. The region borders Uganda, Sudan and Ethiopia to the East, North East and North West respectively. Turkana has a population of approximately 1,014,100 (Kenyan Government, 2009). Despite the progress made by many organisations, Turkana remains the poorest county in Kenya (Kenyan Government, 2006). Although numerous organisation working in the area for many years, the Kenya Household Budget Survey in 2006 found that 94% of the population in Turkana live below the poverty line and only 19% can read and write compared with the national average of 79% (Kenyan Government, 2006).

Turkana is an arid area with temperatures as high as 40°C during the dry season. In recent years, average rainfall has been poor at 120-150mm per year but varies considerably. Traditionally the economy has been based upon nomadic pastoralism, but failed rains and drought, most recently in 2011, have killed livestock resulting in erratic migration and compromised pastoral livelihoods. Consequently according to FEWSNET, many areas of Turkana are in the 'stressed' phase of food insecurity whilst some localised areas are in the 'crisis' phase (FEWSNET and KFSSG, 2012). Figure 1 is a map of Kenya illustrating the food security situation.

Figure 1. Map of Kenya illustrating the food security situation in the country (FEWSNET and KFSSG, 2012). Used by kind permission of the Food and Agriculture Organization.



There are several factors influencing the food security situation in Turkana. The first is high food prices, as crop production is low in agropastoral areas due to a lack of

water and poor agronomic practices employed by farmers (FEWSNET and KFSSG, 2012). In addition, conflicts and insecurity have disrupted livelihood activities, leading to loss of lives, displacement of households and loss of livelihood assets (FEWSNET and KFSSG, 2012).

Approximately 60% of the population in Turkana practices pastoralism by rearing goats, camels, cattle, sheep and donkeys. Agro-pastoralism makes up 20% of the population's livelihood (MoPHS, Oxfam GB, World Vision, Merlin and IRC, 2011a). These individuals keep small herds of livestock and also grow crops such as beans, sorghum and maize. Along the edge of Lake Turkana, households practice fishing as their main source of livelihood, whilst the remaining 8% of the population have formal employment.

The most recent Household Economy Approach (HEA) survey divided Turkana into the following six livelihood zones (FEG, 2012):

- Central Pastoral
- Border Pastoral
- Kerio Riverine Agro-Pastoral
- Turkwell Riverine Agro-Pastoral
- Lake Turkana Fishing
- Lodwar Urban

A Cost of the Diet assessment was undertaken in the central pastoral livelihood zone of Turkana due to ease of access. This zone has a population of approximately 242,979 people (Kenyan Government, 2009) and consists of sandy and rocky plains interspersed with hills and dissected by numerous seasonal rivers. This livelihood zones receives very little rain in comparison with the other livelihood zones in Turkana and rainfall varies considerably. For example, average rainfall in this zone is 246mm per year compared to 386mm per year in the neighbouring border pastoral livelihood zone (FEG, 2012).

The recent HEA (FEG, 2012) assessment found that camels were the most important type of livestock kept in the livelihood zone, followed by sheep/goats ('shoats') and cattle. In many villages cattle are not kept, as there is insufficient grassland to provide food for them.

2.2 Prevalence of undernutrition

Data was not available for central Turkana on all major nutrition indicators, so data for the Rift Valley have been used.

In 2011, Turkana County experienced a serious drought as a result of failed rains in the previous year. Consequently the prevalence of global acute malnutrition or GAM (the sum of the prevalence of severe and moderate acute malnutrition at a population level) in central Turkana was 24% in May 2011 (MoPHS, Oxfam GB, World Vision, Merlin and IRC, 2011a). This is classified as a critical public health problem by the World Health Organization (WHO) (WHO, 1995). In response, many agencies scaled up their emergency nutrition interventions which, coupled with a heavy rainfall at the end of 2011 reduced the level of GAM to 17% in December

2011 (MoPHS, Oxfam GB, World Vision, Merlin and IRC, 2011b). Data from a nutrition survey in July 2012 indicates that these rates have reduced further to 11% problem (MoPHS, Oxfam GB, World Vision, Merlin and IRC, 2012) but are still classified by the WHO as a serious public health (WHO, 1995). The prevalence of stunting (children with a z-score of height-for-age less than -2) is 22% (MoPHS, Oxfam GB, World Vision, Merlin and IRC, 2012), which is classified by the World Health Organization as medium severity (WHO, 1995). Severe acute malnutrition is a result of acute undernutrition whereas stunting is due to long term or chronic undernutrition plus an element of inter-generational undernutrition, as small mothers tend to give birth to small babies.

2.3 Micronutrient deficiencies

The coverage of vitamin A supplements for children under the age of 5 is 68%, which is below the WHO's acceptable level of coverage, which is 80% (MoPHS, Oxfam GB, World Vision, Merlin and IRC, 2011b). This suggests that deficiency may occur. Another proxy indicator for vitamin A deficiency is the prevalence of pregnant women with night blindness: only 2.2% of pregnant women in the Rift Valley reported this problem, which is not of public health significance (Kenya National Bureau of Statistics, 2009). However, recent data on night blindness in pregnant women could not be found for Turkana so the 2.2% presented may not be representative of the central pastoral livelihood zone.

Recent statistics on the prevalence of anaemia in central Turkana could not be found, however proxy indicators of the condition would suggest that it may be an issue in the area. Only 4.5% of children in the Rift Valley province were found to have been given iron supplements in the most recent Demographic and Health Survey (Kenya National Bureau of Statistics, 2009). Iron supplements are often needed once exclusive breastfeeding has ended to ensure that a deficiency does not occur. Thirty three percent of women in the Rift Valley province reported that they had not taken iron supplements during their last pregnancy, 53% took supplements for less than 60 days, and less than 3% took supplements for 60 or more days (Kenya National Bureau of Statistics, 2009). Malaria is also endemic in Turkana but bed net ownership in 2011 was good in the central district with 83% of households reporting that children under the age of 5 were using bed nets (MoPHS, Oxfam GB, World Vision, Merlin and IRC, 2011b).

2.4 Infant feeding and care practices

The timely initiation of breastfeeding among children of 0-23 months was low at 35%. This is linked to practices such as the naming of the child that is given priority before breastfeeding in this culture (MoPHS, Oxfam GB, World Vision, Merlin and IRC, 2011b). Although the findings of nutrition surveys suggest that nearly all the children in central Turkana (97%) are breastfed at some point during their infancy, only 49% are exclusively breastfed for the first 6 months of life as recommended by the WHO (MoPHS, Oxfam GB, World Vision, Merlin and IRC, 2011b). This means that 51% of children are given something else to drink or eat other than breast milk, a practice that increases the risk of diarrhoeal disease. The rates of continued breastfeeding are better as 88% of children at 23 months were still being breastfed (MoPHS, Oxfam GB, World Vision, Merlin and IRC, 2011b).

The WHO recommends that complementary feeding should begin after reaching six months of age. In 2011 only 29% of infants in central Turkana had been given other foods (MoPHS, Oxfam GB, World Vision, Merlin and IRC, 2011a). This could be associated with the drought during this period and may not be representative of current practices. The diversity of the food provided to these children was also reported as being limited. A dietary diversity indicator is used to assess the quality of the diet. It is based on the premise that the greater the number of food groups included in the diet, the more likely it is that the diet will provide the recommended requirements for nutrients. For the diet to achieve minimum dietary diversity, it is recommended by the WHO that foods from four out of seven foods groups should be consumed by a child of 6-23 months. Only 31% of children in central Turkana received foods from at least four food groups. Meal frequency was also low, with only 19% of children in central Turkana receiving food three or four times a day (MoPHS, Oxfam GB, World Vision, Merlin and IRC, 2011a). This indicates that children in the area may not be receiving the adequate quantity or quality of food required for their growth and development.

Diarrhoeal diseases are one of the leading causes of malnutrition and death among young children in developing countries. A nutrition survey conducted by MoPHS, Oxfam GB, World Vision, Merlin and IRC, (2011b) reported that, 32% of children under the age of five in central Turkana had suffered from diarrhoea in the two weeks prior to the survey. To combat the effects of dehydration, the WHO promotes the use of oral rehydration therapy (ORT) whilst increasing intakes of food and other drinks. In 2009, 40% of children in the Rift Valley province with diarrhoea were given this treatment (Kenya National Bureau of Statistics, 2009). Furthermore, in 2009 the Demographic and Health Survey found that during bouts of diarrhoea, 22% of children were given more liquids, 29% were given the same amount of liquids, and 44% of children were given less liquid during diarrhoea. Also, 5% of children were given more food, 31% were given the same amount of food and 53% were given less food (Kenya National Bureau of Statistics, 2009). Some of these practices are not ideal so training parents to make oral rehydration solutions from sugar, salt and clean water and teaching them to sustain children's food intake during illness could help to prevent malnutrition.

2.5 Hygiene and sanitation

The main causes of diarrhoeal diseases are inadequate sanitation and poor hygiene. MoPHS, Oxfam GB, World Vision, Merlin and IRC, (2011b) reported that 86% of households in central Turkana were drinking unsafe water. Sanitation practices also need improvement as the majority of households (85%) did not have access to a latrine with many defecating in open fields or bush. Furthermore 47% of caretakers did not wash their hands with water and soap after using the toilet (MoPHS, Oxfam GB, World Vision, Merlin and IRC, 2011b).

According to the Global Atlas of Helminth Infections (www.thiswormyworld.org), the risk of soil transmitted helminths in Turkana is very low because the area is so arid. Mass treatment is therefore unnecessary.

2.6 Household profiles and key economic characteristics

The HEA, completed a month prior to this study, divided the population of the central pastoral livelihood zone of Turkana into four wealth groups: very poor, poor, middle and better-off. As shown in Table 1, the HEA estimated that 35% of households were classified as very poor, 30% poor, 20% in the middle category and 15% were considered better-off. The typical household size differs substantially between the wealth groups: 7 members for very poor, 10 for the poor, 15 for the middle and 23 for better off households (FEG, 2012).

Livestock ownership is the main factor determining wealth in the central pastoral livelihood zone. With increasing number of animals comes the ability to maintain more wives and a larger household size, so that the better - off have an average 3-4 wives (compared to 1 for the poor) and a household size of 18-28 (compared to 6-8 for the poor) (FEG, 2012).

Table 1 shows the main characteristics of households in the livelihood zone. There is a lack of sustainable self-employment, which is limited to selling firewood, fodder grass and handicrafts. In general the HEA (FEG, 2012) described the district as a relatively self-contained, poor rural economy with little diversity of income or commercial dynamism.

Table 1. The characteristics of households in central pastoral livelihood zone by wealth group

Wealth group	% of households	% of the population	Typical No. of wives	Typical household size
Very Poor	35	20	1	6-8
Poor	30	25	1-2	8-12
Middle	20	26	2-3	12-18
Better - off	15	29	3-4	18-28

Wealth group	Typical livestock holding	Schooling
Very Poor	0-1 camel, 0 cattle, 15-30 sheep/goats	Day school: 1-2 children
Poor	6-12 camels, 0-10 cattle, 30-80 sheep/goats	Day school: 1-3 children
Middle	20-35 camels, 0-15 cattle, 80-150 sheep/goats	Day school: 2-3 children, boarding school: 0-1 child
Better - off	40-60 camels, 0-45 cattle, 150-250 sheep/goats	Day school: 1-3 children, boarding school: 0-2 children

2.7 Food sources

The Household Dietary Diversity Score (HDDS) is a proxy indicator for a household's economic access to food and is based on 12 food groups. Results from the nutrition survey conducted in May 2011 showed that households in central

Turkana were only consuming three food groups, namely cereals, fats and pulses. Fruits and vegetables were the least frequently consumed foods in this area. Interestingly, during the drought the number of food aid beneficiaries doubled in central Turkana, yet the household dietary diversity score for this area did not change, indicating that the economic access to foods did not improved (MoPHS, Oxfam GB, World Vision, Merlin and IRC, 2011b, 2011a).

The HEA (FEG, 2012) found that sources of foods depended on wealth. For very poor households it was found that the most important source of food was food aid, followed by purchased and wild food, which provided 37%, 30% and 15% of energy requirements respectively. Milk from their own herds only provided 4% of the very poor's total energy requirements (FEG, 2012). This is because they owned a small number of sheep or goats and did not own any milking camels or cattle. However it was found that they were able to supplement their own production with gifts of milk and meat from better-off relatives and friends (FEG, 2012). Milk and meat played a greater importance in the other wealth group's diets and accounted for 51% and 57% of total kilocalorie requirements met by the middle and better-off and 34% for the poor.

The HEA (FEG, 2012) also found that the population of the central pastoral livelihood zone obtained a large percentage of their energy requirements from foods purchased at the markets. This increased with wealth, mainly due to the fact that wealthier households did not receive food aid. The very poor, poor, middle and better off relied on markets to purchase 30%, 36%, 45% and 47% of their kilocalorie requirements respectively (FEG, 2012). Market purchases consisted mainly of the staple food (primarily maize grain and maize meal), both in terms of the amount of money spent and in terms of contributions to energy requirement. Other commonly purchased foods included beans, oil, sugar and meat (FEG, 2012). This reliance on the market as a food source makes the population of the central pastoral livelihood zone vulnerable to fluctuations in the price and seasonal availability of foods.

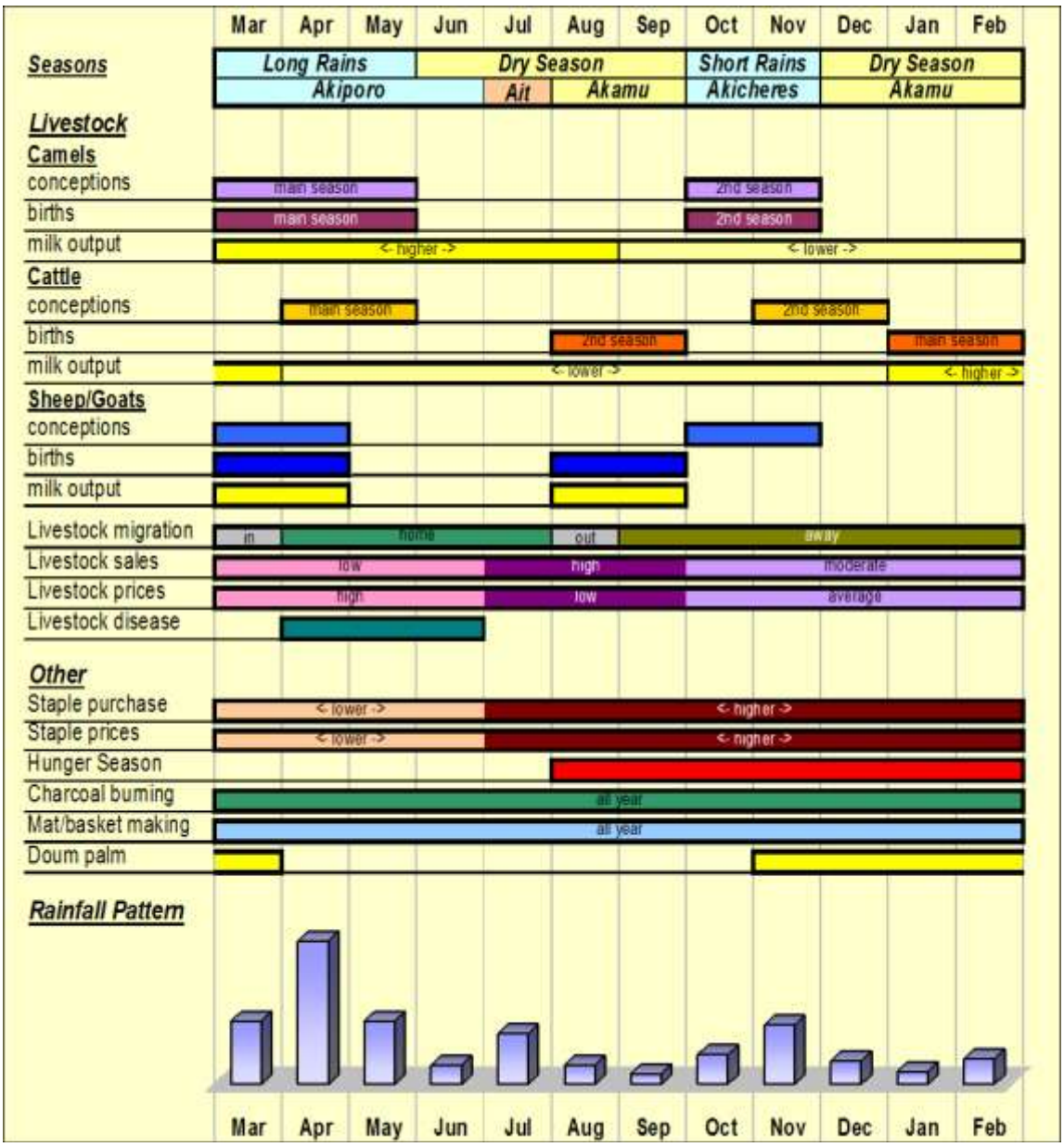
Markets in the central pastoral livelihood zone are very poorly developed. The roads to the markets are poor, there is little market infrastructure and a lack of regular livestock and other markets (FEG, 2012). Furthermore, the markets are isolated from any large urban centre of demand. The areas of Uganda and Ethiopia, for example, that border Turkana, are sparsely populated and poorly integrated into their own national markets. This offers little in the way of opportunities for either import or export (FEG, 2012).

2.8 The seasons in the central pastoral livelihood zone of Turkana

The timing of rainfall determines the seasons in Turkana. There are usually two rainy seasons: long rains from March to May (a*kiporo*) and short rains from October to November (a*kicheres*). The rainfall also influences the conception and subsequent birth of livestock as well as livestock movements, which can be harmed by drought. Milk production is generally greater in the rainy seasons and lowest in the dry seasons. The 'hunger' season lasts from August until the following February: this is the period when animals are away from the home area, access to milk is reduced, and reliance on staple food purchased from the market is at its highest.

Figure 2 shows a seasonal activity calendar developed during the recent HEA (FEG, 2012) in this livelihood zone. This calendar illustrates the timing of key activities during the year.

Figure 2. A seasonal calendar for central pastoral livelihood zone developed during the HEA (FEG, 2012)



2.9 Nutrition programmes in Turkana District, Kenya

Save the Children do not currently work in Turkana but there are several other organisations investing resources in improving food security and livelihoods in this area. In 2005 the Kenyan Government published a 10 year strategy document for arid and semi-arid lands, which includes Turkana district. Several areas for improvement were documented including improving road infrastructure, minimising conflict over land ownership, strengthening livestock and crop production by improving irrigation and water harvesting and improving livestock disease control (Kenyan Government, 2005).

Agencies such as the Wold Food Programme have been regularly distributing relief food throughout Turkana for approximately 30 years. This food has recently been targeted at more vulnerable groups such as the elderly, disabled and orphans (FEG, 2012).

Oxfam are also active in the area, implementing cash transfers, cash for work programmes and distributing food through local traders. The organisation is also working to improve broken water systems that are close to pastures as well as deworming and vaccinating livestock against disease (Oxfam, 2011).

3. Methods

3.1 Location

Figure 3. Livelihood zone map of Turkana (FEG, 2012)

A livelihood zone is defined as an area within which people share broadly the same patterns of access to food (FEG, 2012). Cost of the Diet assessments are often conducted in a livelihood zone because the foods that are available and people consume are homogenous. The Cost of the Diet assessment took place in the central pastoral livelihood zone of Turkana, labelled TCP in Figure 3. This zone occupies a central position in the county, between the Border Pastoral Zone (to the north, west and south) and the Lake Turkana Fishing Zone (to the east).

The data was collected in the villages of Kapua, Kerio, Kaitese, Lomil, Lochwa and Napatet in Turkana District, Kenya. These villages were selected based upon the timing of the markets which had to operate on the 3 days that data collection was taking place within the training schedule. The Cost of the Diet consultant was also reassured that the villages were typical of the livelihood zone.

The assessment took place in June 2012 during the long rainy season called *akiporo.*

3.2 Data collection and sources

This section describes the data collected to undertake an analysis of the cost of the diet.

3.2.1 Market survey to collect price data
Surveys were conducted in the villages mentioned in section 3.1.

Prior to collecting price data, a comprehensive list of all food items available in the district was developed using key informants and the knowledge of local participants in the analysis. This was followed by a field trial in the market of Klaskamer (data not included) where participants practiced data collection methods whilst adding items to the food list. The resulting comprehensive food list was then used to collect data on price and weight in the remaining markets.

For the purpose of the training, retrospective data was collected from June 2012 – July 2011 so that participants could be trained in how to analyse and interpret seasonal data. The seasons and periods used were taken from the standard seasonal calendar for Turkana provided by the Kenya Food Security Steering Group (2012) and do not reflect the fluctuating rainfall experienced in 2012 and 2011, shown in Figure 2:

Season 1 – June 2012 – April 2012: *Akiporo*
Season 2 – March 2012 – January 2012: *Akamu*

Season 3 – December 2011– October 2011: *Akicheres*
Season 4 – September 2011 – July 2011: *Ait*

To collect the information needed to estimate the cost of the diet, market traders were asked the price of the smallest unit of each food item that they sold during each season, assuming that the poor were likely to be able to afford this amount. The poor typically buy foods in small amounts as they cannot afford bulk purchases.

Three samples of each food were weighed using electronic scales that had a precision of 1g (Tania KD-400, Tanita Corpoation, Japan). Where possible in each market, weight and price data were collected from four traders giving a possible total of four prices and 12 weights for each food item found in every market. Market traders were then asked questions about annual trends in prices, seasonality and changes in the demand and supply of commodities. This data were entered into an Excel spread sheet every evening after collection, which averaged the price and weight of each food across every market. The final averaged weight and price for each food was then divided to calculate the cost per 100g of each food item by season.

Each food item identified in the market survey was then selected from the food composition database in the Cost of the Diet software, choosing the variety consumed in the region nearest to Kenya if there was more than one type available to select. All price data were converted to cost per 100g and then entered for each season into the Cost of the Diet programme.

3.2.2 Interviews and focus group discussions to collect typical food consumption

To estimate a diet that is nutritious but takes into account typical food habits of households in the central pastoral livelihood zone, the software needs to be told how many times a week it can or cannot include a food. This is called the minimum and maximum constraints, which need to be determined for each food found on the market. For example if the minimum constraint for Irish potato is set at 5 and the maximum is set at 14 this means that the software must include potato in the diet no less than 5 times a week but no more than 14 times a week (twice a day).

To create the minimum and maximum constraints for each food found on the market, a one hour interview based upon a questionnaire and focus group discussion was carried out. The questionnaire was based upon the food list generated by the market survey and aimed to determine how often the foods were consumed. The questions asked during the focus group discussion were based on early observations from the market data, comments from traders, and responses to the questionnaire. In particular, information was collected on the wild foods consumed, on household production of food, on cultural taboos, on 'normal' consumption patterns, and on key staples. The discussions were held in 4 of villages, Nayuu, Kaitese, Kerio and Lochwa, and each group consisted of 8 women, 2 from each wealth group identified by the HEA (FEG, 2012), all of whom were responsible for preparing food for the household.

During the interview the women were asked to state the frequency with which they ate each item of food on the list. The frequency options given were never, sometimes (1-4 times a week) or often (more than five times a week). The

responses were given a numerical score: 'never' was awarded 0 points, 'sometimes' 1 point and 'usually' 2 points, then the total for each food item from all 8 respondents was calculated. This meant that each item could receive a minimum total score of 0 and maximum of 16. A total score of 0-1 points was translated into a maximum constraint of 0, 1-8 points was translated into a maximum constraint of 7 (a food eaten once a day) and a total score of 9-16 points was translated into a maximum constraint of 14 (a food eaten twice a day).

During the focus group discussions the women stated that maize was the staple food of people in the central pastoral livelihood zone in Turkana. The results from the HEA (FEG, 2012) found the same. This food was entered into the diet a minimum of 7 times per week and a maximum of 14 times per week. The women also stated that milk, beans, lentils, oil, tomatoes and onions were commonly consumed foods. To reflect this, these foods were given a minimum constraint of 0 and a maximum constraint of 14, allowing the software to include these foods up to twice a day but to exclude them if they were not inexpensive and nutritious.

It is important to note that the constraints applied are intended to reflect typical dietary patterns rather than reflect economic constraints, because the Cost of the Diet is a tool to illustrate a diet that could be achieved if economic limits were removed.

3.2.3 Specification of a typical family

A typical household was identified during the focus group discussions as a part of the HEA, a month prior to this study. As shown in Table 2, the household size is larger in wealthier groups. For the purpose of the analysis a household size of 7 individuals, a man, a woman and 5 children, representing very poor households was used. As the estimates of household income for this typical family are based on an energy requirement of 7 x 2,100 kcals, or 14,700 kcal in total, the Cost of the Diet method identifies a family of the same individuals that require as close to 14,700 kcal as possible. This typical household economy analysis/Cost of the Diet (HEA/CoD) family consists of:

- An adult man, aged 30-59y, weighing 50 kg and moderately active (2,750 kcal/d)
- An adult woman, aged 30-59y, 45 kg, moderately active (2,300 kcal/d) and lactating (418 kcal/d)
- A baby (either sex) aged 12-23 months (894 kcal/d)
- Child (either sex) aged 7-8 years (1,625 kcal/d)
- Child (either sex) aged 9-10 years (1,913 kcal/d)
- Child (either sex) aged 11-12 years (2,250 kcal/d)
- Child (either sex) aged 13-14 years (2,575 kcal/d)

The total energy requirement of this family is 14,724 kcal/d.

Because the Cost of the Diet is dependent on the numbers, age and degree of physical activity of the individuals selected for this 'typical' family, which is arbitrary, and to illustrate the possible range in the cost of the diet, a CoD/HEA family was specified in the same way for 5, 6, 8, 9 and 10 members and two other families were specified to cover the highest and lowest energy needs for families of between 5 and 10 members.

A minimum or low energy family was selected by choosing the youngest, smallest family for each number of individuals between 5 and 10; and a maximum or high energy family was selected by choosing the oldest, largest family between 5 and 10 members.

The specification of the HEA/CoD, minimum and maximum energy families of between 5 and 10 members are shown in Appendix 1 and are recommended as standard families for all Cost of the Diet analyses. This ensures that the analysis can be aligned with any HEA and that a possible range in energy needs can be covered.

3.2.4 Requirements for energy and micronutrients

The needs of individuals for energy are taken from a database embedded in the Cost of the Diet software that specifies the estimated average requirement (EAR) recommended by the WHO and FAO (2004) for individuals by age, sex and activity level. As this intake is based on the estimated average requirement, the probability that any given individual's requirement is met is 0.5 or 50%.

The needs of individuals for protein are taken from a database embedded in the software which specifies the safe individual intake recommended by the WHO and FAO (2007) for individuals by age and sex. This intake is defined as the 97.5th percentile of the distribution of individual requirements, so the probability that any given individual's protein requirement is met is 0.975 or 97.5%.

The needs of individuals for vitamins and minerals (collectively called micronutrients) are taken from a database embedded in the software which specifies the recommended nutrient intake (RNI) proposed by the WHO and FAO (2004) for individuals by age and sex. This intake is defined as the 97.5th percentile of the distribution of individual requirements, so the probability that any given individual's requirement is met is 0.975 or 97.5%. The recommended intake of vitamin A is specified as the recommended safe intake, as there are no adequate data to derive mean and standard deviations of intake (WHO/FAO, 2004).

The needs of individuals for fat are specified as 30% of total energy intake (WHO, 2008).

For the purpose of this analysis, a diet selected by the Cost of Diet software which meets all of the requirements described above is called a 'nutritious' diet.

3.3 The Cost of the Diet software

The cost of the diet is a method developed by SC UK to calculate the minimum amount of money a typical household would need to purchase their requirements for energy, protein, fat and micronutrients, with the probabilities specified above, using locally available foods. The cost of food grown at home and consumed at home is included in the calculation by applying market prices. Menu driven software developed that applies linear programming routines in Microsoft Excel 2003[2] is used to minimise the cost of locally available foods to meet these nutrient requirements. The Cost of the Diet software generates a hypothetical diet using a combination of

[2] Available from Save the Children, UK upon request

foods that will enable a family to meet their energy and nutrient requirements as recommended by the WHO and the FAO (2004) at the lowest possible cost. As mentioned, this is defined as a 'nutritious' diet. As the software can select amounts of foods that are not realistic in terms of the frequency with which foods are eaten, for example by specifying that a particular food is eaten three times a day every day, the frequency with which each food is consumed can be adjusted to reflect typical dietary patterns.

3.3.1 Energy only diet

When estimating an energy only diet, the software calculates a lowest cost diet that meets only the average energy requirements of the family. The analysis is not used to promote an energy only diet because it is very unlikely to meet all micronutrient requirements, but it is useful to illustrate:

- The potential for micronutrient deficiencies in a diet that only tries to provide energy
- The additional cost of meeting all nutrient requirements, including micronutrients

3.3.2 Minimum cost nutritious diet (MNUT)

When estimating a MNUT diet, the software calculates the lowest cost combination of foods which meets the average energy requirements and the recommended micronutrient intake of the typical family. This diet does not reflect people's typical dietary patterns but it is useful to illustrate:

- The differences in diet composition and its cost when compared with a diet that takes into account typical dietary patterns.
- The extra cost of micronutrients when compared to the energy only diet

3.3.3. Locally appropriate cost-optimised nutritious diet (LACON)

When creating a LACON diet, the software calculates the lowest cost combination of foods which meet the average energy requirements and the recommended micronutrient requirements, whilst adhering to the minimum and maximum constraints which set the number of times a week specific food items can be included in the diet. This diet therefore does reflect people's typical dietary patterns and is useful to illustrate:

- The extra cost of meeting average energy and recommended nutrient intakes when typical dietary habits such as the main staple, foods commonly consumed and food taboos are taken into account

Table 2 below summarises the characteristics of each diet.

Table 2. A summary of the diets analysed using the Cost of the Diet software.

Diet name	Definition	Energy needs met	Fat at 30% of energy	Protein needs met	Micro-nutrient needs met	Reflects a typical diet
Energy only diet	A lowest cost diet that only meets the average energy requirements of the members of the household	X				
Minimum cost nutritious diet (MNUT)	A lowest cost diet that meets the average energy and the recommended nutrient requirements of the household	X	X	X	X	
Locally appropriate cost-optimised nutritious diet (LACON)	A lowest cost diet that meets the average energy and the recommended nutrient requirements of the household and reflects cultural consumption patterns	X	X	X	X	X

The average cost of all diets were calculated and are given in Kenyan shillings (KSH) rounded to the nearest 100 KSH.

The Cost of the Diet software can also be used, for example:

- To estimate the cost of a typical local diet;
- To estimate the minimum cost of a diet for any given individual and for specified households of multiple individuals;
- To take into account seasonal variations in food prices when costing the diet;
- To identify seasonal gaps in nutrient intake;
- To develop models of the impact of potential interventions that might enable households to meet their nutrient requirements.

A Cost of the Diet assessment is most useful when chronic malnutrition and micronutrient deficiencies have been identified as a nutritional problem and the availability or affordability of nutritious foods are likely to be among the underlying causes.

3.4 Estimating the affordability of diets

3.4.1 Estimating affordability according to annual income

The cost of a nutritious diet becomes a more meaningful figure when compared with the income and purchasing power of the poorest members of the community. A diet may be inexpensive in comparison to other contexts, but if it is beyond the means of the poor, then the risk of malnutrition remains.

Estimates of cash income were made during the HEA (FEG, 2012). For the purpose of the present analysis, in addition to the estimated cash income, the cash value of all food that is consumed but not purchased was estimated based on the market cost of

the same foods. This monetises all food grown or produced by the household, food paid in kind in exchange for labour, or food provided as gifts.

As mentioned previously, the HEA found that household size was larger in wealthier households. To ensure that affordability was not under or over estimated, the cost of the diets was estimated for the household sizes detailed in Table 3.

Table 3. The household size of each wealth group used to estimate the cost of the diets to estimate affordability (FEG, 2012)

Wealth group	Household size
Very poor	7 individuals
Poor	10 individuals
Middle	15 individuals
Better-off	22 individuals

Each family was aligned with the HEA using the methods described in section 3.2.3.

Table 4 shows these estimates for the four wealth groups.

Table 4. Total estimated income in Kenyan Shillings of four wealth groups rounded to the nearest thousand.

	Very poor	Poor	Middle	Better-off
Annual Cash Income	53,300	99,500	157,600	238,500
Annual Own Produce	176,700	455,200	760,300	1,208,300
Total Annual Income	230,000	554,700	917,800	1,446,800

3.4.2 Estimating affordability after accounting for non-food expenditure

The income figures in Table 4 represent the total and potential income as food by households in different wealth groups. However, households have many needs in addition to food, some of which are critical for their survival. The 'non-food expenditure' (NFE), is defined as the annual cost of essential non-food items required by each specified wealth group. These figures are estimated by subtracting the staple food and non-staple food expenditure figures, generated by the HEA, from the total annual expenditure figures for each wealth group, again, generated by the HEA. By subtracting the non-food expenditure from the total annual income figures presented above, a more realistic indication of what amount households may have available to spend on food can be estimated. Table 5 shows the total income of each wealth group after subtracting household's needs for essential non-food items.

Table 5. Total income and non-food expenditure by wealth group (FEG, 2012).

	Very Poor	Poor	Middle	Better-off
Total annual income	230,000	554,700	917,800	1,446,800
Non-food expenditure (NFE)	23,500	48,500	89,300	175,800
Total annual income - NFE	206,500	506,200	828,600	1,271,100

The difference between the total estimated annual income plus non-food expenditure and the annual cost of a nutritious diet was defined as the 'affordability' of the diet.

4. Results

The list of foods identified and used in the Cost of the Diet analysis with the price per 100g in all four seasons can be found in Appendix 2. The list of all food found in the markets in the central pastoral livelihood zone, the portion sizes, minimum and maximum constraints entered into the Cost of the Diet Software can be found in Appendix 3.

The field team collected data on 40 foods found in the markets: 11 cereals, 5 pulses, 6 vegetables, no fruit, 9 animal products, 2 dairy products, 1 tuber, 4 fats/oils, tomato concentrate, sugar and iodised salt. The results from the interviews and focus group discussion found that maize was the main staple food in the central pastoral livelihood zone of Turkana and was imported from other areas of Kenya. As mentioned, food aid rations provide 37% and 30% of a very poor and poor household's energy requirements. These rations consist of maize, a pulse such as kidney beans or lentils, oil, sugar and iodised salt. Many of the women interviewed stated that milk was consumed frequently, but in small amounts as most was sold. For very poor families, meat was rarely consumed as it was too expensive on the market and their animals were more important as a source of income. Finger millet was reported as being a taboo food with many older members of the community believing that it prevents women becoming pregnant.

The most striking finding in the markets visited was the lack of fruit and vegetables. Many women reported that this was mainly due to poor supply as distances to the main markets and transport costs meant that traders only collected fruit and vegetables once a week, but they were often too expensive for poor families to purchase. Furthermore, many fruit and vegetables perished quickly, affecting what traders bought back to the village. The most common vegetables sold were cabbage, kale and onions.

One food that the data collection team struggled to find price and weight data for was goat's milk. It is important to highlight this issue because the HEA found that 4% of energy requirements for very poor households was met by milk, a typical consumption pattern that was not captured in the Cost of the Diet analysis (FEG, 2012). The main reason for this was because goat milk was not in season during the period of data collection.

Table 6 shows the energy density of the main staple foods eaten in the central pastoral livelihood zone of Turkana with their cost in Kenyan shillings per 100 kcal of raw and cooked food and per 10g of protein.

Table 6. The energy density and cost of the main staple foods eaten by people in the central pastoral livelihood zone of Turkana District, Kenya, ranked in terms of cost per 100 g from low to high

		Cost in Kenyan Shillings		
Staple Food	**Energy in kcal per 100g**	**Per 100 kcal raw**	**Per 100 kcal cooked**	**Per 10g protein**
Lentils	311	1.0	-	1.3
Maize	362	1.5	4.4	6.5
Beans	326	2.5	6.4	3.6
Goat meat	188	17.9	12.5	19.4

4.1 The cost of the diet

4.1.1 Energy only diet

Table 7 shows the analysis of the cost of the diet by family group and by season.

The minimum cost of a diet that meets only a household's energy need has been estimated at between 418 – 463 KSH per day, depending on the season, and features only seven of the 40 foods found in the markets within the central pastoral livelihood zone. The annual cost of the diet for the typical family is estimated to be 160,000 KSH.

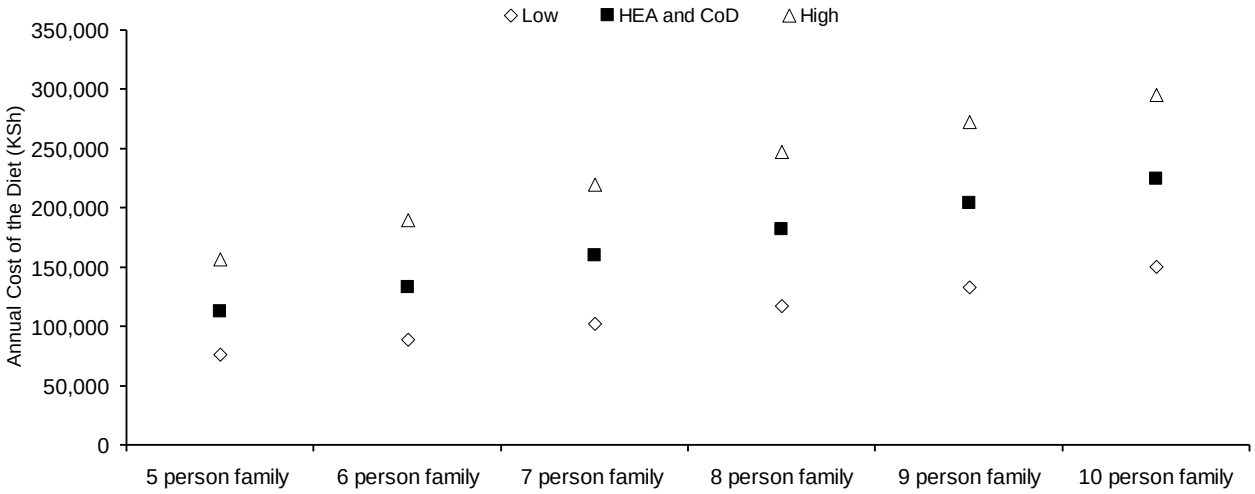
Table 7. The lowest cost diet for the HEA/CoD family in the central pastoral zone, Turkana that meets only energy requirements. The annual costs have been rounded to the nearest 100 KSH.

Age group	**Season 1** ***Akiporo***	**Season 2** ***Akamu***	**Season 3** ***Akicheres***	**Season 4** ***Ait***	**Annual cost**
12-23 month-old	14	15	14	15	5,400
Rest of Family	404	448	423	411	154,600
Overall	418	463	438	426	160,000

It should be noted that the cost of the diet of the child aged 12-23 months only includes the cost of the solid complementary foods the child is given, it does not include the costs of breast milk which are calculated within the average extra energy and nutrients required by the mother each day (418 kcal/day).

The composition of the typical household selected for the Cost of the Diet analysis consists of a family of two adults and five children whose energy intake is aligned with the energy intake used in the HEA. Figure 4 shows how the annual cost of the energy only diet for the HEA/CoD family varies by the number of individuals in the household from five to ten and for families with the minimum and maximum energy requirements. The cost for a family of seven members could range from 102,400 KSH to 220,000 KSH depending on their sex, age, body weight and physical activity.

Figure 4. The annual cost of an energy only diet based upon mean energy values for household of between five and ten members and low, HEA and Cost of the Diet and high average energy requirements.



The key foods in the energy only diet are avocados, wheat flour, lentils, liver and fat. Approximately 65% of recommended intake of energy for the family is provided by three different types of fat: fortified oil, vegetable oil and vegetable fat. Avocados are not included in the diet during seasons two and three as they are at their most expensive. Liver and wheat flour are included during these seasons to make up for the shortfall in energy.

Table 8 shows the absolute weight and cost of the foods selected for the family for the whole year for the energy only diet with the percentage contributed by each food in terms of weight, cost, energy, protein and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total requirements met for each nutrient, averaged over the four seasons.

Table 8. The absolute weight and cost of the foods selected for the HEA/CoD family for the whole year for the energy only diet with the percentage contributed by each food in terms of weight, cost, energy, protein and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total requirements met for each nutrient, averaged over the four seasons.

Food List	Quantity (kg)	% quantity	Cost KSH	% cost	% energy	% protein	% fat
Lentil, whole	48.5	4.7	1,552	1.0	3.0	25.8	0.1
Liver	46.1	4.5	11,020	7.2	1.1	18.4	0.4
Oil, vegetable (WFP specs)	137.8	13.4	38,272	24.9	24.2	0.0	29.3
Pear, avocado	343.8	33.4	22,003	14.3	11.0	15.2	11.2
Vegetable, fat, kimbo	137.8	13.4	38,479	25.1	24.2	0.0	29.3
Vegetable, oil	137.8	13.4	24,183	15.8	23.6	0.0	29.3
Wheat, flour, all-purpose	178.4	17.3	17,887	11.7	12.9	40.6	0.4
Total	1,030.2	100.0	153,398	100.0	100.0	100.0	100.0
% of requirements met					100.0	57.1	275.2

Food List	% vit A	% vit C	% vit B1	% vit B2	% niacin	% vit B6	% folic acid	% vit B12
Lentil, whole	0.0	6.9	26.6	5.1	14.3	16.1	40.6	0.0
Liver	84.7	14.5	7.1	68.0	24.9	12.2	17.1	100.0
Oil, vegetable (WFP specs)	15.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pear, avocado	0.1	78.6	45.0	22.9	34.9	66.8	36.8	0.0
Vegetable, fat, kimbo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vegetable, oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wheat, flour, all-purpose	0.0	0.0	21.3	4.0	25.9	4.9	5.5	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
% of requirements met	197.5	36.3	33.9	70.7	68.3	48.9	69.2	150.0

Food List	% calcium	% iron	% zinc	% copper
Lentil, whole	39.9	30.3	26.5	9.1
Liver	4.8	30.0	32.4	43.0
Oil, vegetable (WFP specs)	0.0	0.0	0.0	0.0
Pear, avocado	12.2	24.4	21.5	25.0
Vegetable, fat, kimbo	0.0	0.0	0.0	0.0
Vegetable, oil	0.0	0.0	0.0	0.0
Wheat, flour, all-purpose	43.2	15.2	19.5	22.9
Total	100.0	100.0	100.0	100.0
% of requirements met	2.4	24.9	41.4	

Although the energy only diet meets the recommended requirements for energy and fat by design, it lacks several essential micronutrients. Figure 5 shows that for a child aged 12 – 23 months in all seasons RNIs for vitamin C, vitamin B1, vitamin B2, niacin, vitamin B6, vitamin B12, pantothenic acid, calcium, iron and zinc not met. The requirements for protein, folic acid and magnesium are not met during seasons two and three due to the absence of avocado in the diet.

Figure 5. The percentage of energy and the recommended nutrient intakes for micronutrients met by an energy only diet for a 12-23 month old child.

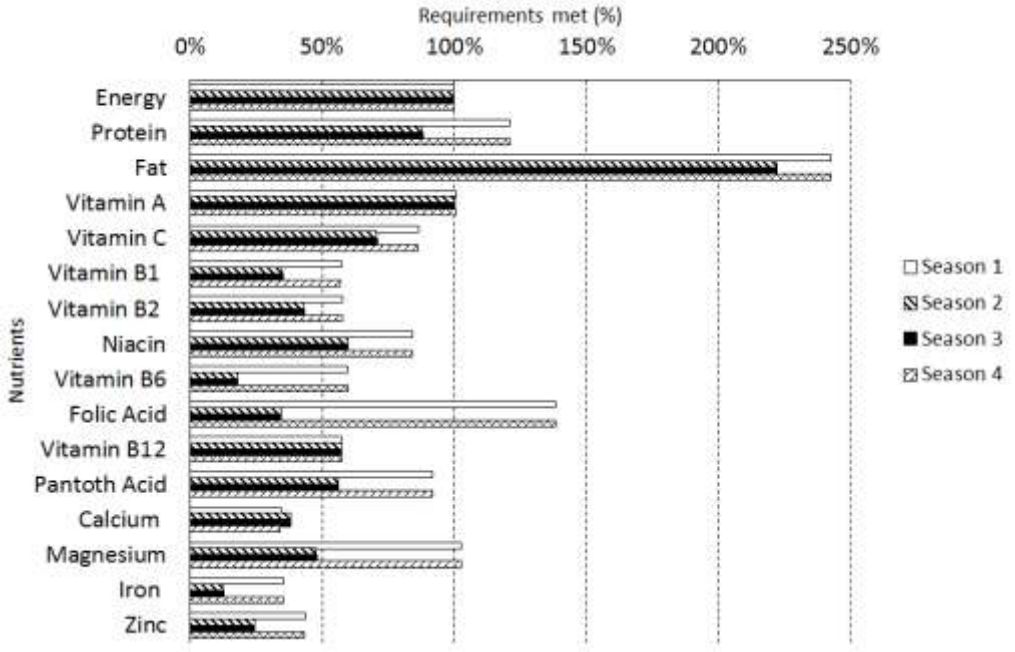
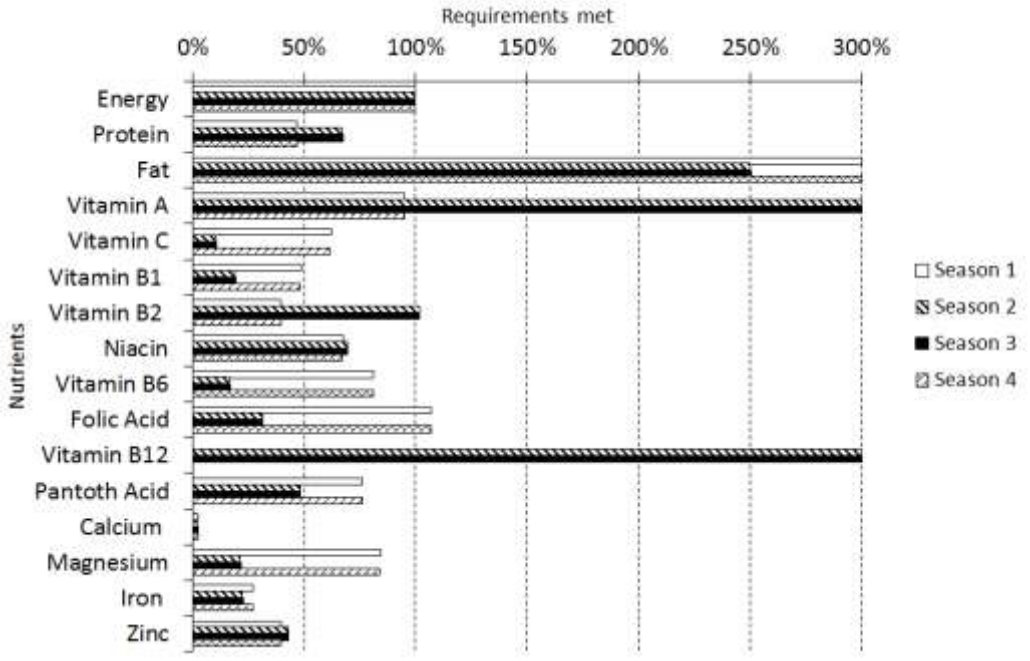


Figure 6 shows that for the rest of the family, a diet that only meets the need for energy, does not provide enough protein, vitamin C, vitamin B1, niacin, vitamin B6, pantothenic acid, calcium, magnesium, iron and zinc in all seasons. Recommended intakes are not met in seasons 1 and 4 for vitamin A, vitamin B2 and vitamin B12 because the software has not selected liver and in seasons two and three, requirements for folic acid are not met because the software has not selected avocado.

Figure 6. Percentage of energy and recommended nutrient intakes for micronutrient met for the rest of the family by an energy only diet.



4.1.2 Minimum cost nutritious diet (MNUT)

The minimum cost of a nutritionally adequate diet that meets the average energy requirements and the RNIs for micronutrients is estimated to cost between 640 and 745 KSH per day, depending on the season. Table 9 shows the costs by family members and by season. However this diet includes 9 of the 40 foods found in the market in the central pastoral zone of Turkana, some of which have to be eaten at three meals a day, every day, which is unlikely.

Table 9. The lowest cost diet for the HEA/CoD family in the central pastoral zone, Turkana that meets needs for energy and micronutrient but does not take into account the typical diet. The annual costs have been rounded to the nearest 100 KSH,

Age Group	Season 1 *Akiporo*	Season 2 *Akamu*	Season 3 *Akicheres*	Season 4 *Ait*	Annual Cost
12-23 month-old	30	33	32	30	11,400
Rest of Family	611	713	703	610	242,000
Overall	641	745	735	640	253,400

The key foods selected by the Cost of the Diet software are avocado, lentil, vegetable oil and beef. Liver has been identified by the software as an inexpensive source of vitamin A, vitamin B2, and vitamin B12, providing 96%, 28%, 66% of these nutrients respectively in the MNUT diet. Lentils have been identified by the software as an inexpensive and important source of energy, protein, soluble B group vitamins and folic acid. Avocados provide an inexpensive source of energy, fat, vitamin C, soluble B group vitamins and folic acid. Recommended intakes for calcium are being provided primarily by small dried fish.

Table 10 shows the absolute weight and cost of the foods selected for the family for the whole year for the MNUT diet with the percentage contributed by each food in terms of weight, cost, energy, protein and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total requirements met for each nutrient, averaged over the four seasons.

Table 10. The absolute weight and cost of the foods selected for the family for the whole year for the MNUT diet with the percentage contributed by each food in terms of weight, cost, energy, protein and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total requirements met for each nutrient, averaged over the four seasons.

Food List	Quantity (kg)	% quantity	Cost KSH	% cost	% energy	% protein	% fat
Beef, raw	106.5	6.1	30,767	12.8	5.4	9.3	6.2
Fish, large dried	101.4	5.8	86,063	35.9	6.7	29.0	2.8
Kale	42.7	2.4	2,603	1.1	0.3	0.4	0.0
Lentil, whole	413.4	23.6	13,228	5.5	25.5	48.6	1.3
Liver	32.3	1.8	8,087	3.4	0.8	2.9	0.3
Millet, finger	63.3	3.6	3,353	1.4	4.1	2.0	0.2
Pear, avocado	812.1	46.3	59,679	24.9	26.0	7.9	36.3
Vegetable, fat	43.0	2.5	11,967	5.0	7.6	0.0	12.6
Vegetable, oil	137.8	7.9	24,183	10.1	23.6	0.0	40.2
Total	1,752.4	100.0	239,933	100.0	100.0	100.0	100.0
% of requirements met					100.0	258.5	204.2

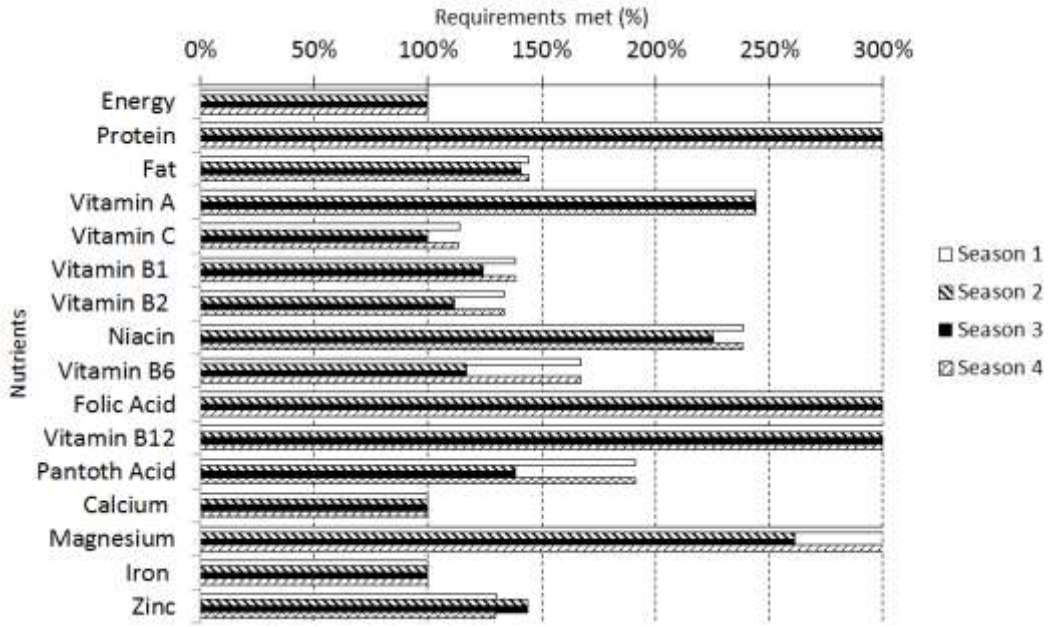
Food List	% vit A	% vit C	% vit B1	% vit B2	% niacin	% vit B6	% folic acid	% vit B12
Beef, raw	0.0	0.0	2.0	3.7	7.9	4.9	0.2	3.6
Fish, large dried	0.0	0.0	3.2	8.7	25.4	7.9	1.1	30.5
Kale	3.1	16.4	0.7	1.0	0.5	1.1	0.2	0.0
Lentil, whole	0.1	19.4	59.5	25.1	35.3	37.7	76.5	0.0
Liver	96.2	3.3	1.3	27.5	5.0	2.3	2.6	65.9
Millet, finger	0.0	0.0	5.3	2.8	2.0	2.8	0.2	0.0
Pear, avocado	0.5	60.9	28.0	31.2	23.9	43.3	19.2	0.0
Vegetable, fat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vegetable, oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
% of requirements met	380.6	110.6	129.1	122.8	235.7	178.3	313.2	806.0

Food List	% calcium	% iron	% zinc	% copper
Beef, raw	0.2	4.1	11.2	1.0
Fish, large dried	84.2	8.2	18.5	6.8
Kale	0.2	0.7	0.3	1.0
Lentil, whole	8.0	64.3	50.8	41.5
Liver	0.1	5.2	5.1	16.2
Millet, finger	6.6	3.0	2.7	1.8
Pear, avocado	0.7	14.4	11.4	31.7
Vegetable, fat	0.0	0.0	0.0	0.0
Vegetable, oil	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0
% of requirements met	100.0	100.0	184.1	

Figure 7 shows that the RNI is exactly 100% for calcium and iron for the young child in all seasons of the year. The RNI is 100% for vitamin C during seasons 2 and 3

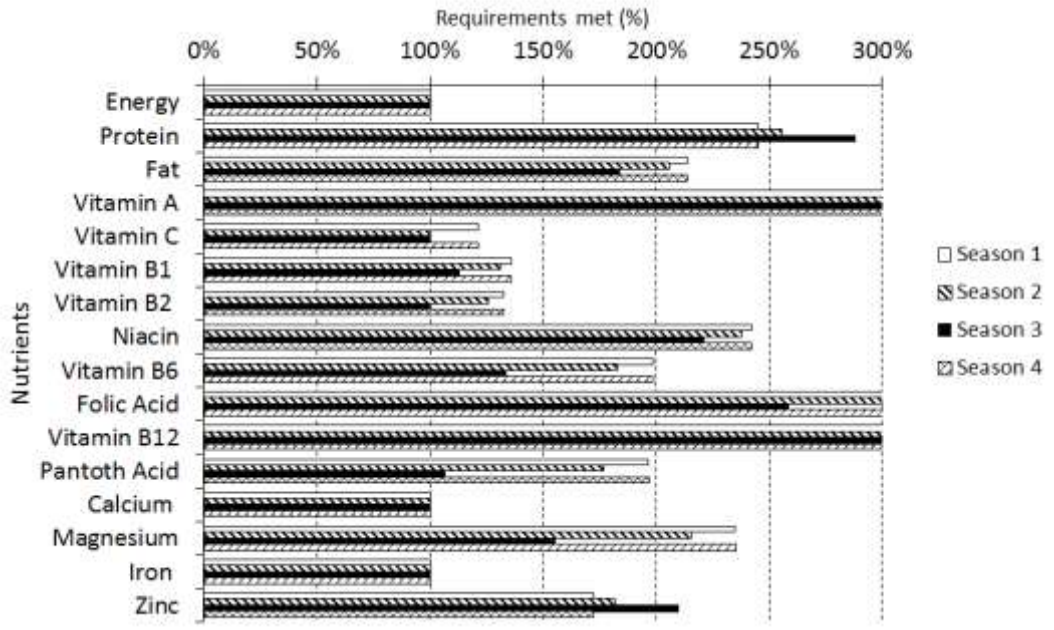
when avocados are not included in the diet by the software as they are at their most expensive. This analysis identifies iron, vitamin C and calcium as the most difficult micronutrients to obtain from the diet for the 12-23 month old in a nutritious diet that is not constrained by typical dietary patterns.

Figure 7. The percentage of energy and the recommended nutrient intakes for micronutrients met by a MNUT diet for a 12-23 month old child.



For the rest of the family, figure 8 shows that the RNI is exactly 100% for iron in all seasons of the year. The requirement for vitamin C is also only just met in seasons 2 and 3 as the quantity of avocado included in the diet by the software has been reduced due to its high cost during these seasons. Furthermore, the RNI for vitamin B2 is exactly 100% in season 3 as the quantity of dried fish and avocado is reduced by the software compared to the other seasons due to their higher costs. These nutrients are therefore the hardest for the software to meet requirements for in the central pastoral zone of Turkana, when a nutritious diet is not constrained by typical dietary patterns. However it should be recognised that the recommended amounts used as targets by the software are greater than the actual needs of 97% of all individuals.

Figure 8. The percentage of energy and the recommended nutrient intakes for micronutrients met by a MNUT diet for the rest of the family.



4.1.3. Locally appropriate cost-optimised nutritious diet (LACON)

The MNUT diet specified in section 4.1.2 above was not chosen to be typical of the foods eaten by people in the central pastoral zone; the diet reflects the least expensive way for the typical family to meet the specified amounts of energy and micronutrients using all foods available in the market, but in unconstrained amounts.

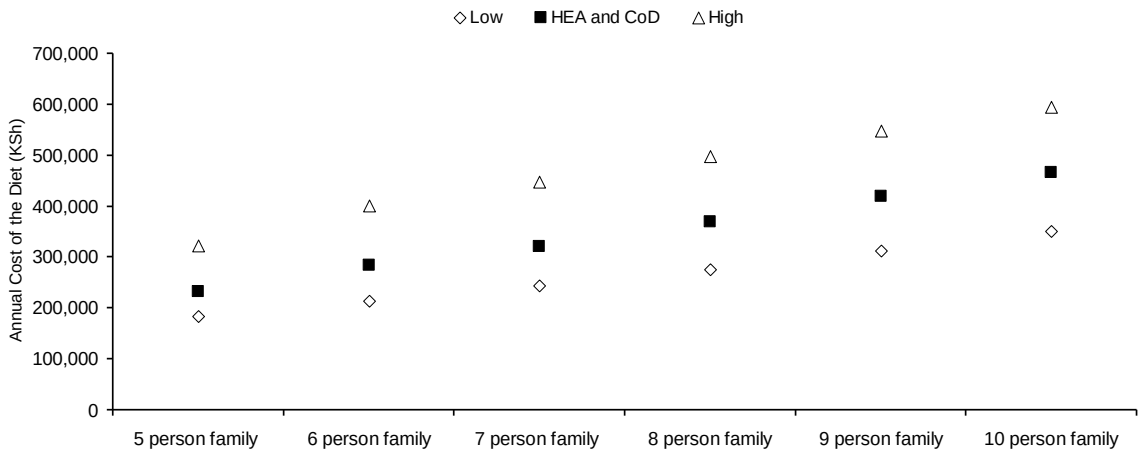
Table 11 shows the breakdown of costs by family members and by season for a culturally acceptable diet (LACON). The estimated minimum amount of cash that a family of 7, including a child aged 12-23 months, would need to be able to purchase this diet from the market is between 862 – 897 KSH a day and includes 14 of the 40 foods found in the markets in central pastoral livelihood zone of Turkana.

Table 11. The lowest cost diet for the HEA/CoD family in the central pastoral livelihood zone of Turkana that meets needs for energy and micronutrients and is adjusted to account for usual dietary habits. The annual costs have been rounded to the nearest 100 KSH.

Age group	Season 1 *Akiporo*	Season 2 *Akamu*	Season 3 *Akicheres*	Season 4 *Ait*	Annual cost
12-23 month-old	51	48	47	51	18,000
Rest of family	812	849	834	811	303,300
Overall	863	897	880	862	321,300

Figure 9 shows how the annual cost of the LACON diet for the HEA/CoD family varies by the number of individuals in the household from five to ten and for families with the minimum and maximum energy requirements. The cost for a family of seven members could range from 243,600 KSH to 448,000 KSH depending on their sex, age, body weight and physical activity

Figure 9. The annual cost of a diet that meets average energy requirements and the RNI of micronutrient for households of between five and ten members for the low energy, HEA/CoD and high average energy requirement families.



The cost of the diet of the child aged 12 to 23 months represents the additional foods needed meet the recommended energy and nutrient intakes in addition to breast milk, the cost of which is included in the cost of the mother's diet. It is important to note the essential contribution of breast milk in this diet for children aged 12-23 months. Although breast feeding should be partial at this age and only contributes 39% of the average energy intakes, it makes the greatest contribution to a child's intake of fat (60%), vitamin C (57%), vitamin B2 (23%) and niacin (16%). Breast milk contains little iron however, so it is important that iron-rich complementary foods are given to the child.

Table 12 shows the absolute weight and cost of the foods selected for the family for the whole year for the LACON diet with the percentage contributed by each food in terms of weight, cost, energy, protein and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total requirements met for each nutrient, averaged over the four seasons.

Table 12 shows a diet that meets average energy requirements and meets or exceeds the RNIs for micronutrients at lowest possible cost, based on market prices in June 2012. However it is not a realistic diet as only 14 foods from the 41 identified have been selected and three are specified in very large amounts: avocado (19% by weight and 12% by energy), maize (16% by weight and 24% by energy) and lentil (13% by weight and 15% by energy).

Table 12. The absolute weight and cost of the foods selected for the family for the whole year for the LACON diet with the percentage contributed by each food in terms of weight, cost, energy, protein and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total requirements met for each nutrient, averaged over the four seasons.

Food List	Quantity (kg)	% quantity	Cost KSH	% cost	% energy	% protein	% fat
Beef, raw	137.8	7.1	39,823	13.2	7.0	10.3	11.0
Camel, raw	86.6	4.4	25,028	8.3	3.2	6.3	4.3
Fish, dried, fresh water	91.9	4.7	77,992	25.9	6.1	22.5	3.4
Heart	73.5	3.8	17,013	5.7	1.5	5.4	0.8
Kale	117.7	6.0	6,983	2.3	0.7	0.9	0.2
Lentil, whole	249.6	12.8	7,986	2.7	15.4	25.2	1.1
Liver	29.5	1.5	7,367	2.4	0.7	2.2	0.4
Maize, yellow	330.7	17.0	17,445	5.8	23.8	11.2	4.7
Milk, cow	162.2	8.3	14,378	4.8	2.1	2.2	2.5
Millet, finger	70.0	3.6	3,711	1.2	4.6	1.9	0.4
Pear, avocado	385.8	19.8	31,059	10.3	12.3	3.2	23.5
Sheep, raw	120.7	6.2	34,887	11.6	6.4	8.5	10.4
Vegetable, fat	29.6	1.5	5,842	1.9	5.1	0.0	11.8
Vegetable, oil	64.1	3.3	11,303	3.8	11.0	0.0	25.5
Total	1,950	100.0	300,817	100.0	100.0	100.0	100.0
% of requirements met					100.0	300.9	149.8

Food List	% vit A	% vit C	% vit B1	% vit B2	% niacin	% vit B6	% folic acid	% vit B12
Beef, raw	0.0	0.0	2.3	4.3	8.8	6.4	0.3	4.5
Camel, raw	0.0	0.0	1.5	2.7	5.4	3.9	0.2	2.8
Fish, dried, fresh water	0.0	0.0	2.6	7.0	19.9	7.3	1.5	26.8
Heart	0.0	0.0	1.0	2.1	4.6	3.3	0.2	2.3
Kale	8.6	50.0	1.7	2.3	1.2	3.2	0.9	0.0
Lentil, whole	0.1	12.9	32.5	13.4	18.4	23.3	72.5	0.0
Liver	87.7	3.4	1.1	22.2	4.0	2.2	3.8	58.3
Maize, yellow	1.5	0.0	36.5	18.8	17.0	19.3	5.0	0.0
Milk, cow	1.8	1.7	1.8	7.8	1.6	1.9	0.6	1.6
Millet, finger	0.0	0.0	5.3	2.8	1.9	3.1	0.4	0.0
Pear, avocado	0.2	32.0	12.0	13.1	9.8	21.0	14.3	0.0
Sheep, raw	0.0	0.0	1.7	3.4	7.3	5.2	0.3	3.7
Vegetable, fat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vegetable, oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
% of requirements met	380.6	100.0	142.9	138.4	272.5	174.6	199.5	830.7

Food List	% calcium	% iron	% zinc	% copper
Beef, raw	0.2	5.4	11.5	1.6
Camel, raw	0.1	3.4	7.0	1.0
Fish, dried, fresh water	76.3	7.4	13.3	7.9
Heart	0.1	2.9	5.7	0.8
Kale	0.6	1.9	0.7	3.6
Lentil, whole	4.9	38.8	24.3	32.1
Liver	0.1	4.8	3.7	18.9
Maize, yellow	0.8	20.5	16.5	10.8
Milk, cow	9.1	0.5	1.8	0.0
Millet, finger	7.3	3.3	2.3	2.6
Pear, avocado	0.3	6.8	4.3	19.3
Sheep, raw	0.2	4.3	9.0	1.4
Vegetable, fat	0.0	0.0	0.0	0.0
Vegetable, oil	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0
% of requirements met	100.0	100.0	232.8	

Figure 10 and 11 show that the RNI is exactly 100% for calcium and iron for both the young child and the rest of the family in all seasons of the year. The requirement for vitamin C is also only just met in all seasons for the rest of the family. This analysis identifies iron, vitamin C and calcium as the most difficult micronutrients to obtain from the diet, but it should be recognised that the recommended amounts used as targets by the software are greater than the actual needs of 97% of all individuals.

Figure 10. The percentage of energy and the recommended nutrient intakes for micronutrients met by a LACON diet for a 12-23 month old child.

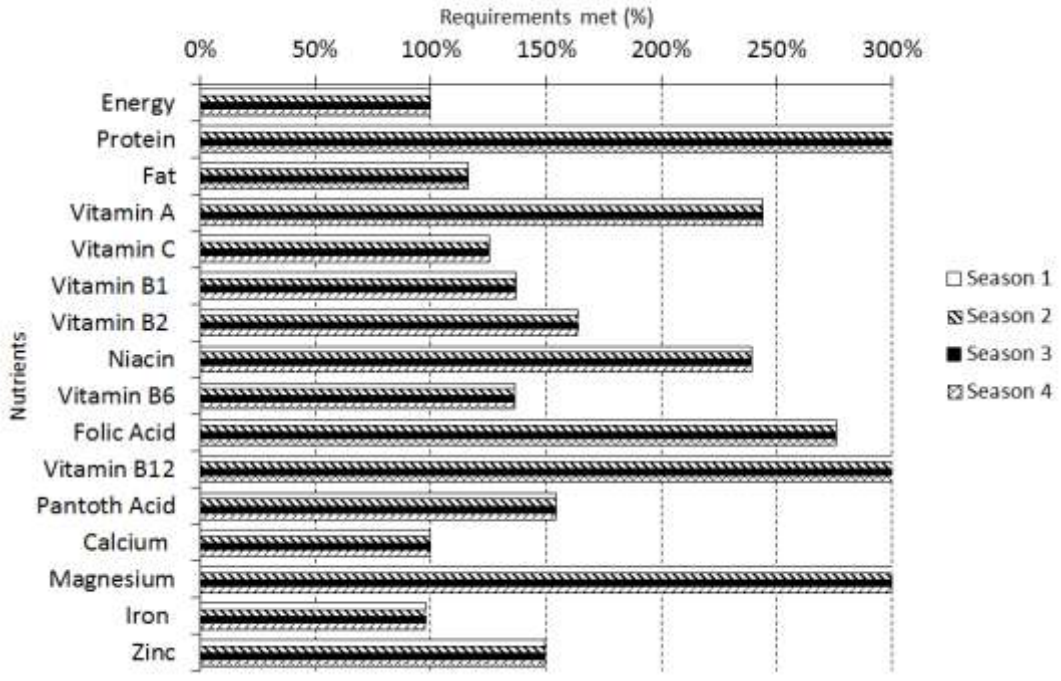
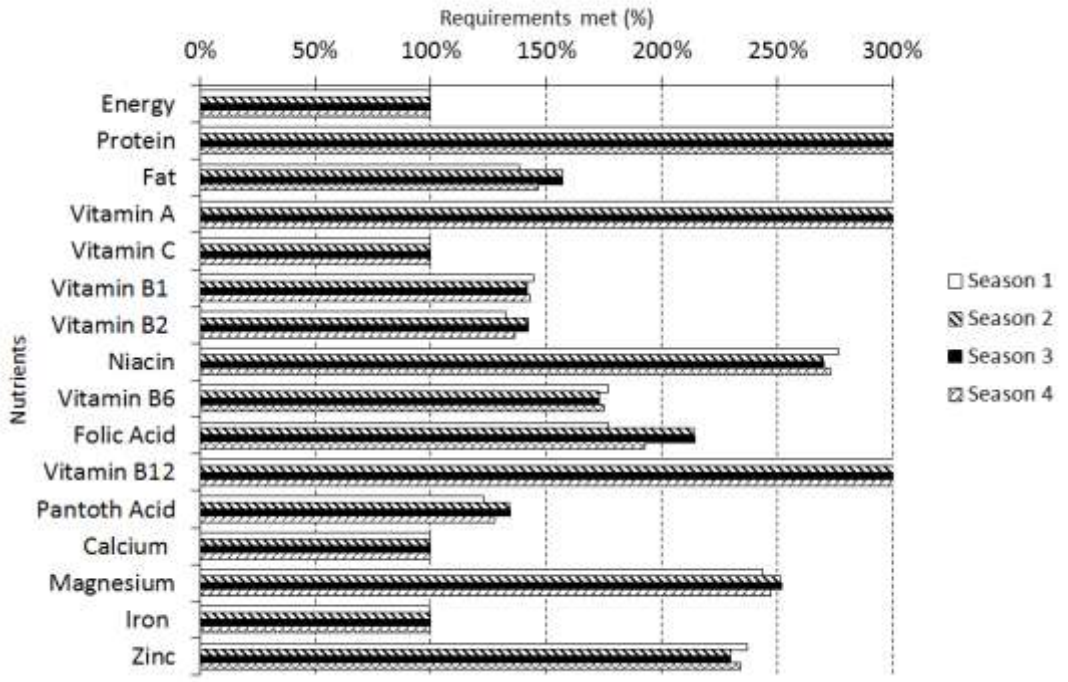


Figure 11. The percentage of energy and the recommended nutrient intakes for micronutrients met by a LACON diet for the rest of the family.

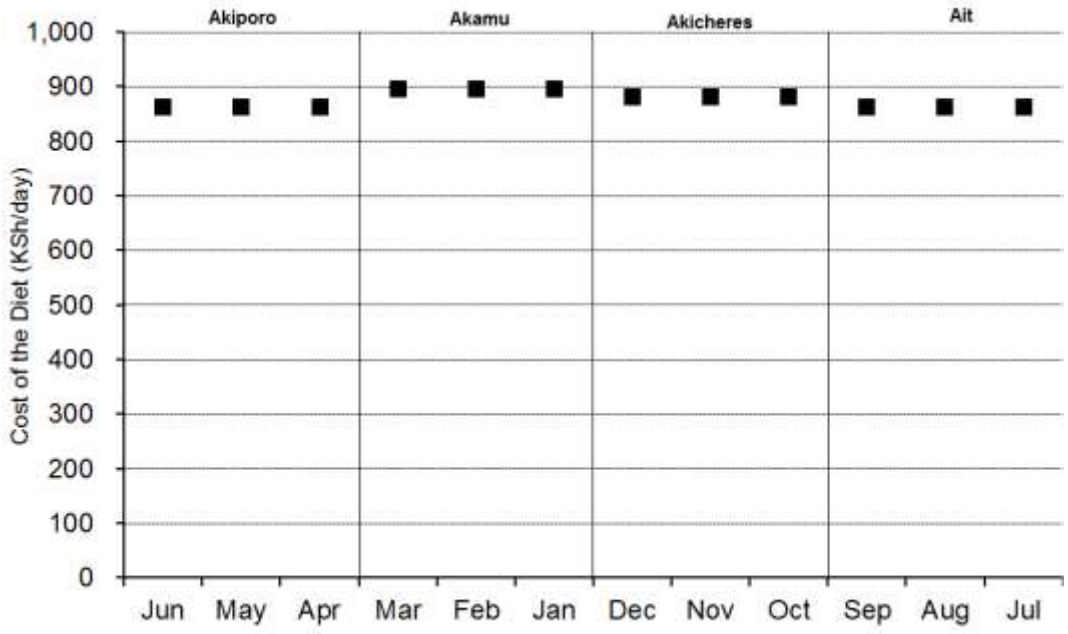


4.2 Seasonal fluctuations in the LACON diet

Figure 12 shows the cost of the LACON diet by season of the year. As mentioned, the timing of rainfall determines the seasonality of pastoral livelihoods through livestock production and livestock movements. Figure 12 shows that the cost of a nutritious diet is lowest during the long rains season *Akiporo*. This is because pastures are at their greenest, animals tend to be kept at home and milk production is at its highest.

Typically the hunger season lasts from August until February as pastoralists and their animals migrate to find green pastures therefore reducing access to milk and creating a greater reliance on staple food purchase from the market. This is captured to an extent in Figure 10 through the rising costs of the diet but the effect may have been mitigated against by the distribution of food aid during this period.

Figure 12. The cost of the LACON diet by season of the year.

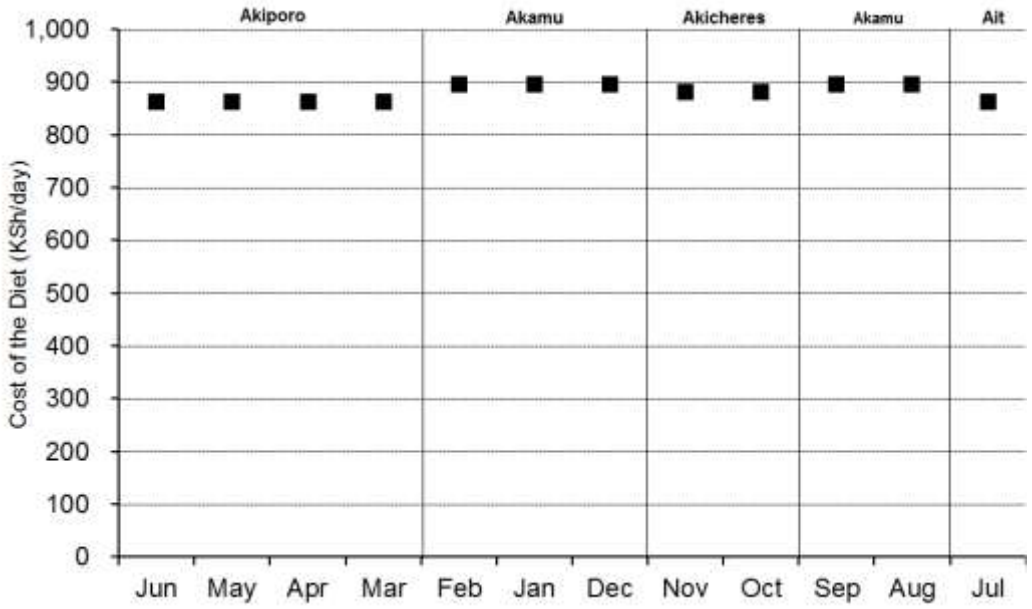


As mentioned in section 3.2.1 the seasons and periods used for this analysis were taken from the standard seasonal calendar for Turkana, provided by the Kenya Food Security Steering Group (2012) and do not reflect the poor rainfall experienced in 2012 and 2011.

It is important to note that the inhabitants of Turkana do not follow the typical length of season and continue to call the season *akiporo* and *akicheres* until the rains stop entirely. This greatly affects the collection of retrospective data during the market survey as the seasons are used to prompt trader's recollection of food prices. Figure 9 shows the cost of the LACON diet by season using the seasonal calendar produced by the HEA which better reflected the cost of the diet's reference year seasons.

Figure 13 shows greater fluctuations in the daily cost of the diet compared to Figure 12 and better emphasises the effect that the rains (a*kiporo* and a*kicheres*) have on the cost of the diet. The annual cost of the diet is calculated using a weighted average, based upon the daily cost of the diet and the length of the seasons. It is therefore important to note that using the HEA seasons does not greatly affect the annual cost of the three diets and, increasing them by 1%.

Figure 13. The cost of the LACON diet by the HEA's seasons of the year



4.3 Contribution of food groups to the cost of the LACON diet

Most of the cost of the LACON diet is due to foods that provide micronutrients. This can be judged from the fact that it costs 161,400 KSH (200%) more than the basic, energy only diet, which does not provide all micronutrients.

Figure 14 shows for the LACON diet that meat, poultry fish and eggs are the most costly element of the diet for a child aged 12 to 23 months. This is because of the inclusion of eggs, goat and camel meat and dried fish, which accounted for 50% of the overall cost of the LACON diet, but needed to be included as important sources of vitamin B2, protein, niacin, vitamin B12 and calcium. As previously discussed, although the main livelihood is pastoralism, many women during the focus group discussion stated that meat was expensive in the market and that animals were rarely slaughtered unless there was a celebration or for sustenance during the hunger season.

The same data for the rest of the family shown in Figure 15 reveal that meat, fish, poultry and eggs contribute the most to the cost of the LACON diet for the same reasons as the 12-23 month old diet. Vegetables such as avocado are also costly and are not widely available.

Figure 14. The weekly cost of foods each week selected by the Cost of the Diet software for the LACON diet which meets needs for energy and micronutrients in a culturally acceptable diet for a 12-23 month old child.

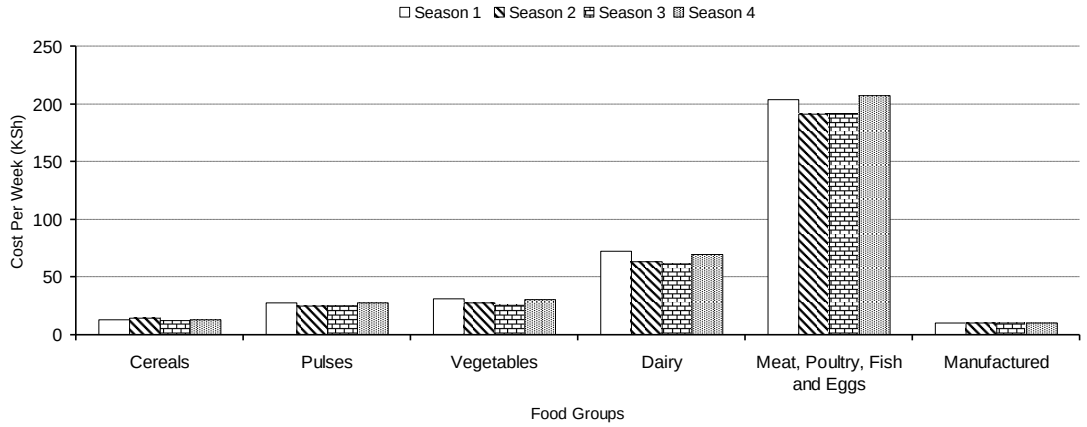
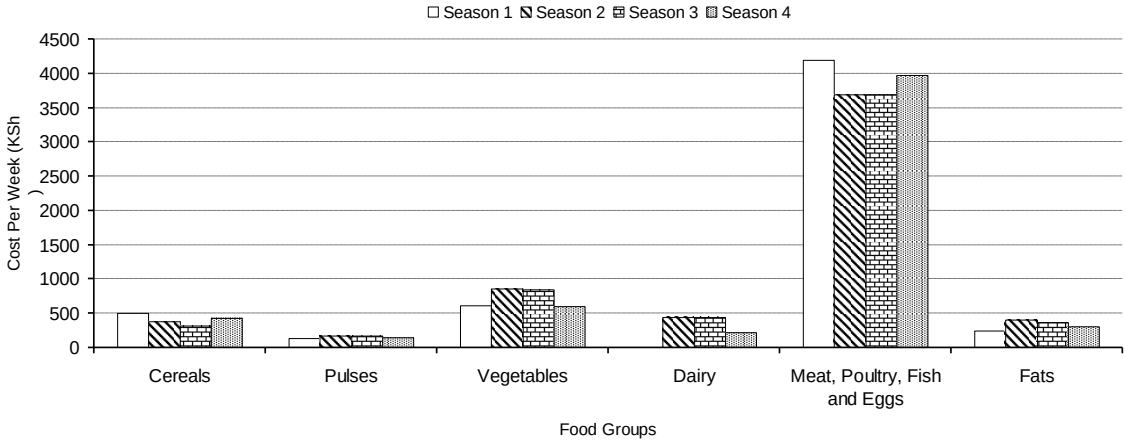


Figure 15. The weekly cost of foods each week selected by the Cost of the Diet software for the LACON diet which meets needs for energy and micronutrients in a culturally acceptable diet for the rest of the family



4.4 Affordability of the diets

In order to calculate affordability, the cost of the diet plus non-food expenditure is subtracted from the total income, all of which are estimates based on multiple assumptions and variable parameters by the HEA. Table 13 shows the estimated affordability of the diet per year if the non-food expenditure specific to each wealth group are applied to the cost of the three diets calculated in this analysis.

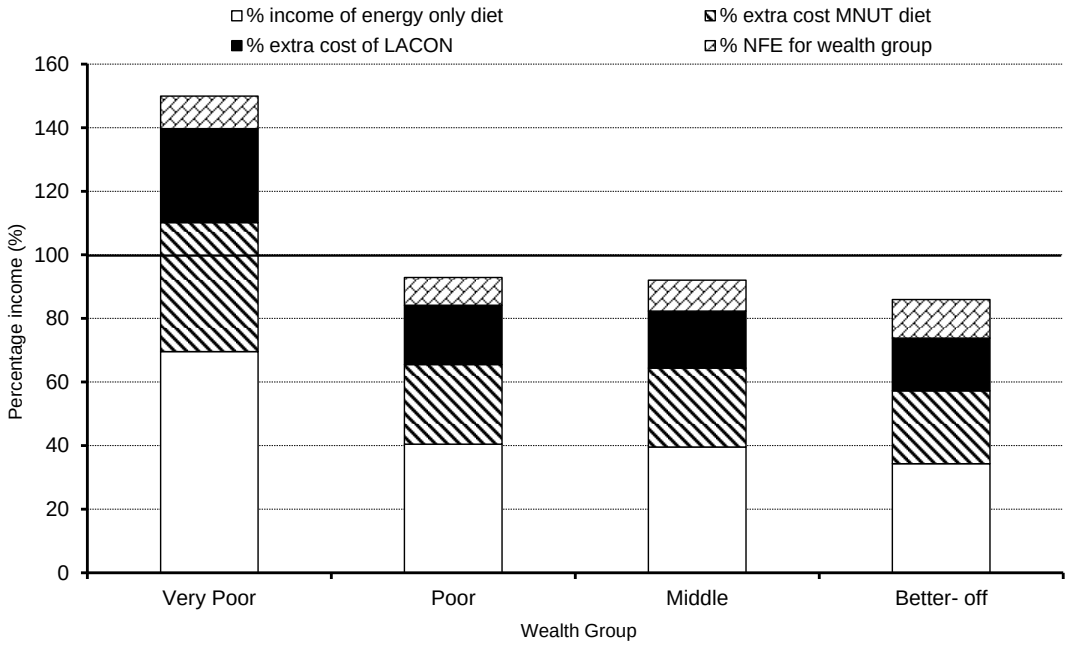
Table 13 indicates that an energy only diet accounts for 70% of the poorest wealth group's total income. Table 13 also shows that the poor, middle and better off households can afford the most nutritious diet; even after non-food expenditure is accounted for but would use 93%, 92%, 86% of their income respectively. However for very poor households the most nutritious diet is 40% more than their total income, without accounting for non-food expenditure. When non-food expenditure is accounted for the cost of the most nutritious diet is about 50% more than the income of very poor households, or about 115,000 KSH year.

Table 13. The estimated incomes by wealth group, non-food expenditure (NFE) and the costs of three diets estimated by the Cost of the Diet software for households in the central pastoral livelihood zone of Turkana District, Kenya in June 2012.

Wealth Group		**Very Poor**	**Poor**	**Middle**	**Better-off**
Annual income		230,000	554,700	917,800	1,446,800
Wealth Group NFE		23,500	48,500	89,300	175,750
Total income - NFE	(a)	206,500	506,200	828,600	1,271,100
Cost of energy only diet	(c)	160,000	224,400	363,000	496,300
Excess or shortfall	(a) - (c)	46,500	281,800	465,600	774,800
Cost of MNUT diet	(d)	253,400	363,400	590,700	827,800
Excess or shortfall	(a)-(d)	-46,865	142,800	237,800	443,300
Cost of LACON diet	(e)	321,400	466,700	755,400	1,067,900
Excess or shortfall	(a) - (e)	-114,800	39,500	73,100	203,100
Spending on food					
Cost of energy only diet (KSH)		160,000	224,400	363,00	496,300
% income of energy only diet		70	40	40	34
Extra cost of MNUT diet (KSH)		93,400	139,00	227,700	331,400
% extra cost MNUT diet		41	25	25	23
Extra cost of LACON (KSH)		68,000	103,300	164,700	240,200
% extra cost of LACON		30	19	18	17
Non-food expenditure (KSH)		23,500	48,500	89,300	175,800
% NFE for wealth group		10	9	10	12
Total		150	93	92	86

Figure 16 shows the gaps between estimated income and expenditure for the wealth groups and their typical household size, presented in Table 16 in the central pastoral zone of Turkana. The black solid line represents 100% of income.

Figure 16. The affordability of an energy only, MNUT and LACON diet based on the numbers presented in Table 13.



4.5 Modelling nutritional interventions

The Cost of the Diet software can be used to examine the effect of changing variables and assumptions to assess their effect on the cost and affordability of each diet, but usually the most nutritious, LACON, diet. For example the effect of activities to generate income, the effect of changing the cost of foods and the effect of providing foods that have a higher nutrient content could all be examined in terms of their effect on the cost and composition of the diet. Such models can illustrate the potential for activities to improve the diet either through nutritional interventions or by poverty alleviation. The models presented can help to generate ideas and test assumptions about the impact of activities on household nutrition, and to set targets and indicators. All the models described here are theoretical and, in reality, the situation will be influenced by numerous external factors that cannot be included in the model, so the actual effect on the Cost of the Diet may be different.

Five interventions were modelled to examine the effects on the composition and cost of the diet:

- The impact of including goat milk on the cost of a nutritious diet
- The impact of the Hunger Safety Net Programme on the affordability of a nutritious diet
- The impact of Oxfam's camel restocking intervention on the cost of a nutritious diet
- The impact of excluding finger millet to reflect cultural eating habits on the cost of a nutritious diet
- Applying the average prices of the major food groups to each of the constituent foods to see which are selected by the cost of diet software presumably based on their nutritional value.

As the analysis above indicated that the poor, middle and better - off wealth groups can afford a nutritious diet, the possible effects of these interventions was examined only for the very poor households using the income figure estimated by the HEA (FEG, 2012) for these groups.

4.5.1 Modelling the impact of goat's milk on the cost of the diet

One food that was not captured effectively during the market survey was goat milk. This was because goats and shoats were not producing milk when the data was collected and cows and camels were only owned by wealthier families. As the consumption of goat milk in poor households is typical in the central pastoral livelihood zone of Turkana this consumption is not captured in the results. The inclusion of goat milk in the diet may reduce the daily cost of a nutritious diet by replacing expensive sources of calcium such as small dried fish; it may also improve the intake of calcium, which has been identified as a nutrient that is difficult to meet requirements for using locally available foods.

Price and weight data were taken from the HEA (FEG, 2012) showed that goat's milk was typically sold for 1.2 KSH/100g. This price was entered into the software. The minimum and maximum constraints were set at 0 and 14 respectively which reflect the results from the focus group discussions. The HEA found that goat's milk production lasted for approximately 60 days of the year during March and April. The price per 100g for this milk was therefore entered into season 2 to reflect this.

The software included two portions of goat's milk a day for the six members of the family above the age of two years, amounting to a total of 11 litres of milk a day. The software included 80 ml goat's milk a day, four days a week for child aged 12-23 months. The HEA found that on average one goat will produce 0.5 litres of milk a day, so to drink the amount of milk recommended by the software; households would need to own at least 23 goats which for very poor households maybe unfeasible as summarised in Table 1.

Figure 17 shows that including goat milk in the diet led to a 34% lower daily cost for a nutritious diet. In terms of cash, this decrease in cost in season 2 was 307 KSH a day. The bold black line in Figure 17 represents average daily income for very poor households. Although it is unlikely that daily income is static it does show that although the cost of a nutritious diet has reduced by a third, it is still unaffordable for this wealth group.

Figure 17. A bar chart showing cost of the most nutritious, LACON diet, with and without consuming goat milk, in season 2 in the central pastoral livelihood zone of Turkana, Kenya

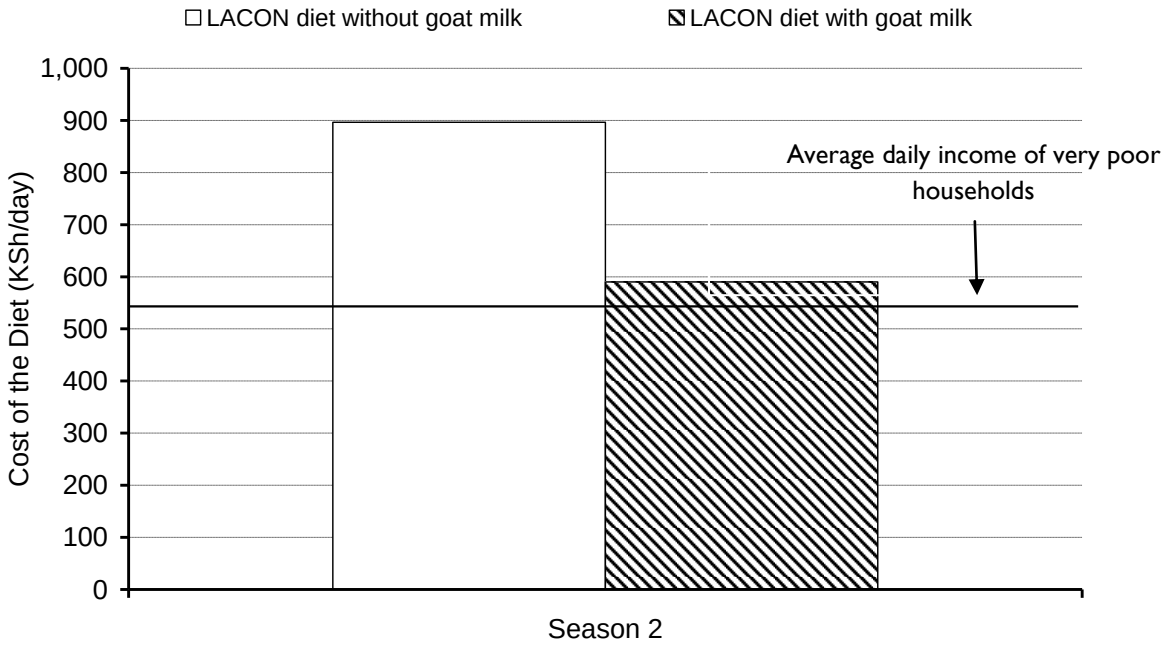


Table 14 shows the absolute weight and cost of the foods selected for the family for the whole year for the LACON diet with goat's milk with the percentage contributed by each food in terms of weight, cost, energy, protein and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total requirements met for each nutrient, averaged over the four seasons.

The detailed diet results showed that goat milk reduced the need for small dried fish, UHT cow's milk, finger millet, vegetable fat and vegetable oil in the diet. The results of this model emphasise the potential importance of goat milk in providing essential macro and micro-nutrients in the diet of households in Turkana. Table 14 shows that, for the year, goat milk provides 25% of energy, 25% of protein, 35% of fat, 20% of vitamin A and 79% of calcium. It also provides an important contribution to B group vitamins and vitamin C. Including goat milk in the diet has also improved the percentage of calcium requirements met by the LACON diet from 100% to 172% in season 2.

Table 14. The absolute weight and cost of the foods selected for the family for the whole year for the LACON diet with goat's milk with the percentage contributed by each food in terms of weight, cost, energy, protein and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total requirements met for each nutrient, averaged over the four seasons.

Food List	Quantity (kg)	% quantity	Cost KSH	% cost	% energy	% protein	% fat
Bean, mung, raw	11.5	0.6	889	0.3	0.7	0.9	0.1
Beef, medium fat, raw	137.8	5.4	39,823	14.6	7.0	10.0	11.7
Camel, fresh, meat	112.2	4.0	32,425	11.9	4.2	7.9	6.0
Fish, dried, fresh water	68.9	2.4	58,494	21.4	4.6	16.3	2.8
Heart	73.5	2.9	17,013	6.2	1.5	5.2	0.9
Kale	117.1	4.5	6,941	2.5	0.7	0.9	0.2
Lentil, whole	249.6	9.9	7,986	2.9	15.4	24.3	1.2
Liver	27.4	1.0	6,876	2.5	0.6	2.0	0.4
Maize, yellow, raw	330.7	12.9	17,445	6.4	23.8	10.8	5.1
Milk, cow, UHT	95.4	3.5	8,633	3.2	1.3	1.2	1.6
Milk goat, fresh, whole	624.7	32.5	7,496	2.7	8.6	9.1	10.9
Millet, finger	67.6	2.2	3,582	1.3	4.4	1.8	0.4
Pear, avocado	322.2	11.7	24,885	9.1	10.3	2.6	21.0
Sheep, raw	100.9	4.2	29,164	10.7	5.4	6.9	9.3
Vegetable, fat, kimbo	26.3	0.2	918	0.3	0.6	0.0	11.2
Vegetable, oil	41.2	2.1	10,981	4.0	11.0	0.0	17.5
Total	2,407	100.0	273,553	100.0	100.0	100.0	100.0
% of requirements met					100.0	311.7	140.2

Food List	% vit A	% vit C	% vit B1	% vit B2	% niacin	% vit B6	% folic acid	% vit B12
Bean, mung, raw	0.0	0.0	1.6	0.4	0.7	0.6	3.8	0.0
Beef, medium fat, raw	0.0	0.0	2.2	3.7	8.8	6.4	0.3	5.0
Camel, fresh, meat	0.0	0.0	1.8	3.0	6.9	5.0	0.3	4.0
Fish, dried, fresh water	0.0	0.0	1.8	4.5	14.8	5.5	1.1	22.4
Heart	0.0	0.0	1.0	1.8	4.6	3.3	0.2	2.6
Kale	8.6	49.8	1.5	2.0	1.2	3.2	0.9	0.0
Lentil, whole	0.1	12.9	30.3	11.5	18.3	23.1	71.8	0.0
Liver	81.6	3.1	0.9	17.7	3.7	2.0	3.5	60.4
Maize, yellow, raw	1.5	0.0	34.1	16.1	16.9	19.2	4.9	0.0
Milk, cow, UHT	1.0	1.0	1.0	3.9	0.9	1.1	0.3	1.0
Milk goat, fresh, whole	6.9	6.5	8.2	21.2	7.3	6.0	0.4	1.2
Millet, finger	0.0	0.0	4.8	2.3	1.8	3.0	0.4	0.0
Pear, avocado	0.2	26.7	9.4	9.4	8.1	17.4	11.9	0.0
Sheep, raw	0.0	0.0	1.3	2.5	6.1	4.3	0.2	3.4
Vegetable, fat, kimbo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vegetable, oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
% of requirements met	380.6	100.0	153.0	161.6	274.7	175.6	201.3	746.4

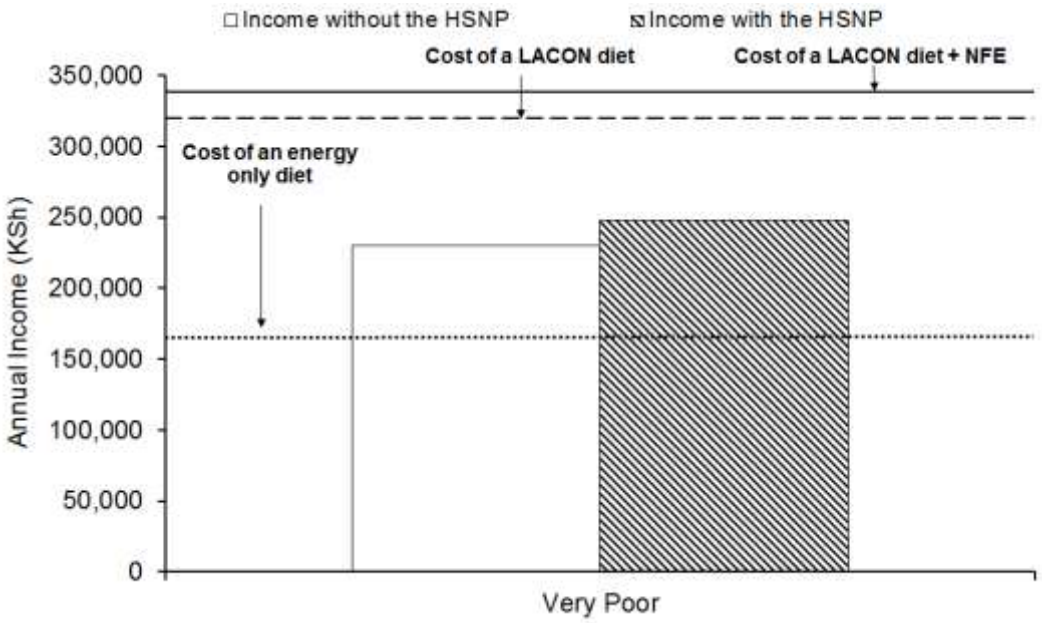
Food List	% calcium	% iron	% z zinc	% copper
Bean, mung, raw	0.2	1.3	1.1	1.6
Beef, medium fat, raw	0.2	5.4	11.3	1.6
Camel, fresh, meat	0.1	4.4	8.9	1.3
Fish, dried, fresh water	48.5	5.6	9.8	5.9
Heart	0.1	2.9	5.6	0.8
Kale	0.5	1.9	0.6	3.6
Lentil, whole	4.1	38.8	23.8	31.8
Liver	0.1	4.4	3.4	17.4
Maize, yellow, raw	0.6	20.5	16.2	10.7
Milk, cow, UHT	4.5	0.3	1.0	0.0
Milk goat, fresh, whole	34.6	2.0	5.1	5.9
Millet, finger	6.0	3.2	2.2	2.4
Pear, avocado	0.2	5.7	3.5	15.9
Sheep, raw	0.1	3.6	7.4	1.2
Vegetable, fat, kimbo	0.0	0.0	0.0	0.0
Vegetable, oil	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0
% of requirements met	118.0	100.0	236.9	

5.5.2. Modelling the impact of the Hunger Safety Net Programme on the affordability of the diet

The Hunger Safety Net Programme (HSNP) is a social protection project in the Arid and Semi-Arid Lands (ASALs), including Turkana. The HSNP is intended to reduce dependency on emergency food aid by sustainably strengthening livelihoods through cash transfers. Beneficiaries of the programme receive 3,000 KSH every two months or 18,000 KSH each year. To model the potential impact of this intervention, the additional income was added to this wealth group's annual to model the impact of this intervention on the affordability of the diet. It is important to note that the main assumption made in this model is that all of the cash transfer will be spent on food for the household, which may not be likely in reality.

Figure 18 shows the effect that this additional income could have on the affordability of the energy-only and nutritious (LACON) diets for very poor households. The results show that although an energy only diet is affordable, buying a nutritious diet, plus expenditure on non-food items, would require an additional 39% of the income of the very poor, down from 50%. Although this shows an 11% improvement in the affordability of a nutritious diet, an additional 96,700 KSH a year is still required.

Figure 18. The income of very poor households before and after the HSNP cash transfer to provide 18,000 KSH a year.



4.5.3. Modelling the impact of Oxfam's camel restocking intervention

Oxfam are implementing a camel restocking programme in this livelihood zone for very poor households whereby beneficiary households receive 3 female camels and 1 male camel. As demonstrated by the goat milk model, milk could potentially provide essential macro and micronutrients in a setting where access to food in general is limited.

To model the potential impact of this intervention, price and weight data were taken from the HEA (FEG, 2012) and converted into a price per 100g which was entered into the software. The minimum and maximum constraints were set at 4 and 14 respectively which reflect the assumption that households will drink at least one portion of camel's milk every other day when it is available. The HEA reported that camel milk production lasted for approximately 180 days of the year during April to September. The price per 100g for camel milk was therefore entered into season 1 and 4 to reflect this.

The software included one portion of camel milk, four times a week for each family member above the age of 2 years, amounting to a total of 1.8 litres of milk a day. The software did not include camel milk in the diet for the 12-23 month old. It is thought that this is due to the inclusion of breast milk in the diet. The HEA found that on average one camel will produce 1.5 litres of milk a day. Therefore, to drink the amount of milk recommended by the software, households affected by this intervention would have enough camels to meet this requirement.

Figure 19 shows that a portion of camel milk a day led to a 47% lowers the daily cost of a nutritious diet during seasons 1 and 4. In terms of cash, this lower cost was 402 KSH a day. The bold black line in figure 19 represents average daily income for very poor households. Although it is unlikely that income will be static it does show that

during the periods when camel milk is available, a nutritious diet could be affordable for this wealth group.

Figure 19. A bar chart showing the cost of the most nutritious, LACON diet, with and without consuming camel milk, in seasons 1 and 4 in the central pastoral livelihood zone of Turkana, Kenya

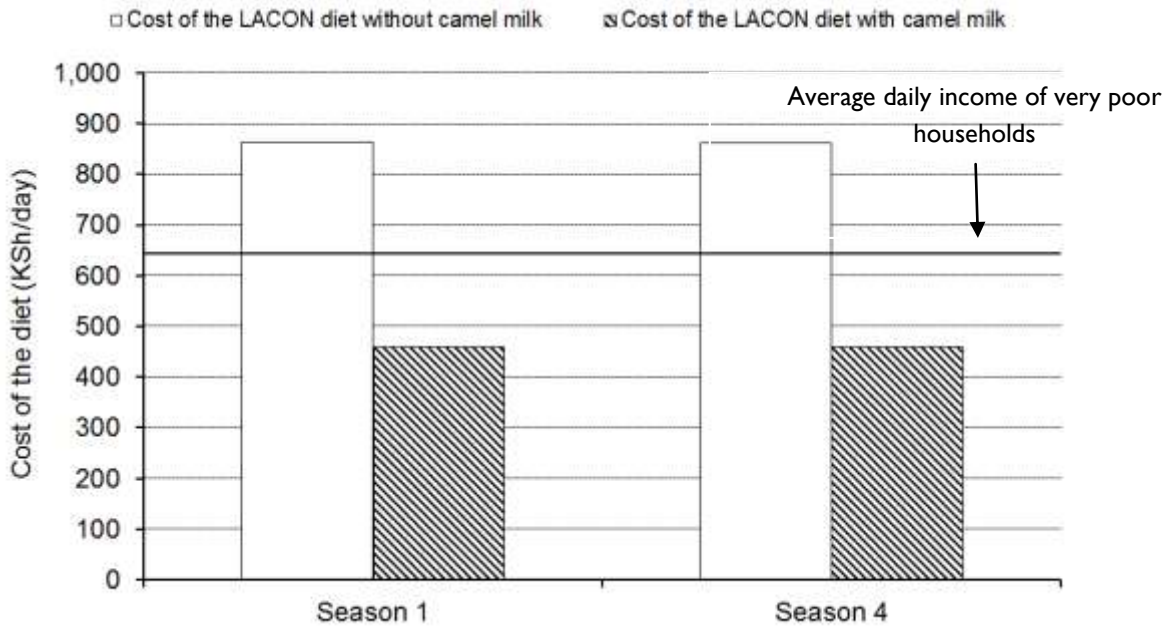


Table 15 shows the absolute weight and cost of the foods selected for the family for the whole year for the LACON diet with camel's milk with the percentage contributed by each food in terms of weight, cost, energy, protein and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total requirements met for each nutrient, averaged over the four seasons. The results showed that camel milk reduces the amount of beef, camel meat, heart, liver, sheep meat, lentils, UHT cow's milk and vegetable fat required, when compared with the original LACON diet. It also provides 30% of zinc in the diet.

Table 15. the absolute weight and cost of the foods selected for the family for the whole year for the LACON diet with camel's milk with the percentage contributed by each food in terms of weight, cost, energy, protein and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total requirements met for each nutrient, averaged over the four seasons.

Food List	Quantity (Kg)	% quantity	Cost KSH	% cost	% energy	% protein	% fat
Beef, raw	68.9	3.4	19,911	8.8	3.5	5.5	6.4
Camel, raw	17.7	0.9	5,116	2.2	0.7	1.4	1.0
Fish, dried	82.6	4.0	70,093	30.8	5.5	21.4	3.6
Heart	36.7	1.8	8,506	3.7	0.7	2.8	0.5
Kale, raw	119.0	5.8	7,054	3.1	0.8	1.0	0.2
Lentil	275.6	13.4	8,818	3.9	17.0	29.4	1.4
Liver	18.4	0.9	4,480	2.0	0.4	1.5	0.3
Maize, yellow, raw	330.7	16.1	17,444	7.7	23.8	11.8	5.5
Milk, camel	338.8	16.5	4,066	1.8	5.5	7.5	9.0
Milk, cow, UHT	133.6	6.5	11,491	5.1	1.8	1.9	2.4
Millet finger	147.8	7.2	7,831	3.4	9.6	4.3	0.9
Pea, dry	39.1	1.9	1,916	0.8	2.6	4.0	0.2
Pear, avocado	282.4	13.8	24,439	10.7	9.0	2.5	20.0
Sheep, raw	68.9	3.4	19,911	8.8	3.7	5.1	6.9
Vegetable fat	6.7	0.3	1,868	0.8	1.2	0.0	3.1
Vegetable oil	83.2	4.1	14,599	6.4	14.2	0.0	38.5
Total	2,050.1	100.0	227,551	100.0	100.0	100.0	100.0
% of requirements met					100.0	285.1	128.6

Food List	% vit A	% vit C	% vit B1	% vit B2	% niacin	% vit B6	% folic acid	% vit B12
Beef, raw	0.0	0.0	1.1	2.5	5.1	3.5	0.1	3.3
Camel, raw	0.0	0.0	0.3	0.6	1.3	0.9	0.0	0.8
Fish, dried	0.0	0.0	2.1	7.2	20.8	7.3	1.2	35.5
Heart	0.0	0.0	0.5	1.2	2.7	1.8	0.1	1.7
Kale, raw	11.9	50.6	1.5	2.7	1.4	3.6	0.8	0.0
Lentil	0.1	14.3	32.6	17.0	23.6	28.3	72.0	0.0
Liver	74.9	2.1	0.6	15.9	2.9	1.5	2.1	53.6
Maize, yellow, raw	2.1	0.0	33.1	21.4	19.8	21.3	4.5	0.0
Milk, camel	8.6	7.0	3.5	2.2	0.0	0.0	1.1	0.0
Milk, cow, UHT	2.0	1.4	1.4	7.4	1.5	1.7	0.4	1.9
Millet finger	0.1	0.0	10.3	6.7	4.6	7.3	0.8	0.0
Pea, dry	0.0	1.2	4.2	2.0	3.2	2.7	7.2	0.0
Pear, avocado	0.2	23.4	8.0	11.0	8.4	16.9	9.4	0.0
Sheep, raw	0.0	0.0	0.9	2.2	4.8	3.2	0.1	3.1
Vegetable fat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vegetable oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
% of requirements met	278.3	100.0	157.2	121.1	234.8	158.3	221.9	564.1

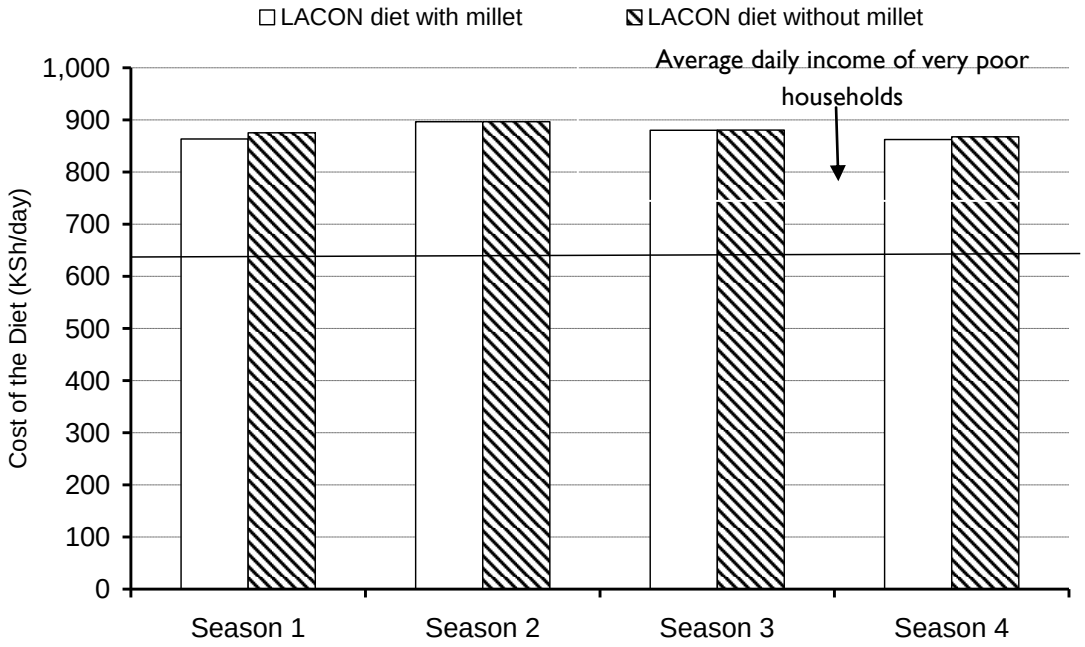
Food List	% calcium	% iron	% zinc	% copper
Beef, raw	0.1	2.7	4.6	0.8
Camel, raw	0.0	0.7	1.2	0.2
Fish, dried	68.5	6.7	9.6	7.5
Heart	0.1	1.4	2.3	0.4
Kale, raw	0.7	1.9	0.5	3.8
Lentil	5.4	42.9	21.7	37.2
Liver	0.0	3.0	1.9	12.4
Maize, yellow, raw	0.8	20.5	13.4	11.3
Milk, camel	0.0	0.0	30.4	0.0
Milk, cow, UHT	7.5	0.4	1.2	0.0
Millet finger	15.5	7.1	4.0	5.7
Pea, dry	1.1	5.3	2.5	5.0
Pear, avocado	0.2	5.0	2.5	14.8
Sheep, raw	0.1	2.5	4.2	0.8
Vegetable fat	0.0	0.0	0.0	0.0
Vegetable oil	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0
% of requirements met	100.0	100.0	288.0	

4.5.4. Modelling the impact of removing millet from the diet to reflect the cultural taboo in the central pastoral zone of Turkana

During the focus group discussion, all of the groups identified finger millet as a taboo food as they believed that it stopped women becoming pregnant. As the original LACON diet included a small amount of millet, to reflect cultural eating habits this was removed to see what impact this had on the cost of a nutritious diet.

Figure 20 shows that removing millet made little difference to the cost of a nutritious diet, which increased the most in season 1 by 12 KSH or 1%. The results showed that millet was replaced by higher intakes of camel and sheep meat, vegetable fat and kale to make up the shortfall of vitamin A, vitamin B2 and calcium.

Figure 20. A bar chart showing cost of the most nutritious, LACON diet, with and without consuming millet, in all seasons of the year in the central pastoral livelihood zone of Turkana, Kenya



4.5.5. The application of average prices of food groups

The aim of this analysis was to see what foods were chosen by the Cost of the Diet software in each of the main food groups when the price of each food group was standardised by taking the average. This served to eliminate differences in cost so that the software should chose foods based upon their nutrients composition alone. Table 16 shows the average cost of the food groups in ascending order. When the prices are averaged, the cheapest food group is manufactured foods at 5.05 KSH per 100g and the most expensive are animal products, which are 6.6 times more expensive at 33.57 KSH per 100g. This process roughly maintains the ratio in the price between the different food groups but serves to minimise the inclusion of expensive foods.

To ensure that food items were selected based upon nutrient content alone, the minimum constraints, which specify how many times a food item should be included in the diet were removed.

Table 16. The average cost of the food groups, entered into the software to identify which foods are the most nutritious regardless of their price.

Food Groups	Cost (KSH/100g)	Manufactured = 1
Manufactured	5.05	1
Roots	5.58	1.1
Pulses	6.76	1.3
Cereals	8.29	1.6
Vegetables	12.21	2.4
Sugar	17.18	3.4
Fat	26.98	5.3
Animal	33.57	6.6

Table 17 shows that when the average food group prices are entered into the software the minimum cost of a diet that meets a household's energy and nutrient need is estimated at 621 KSH per day and features only 7 of the 41 foods included in the software. The annual cost of the diet for the typical family is estimated to be 266,800 KSH.

Table 17 shows that the cost of the diet for each season is the same. This was because the traders stated that all the foods found in the market were available all year round, mainly because of food aid distributions and the lack of fruit and vegetables available.

Table 17. The cost of a diet that meets the average energy and recommended nutrient requirements when the average food group prices are applied to the software.

Age Group	Season 1 *Akiporo*	Season 2 *Akamu*	Season 3 *Akicheres*	Season 4 *Ait*	Annual Cost
12-23 month-old	25	25	25	25	9,200
Rest of Family	596	596	596	596	217,500
Overall	621	621	621	621	226,800

Table 18 shows the absolute weight and cost of the foods selected for the family for the whole year for a nutritious diet with the prices averaged by food group, with the percentage contributed by each food in terms of weight, cost, energy, protein and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total requirements met for each nutrient, averaged over the four seasons.

Table 18 shows that by averaging the prices of food items by food group the number of foods in the diet has halved. Vitamin C rich foods such as kale and avocado have been replaced almost entirely by tomato concentrate. Interestingly liver was identified as the best source of vitamin B12. Small dried fish have increased by 15% of the total quantity in the diet providing the best source of protein (53% of total requirement), vitamin B2 (28% of total requirement), niacin (54% of total requirement), vitamin B12 (58% of total requirement), calcium (95% of total requirement) and zinc (43% of total requirement). This would suggest that small

dried fish are one of the most nutrient rich animal products found in the market in this livelihood zone. Interesting pasta has been included providing 20% of the total quantity of the diet, providing 21% of energy requirements and makes a small contribution to protein, vitamin B1, niacin and copper. Although these food items were of limited availability in markets in the central livelihood zone of Turkana, this model does highlight potential sources of nutrient rich foods that may have been excluded from previous analysis because of their cost.

Table 18. The absolute weight and cost of the 7 foods selected for the family for the whole year for a nutritious diet with the prices averaged by food group, with the percentage contributed by each food in terms of weight, cost, energy, protein and fat, the percentage contribution of each food for eight vitamins and four minerals and the percentage of the total requirements met for each nutrient, averaged over the four seasons.

Food Items	Quantity (Kg)	% quantity	Cost KSH	% cost	% energy	% protein	% fat
Fish, dried, fresh water	264	20.0	88,649	40.9	17.6	52.7	11.2
Lentil, whole	413	31.3	27,945	12.9	25.5	33.9	2.0
Liver	28	2.1	9,315	4.3	0.7	1.7	0.5
Oil, vegetable (WFP specs)	78	5.9	21,108	9.7	13.8	0.0	35.2
Pastas	300	22.7	24,887	11.5	21.7	10.5	1.4
Tomato, concentrate	128	9.7	15,581	7.2	1.6	1.2	0.5
Vegetable, fat	109	8.3	29,462	13.6	19.2	0.0	49.2
Total	1,320	100.0	216,946	100.0	100.0	100.0	100.0
% of requirements met					100.0	370.2	132.3

Food Items	% vit A	% vit C	% vit B1	% vit B2	% niacin	% vit B6	% folic acid	% vit B12
Fish, dried, fresh water	0.0	0.0	9.7	28.0	54.3	30.1	3.3	58.4
Lentil, whole	0.1	21.4	69.6	30.8	28.9	55.1	89.1	0.0
Liver	82.7	3.2	1.3	29.0	3.6	2.9	2.7	41.6
Oil, vegetable (WFP specs)	13.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pastas	0.0	0.0	11.0	4.7	10.4	3.3	2.4	0.0
Tomato, concentrate	3.3	75.4	8.4	7.5	2.9	8.5	2.6	0.0
Vegetable, fat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
% of requirements met	380.6	100.0	110.4	100.0	287.4	122.1	268.8	1096.4

Food Items	% calcium	% iron	% zinc	% copper
Fish, dried, fresh water	95.6	21.4	43.0	16.1
Lentil, whole	3.5	64.3	45.3	37.6
Liver	0.0	4.5	3.9	12.6
Oil, vegetable (WFP specs)	0.0	0.0	0.0	0.0
Pastas	0.7	6.4	6.6	30.1
Tomato, concentrate	0.1	3.4	1.2	3.6
Vegetable, fat	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0
% of requirements met	229.2	100.0	206.4	

5. Key Findings

The results from the cost of the diet analysis show that the MNUT diet was 1.5 times more expensive than the energy only diet, meaning that it cost almost twice as much money to meet recommended protein, fat and micronutrient requirements compared to only meeting energy requirements. The LACON diet was 1.3 times more expensive than the MNUT diet which means that the constraints applied to the software to reflect typical dietary habits have made it harder for the software to meet recommended nutrient intakes. These constraints included reducing the number of times that the software could include nutritious foods such as lentils, avocado and liver in the diet per week, which meant that it had to include other, more expensive sources of these nutrients to meet requirements such as meat from cow, camel and sheep.

The data collection team found 40 foods on the market in the central pastoral livelihood zone of Turkana. The team who collected data in the agropastoral livelihood zone of Turkana also found the same number of foods in the markets. However, in comparison to other areas of East Africa, such as Rwanda where 82 foods were found or Tanzania where 51 foods were found, this does show a limited availability of food in general in this zone. The type of food available is also indicative of the arid environment, which in particular restricts the cultivation of fruit and vegetables. The main foods available in the markets are therefore imported foods such as cereals, oils and pulses, typically provided in food aid rations, which is what the current diet of poor households in this livelihood zone is predominantly based on.

The current diet may not be particularly diverse, in terms of the number of food groups consumed, but it is not necessarily lacking in all essential nutrients. Maize is the main staple food, providing a source of starchy carbohydrates, with beans and lentils, a source of protein. Milk is consumed when it is in season to provide essential protein, fat, vitamin A and B group vitamins and calcium. Oils and fats are essential in the diet to promote the absorption of fat soluble vitamins, whilst meat and offal are eaten occasionally and are an important source of iron and vitamin B12. The main issue with the current diet is its lack of fruit and vegetables, which would provide vitamin A, folic acid and vitamin C.

The results from the Cost of the Diet analysis emphasise that a nutritious diet does not necessarily need to contain many foods as only nine were included in the MNUT diet and 14 were included in the LACON diet. The results also highlight the importance of the foods that households are currently consuming whist emphasising the need for more vegetables such as kale and avocados in the diet. For example, the software has shown that lentils provide inexpensive sources of protein, zinc and copper; lentils and maize are an important source of iron which is required to make haemoglobin which transports oxygen in blood; liver has been selected as an inexpensive source of ß-carotene, a precursor of vitamin A; and lentils and avocados provide folate, which is needed to make red blood corpuscles and prevent neural tube defects in the foetus, carried by pregnant women. Maize, liver, avocado and lentils provide a large proportion of the water soluble B-group vitamins, while kale also provides a large proportion of vitamin C. Although expensive at 84 KSH/100g

and only found in *Kapua* market, dried fish have also been identified as a good source of vitamin B12 and calcium.

One of the issues with both of the nutritious diets (MNUT and LACON) is that the foods that have been identified need to be eaten in large quantities to meet recommended nutrient intakes, which may be unrealistic for poor households. For example, the LACON diet includes a total of 445 Kg a year of meat and offal from cow, camel and sheep for a family of seven. Although pastoralism is the predominant livelihood, the results from the focus group discussion showed that poorer households rarely slaughtered their livestock unless there was a celebration or for sustenance during the hunger season. This was emphasised by the HEA results, which showed that no energy requirements were provided by consuming meat in the very poor wealth group's food summary (FEG, 2012). However the software is highlighting the importance of consuming these foods, particularly liver, to meet essential micronutrient requirements such as iron, vitamin B12 and vitamin A.

Another example of a food that is included in unrealistic quantities is avocado. The MNUT diet includes 800 Kg a year of this food a year for a seven person household whilst the LACON diet includes 400 Kg a year. This food was only found in *Nepatet* market and would therefore be considered as being unavailable in the livelihood zone. However, the software has identified avocado as an important source of energy, fat, vitamin C, vitamin B1, vitamin B2, niacin, vitamin B6 and folic acid in each of the three diets.

Another issue with the results presented in this report is the lack of price data on goat milk. This food was therefore excluded from the initial cost of the diet results. The data collection team struggled to find this food in the markets because it was not in season during the data collection period. The goat milk model, which used price data from the HEA study showed that not only could this food lower the daily cost of the diet but also provide an essential source of fat, protein, calcium, vitamin A and B group vitamins. However, households would require at least 23 goats to be able to consume the amount of milk that was selected by the software. According to the results from the HEA study, very poor households owned between 15-30 goats which means that those households at the lower end of this scale would not be able to access the quantity of milk specified by the software. It was also assumed that all milk would be consumed, which in reality is unrealistic as many women during the focus group discussions highlighted the importance of this product as a source of income as opposed to a source of nutrients.

Another limitation of the results is that food aid distribution may be making a contribution to micronutrient intakes through the use of fortified foods, which has not been effectively captured in this analysis. This is because the inclusion of food aid in the diet has been treated as a 'free' source of food which has been monetised and included in the income figures as described in section 3.4. To determine the impact that food aid has on contributing to micronutrient requirements, the standard ration for a household of seven people would need to be included in the software at a cost of '0'. However, the analysis shows that without food aid, it is possible for households to obtain their recommended intakes energy and nutrients using foods locally available but access to these foods is currently hindered due to poverty and poorly developed markets and road infrastructure.

The software has identified calcium, iron and vitamin C as the nutrients that are the most difficult to meet recommended intakes for using foods available in the market because the RNI for these nutrients have only been met by 100% in one or all of the seasons. These nutrients are also the most expensive and will increase the cost of the diet as the software tries to find foods to meet their requirements. This is emphasised by the analysis of the food groups that contributed the most to a nutritious diet which for both the child aged 12-23 months and the rest of the family were meat, fish, poultry and eggs, dairy and vegetables. However, it should be recognised that the recommended intakes used as targets by the software are set very high and are greater than the actual needs of 97% of all individuals.

The results show that the daily cost of the LACON diet does not fluctuate very much by season. Although the seasonal costs that have been produced are justifiable using the seasonal calendar produced by the recent HEA study (FEG, 2012) there are inherent disadvantages associated with collecting retrospective data whereby traders are expected to remember the price of all foods in previous seasons. Traders are also expected to recall the seasonal availability of foods which may differ depending on the trader and their memory. The results in Appendix 2 also suggest that all of the foods found on the market were available during each season of the year, which for foods such as kale and avocado may not be the case.

The results from the cost of the diet show that all wealth groups can afford a diet that meets energy requirements. This was also implied by the results from the HEA study, which reported that households in all wealth groups were able to meet their energy requirements from foods. However, very poor households in the central pastoral livelihood zone cannot afford a nutritious diet (MNUT or LACON) that meets their recommended energy, fat, protein and micronutrient intakes. The HEA study estimated that these households represented 20% of the population of this zone of Turkana.

The gap in the affordability of the LACON diet, expressed in cash (115,000 KSH a year), is very large and would be impossible to close through cash transfers alone. The result from the HSNP cash transfer scenario demonstrates this. Alternative ways of increasing income or reducing the cost diet therefore need to be researched. The models presented in the report do begin this thought process but in general the modelling opportunities were limited due to environmental constraints and the lack of livelihood opportunities in this zone. Having said this, the scenario models do identify the potential for goat and camel milk to reduce the cost and improve the quality of the diet. However, the potential impact of the camel milk scenario would only be possible for those households which were targeted by Oxfam's camel restocking intervention.

The average food price model identified small dried fish as one of the most nutritious foods on the market. This food is particularly rich in calcium and could be given to young children during the seasons where milk is not available. However this food was only available in one market. With road infrastructure currently limiting the transportation of foods it is unlikely that households will be able to access dried fish until the quality of the roads is improved.

6. Recommendations and Conclusions

The results from the Cost of the Diet analysis show that it is possible for households to obtain their recommended intakes of energy, fat, protein and micronutrients from foods found in the local markets. However, very poor household's access to the nutritious foods selected by the software is restricted by poverty and poor road infrastructure.

Therefore, one of the most important recommendations to be made in this report is the need to invest in improving road and market infrastructure in this livelihood zone. This was also one of the main recommendations made by the HEA study (FEG, 2012). Currently, roads are either non-existent or in a very poor condition. There is a lack of markets in this zone in general and those that do exist in remote villages sell mainly cereals, pulses and oil and are almost devoid of vegetables, dairy and animal products: the most nutritious foods available in this livelihood zone as identified by the Cost of the Diet software. Until access of remote villages by road is improved, it is unlikely that the availability of these foods in the market will improve and access will therefore remain poor.

The results on the affordability of the diet has shown that potentially, very poor households in the central pastoral livelihood zone of Turkana would require an additional 115,000 KSH a year to be able to afford a nutritious diet that meets the recommended energy and nutrient intake of a household whilst taking into account typical dietary habits. The current cash transfer amount given in the HSNP does make some contribution to improving the affordability of a nutritious diet but it is not enough to close this gap. The results from this model provide justification for increasing the amount of money given to households; however it is recommended that more research is undertaken to determine the monetary value of this increase. Other ways of increasing income or reducing the cost of the diet also need to be considered.

The scenarios modelled in this report have shown the potential for milk, either from goats or camels to reduce the daily cost of the diet and improve intakes of essential micronutrients such as protein, fat, vitamin A, B group vitamins, folic acid, calcium and zinc. Currently, poor households view their livestock as a source of income as opposed to a source of nutrition and need to be educated in the importance of providing milk to children and pregnant or lactating women to improve nutritional status.

The cost of the diet results for the 12-23 month old child emphasise the importance of continued breastfeeding until the age of 2 years. In the analysis of the LACON diet, breast milk provided over half of fat and vitamin C intakes and contributed to energy, vitamin A, vitamin B1, vitamin B2, niacin, folic acid and calcium requirements. Promoting the benefits of exclusive and continued breastfeeding is therefore highly recommended**.** However, breast milk is not rich in iron. Therefore making iron rich foods such as meat and offal more accessible in terms of their price and physical presence in the market needs to be undertaken so that the consumption of these foods can be advocated for.

The seasonal fluctuations in the daily cost of a nutritious diet have not been effectively captured in this study because retrospective data collected methods during the market survey were used for training purposes. However, this analysis does show that the cost of a nutritious diet is most expensive during August to February or *akamu*. The HEA found that all wealth groups used the market to purchase at least a third of their energy requirements. The seasonal fluctuation of food prices may therefore greatly impact a household's access to food sold on markets. Interventions that aim reduce foods prices or improve a household's income; with a focus on nutrition outcomes may have the greatest impact when the cost of the diet is at its most expensive during August to February or *akamu*.

If this study is repeated it is recommended that a data collection team undertakes a market survey during each season to better understand the seasonal cost and availability of foods found on the market and the potential impact on those households that purchase the majority of their food from the market. Greater emphasis should also be given to collecting sufficient price and weight data on fresh milk, which has been shown by this study to be an important source of nutrients. It is also recommended that the potential contribution that food aid makes to micronutrient intakes through the use of fortified foods is modelled in a seasonal Cost of the Diet analysis.

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Appendix 1. Family members chosen from the WHO database of average energy requirement used to create households with low and high average energy requirements plus a household with an energy requirement closest to the number of people x 2,100 kcal (HEA/CoD family).

Family size		**5 individuals**			**6 individuals**			**7 individuals**			**8 individuals**			**9 individuals**			**10 individuals**		
Household member	**Kcal/day**	**Low**	**HEA & Cost of the Diet**	**High**	**Low**	**HEA & Cost of the Diet**	**High**	**Low**	**HEA & Cost of the Diet**	**High**	**Low**	**HEA & Cost of the Diet**	**High**	**Low**	**HEA & Cost of the Diet**	**High**	**Low**	**HEA & Cost of the Diet**	**High**
Woman is lactating	418	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Baby (either sex) 12-23 months	894	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Child (either sex) 2-3 years	1,088	X			X			X			X			X			X		
Child (either sex) 3-4 years	1,200	X			X			X			X			X			X		
Child (either sex) 4-5 years	1,300				X			X			X			X			X	X	
Child (either sex) 5-6 years	1,400							X			X			X	X		X		
Child (either sex) 6-7 years	1,500										X	X		X			X	X	
Child (either sex) 7-8 years	1,625								X					X	X		X		
Child (either sex) 8-9 years	1,763					X						X					X	X	
Child (either sex) 9-10 years	1,913		X						X						X				
Child (either sex) 10-11 years	2,075					X						X						X	
Child (either sex) 11-12 years	2,250		X						X						X				X
Child (either sex) 12-13 years	2,413					X						X				X		X	X
Child (either sex) 13-14 years	2,575								X				X		X	X			X
Child (either sex) 14-15 years	2,725									X		X	X			X		X	X
Child (either sex) 15-16 years	2,838						X			X			X		X	X			X
Child (either sex) 16-17 years	2,913			X			X			X			X			X		X	X
Child (either sex) 17-18 years	2,950			X			X			X			X			X			X
Man, 18-29y, 50 kg, light activity	2,300	X			X			X			X			X			X		
Man, 30-59y, 50 kg, mod active	2,750		X			X			X			X			X			X	
Man, 30-59y, 60 kg, vig active	3,450			X			X			X			X			X			X
Woman, 18-29y, 45 kg, light activity	1,850	X			X			X			X			X			X		
Woman, 30-59y, 45 kg, mod active	2,300		X			X			X			X			X			X	
Woman, 30-59y, 55 kg, vig active	2,850			X			X			X			X			X			X
Total average energy requirement		7,749	10,524	13,474	9,049	12,612	16,312	10,449	14,724	19,037	11,949	16,837	21,612	13,574	18,962	24,024	15,337	21,037	26,274
HEA energy specification			10,500			12,600			14,700			16,800			18,900			21,100	

Appendix 2. All the foods that were found in the market of the central pastoral livelihood zone of Turkana and the costs per 100g reported by market traders

FOOD LIST	Season 1	Season 2	Season 3	Season 4
MAIZE, YELLOW, RAW (KENYA)	5.20	5.80	4.90	5.20
MAIZE, FLOUR, DRY (KENYA)	6.80	7.10	6.60	7.10
MAIZE, WHITE, FLOUR (INDONESIA)	9.20	9.90	9.50	10.40
SORGHUM, WHOLE GRAIN, RED (SENEGAL)	7.30	7.80	7.30	7.30
RICE, RAW (KENYA)	11.20	12.60	11.30	12.70
PASTAS (MEXICO)	14.80	15.90	14.30	15.70
MILLET, FINGER (KENYA)	5.30	5.30	5.30	5.30
WHEAT, LOCAL (INDIA)	5.70	5.70	5.30	5.90
WHEAT, FLOUR, ALL-PURPOSE, 72% EXTRACT. (KENYA)	9.30	10.65	9.40	9.60
BEAN, KIDNEY, DRIED, RAW (KENYA)	7.90	8.30	8.20	8.00
LENTIL, WHOLE (EGYPT)	3.20	3.20	3.20	3.20
PEA, DRY (EGYPT)	4.90	4.90	4.90	4.90
COWPEA, UNCOOKED (KENYA)	10.40	8.40	8.40	10.40
BEAN, MUNG, RAW (KENYA)	8.70	7.70	7.70	8.70
PLANTAIN, AVERAGE (MEXICO)	18.50	10.90	10.90	16.30
PEAR, AVOCADO (INDONESIA)	6.40	9.70	9.70	6.40
KALE, RAW (KENYA)	5.60	6.50	6.10	5.60
CABBAGE, GREEN, RAW (KENYA)	7.60	8.20	7.60	8.70
TOMATO, RIPE, FRESH (SENEGAL)	13.30	10.40	9.80	13.30
ONION W/STALKS (INDIA)	9.40	9.30	8.20	9.00
SHEEP, RAW-EP (SENEGAL)	28.90	28.90	28.90	28.90
GOAT, RAW (KENYA)	35.50	31.90	31.90	35.50
CAMEL, FRESH MEAT (SENEGAL)	28.90	28.90	28.90	28.90
BEEF, MEDIUM FAT, RAW (KENYA)	28.90	28.90	28.90	28.90
LIVER (EGYPT)	26.10	23.90	23.90	26.10
HEART (EGYPT)	23.15	23.15	23.15	23.15
GOAT INTESTINES & STOMACH, RAW (KENYA)	25.07	22.72	22.72	25.07
FISH, DRIED, FRESH WATER (MEXICO)	84.90	84.90	84.90	84.90
EGG, CHICKEN, WHOLE, LOCAL (EGYPT)	26.60	21.80	21.80	29.00
POTATO, ENGLISH, RAW (KENYA)	6.30	5.00	5.00	6.00
VEGETABLE OIL (INDONESIA)	17.70	18.70	16.50	17.30
VEGETABLE FAT, KIMBO (KENYA)	27.20	28.50	27.50	28.50
OIL, VEGETABLE (WFP SPECS) (SUPPLEMENT)	27.50	27.50	27.50	28.60
MARGARINE, FORTIFIED (INDONESIA)	38.50	30.80	30.80	38.50
SUGAR, REFINED (MEXICO)	13.50	19.30	19.15	16.75
SALT, IODIZED (KENYA)	5.10	5.10	5.00	5.00
MILK, COW, PWD, WHOLE (KENYA)	80.70	87.40	80.70	87.40
MILK, COW, UHT (KENYA)	11.50	8.60	8.60	10.10
TOMATO, CONCENTRATE 28% (SENEGAL)	28.60	28.60	28.60	28.60
MAIZE, YELLOW, FLOUR (INDONESIA)	5.90	5.50	5.90	5.50
SORGHUM, WHOLE GRAIN (SENEGAL)	5.80	5.80	5.30	5.60

Appendix 3. The list of all food found in the markets in the central pastoral livelihood zone of Turkana, the portion sizes, minimum and maximum constraints entered into the Cost of the Diet Software.

Food list	Portion size (g)	Minimum contraint (No. Times/week)	Maximum contraint (No. Times/week)
BREAST MILK (GENERIC)	532	7	7
MAIZE, YELLOW, RAW (KENYA)	36	7	14
MAIZE, FLOUR, DRY (KENYA)	23	0	14
MAIZE, WHITE, FLOUR (INDONESIA)	23	0	14
SORGHUM, WHOLE GRAIN, RED (SENEGAL)	36	0	7
RICE, RAW (KENYA)	36	0	7
PASTAS (MEXICO)	36	0	7
MILLET, FINGER (KENYA)	36	0	7
WHEAT, LOCAL (INDIA)	36	0	7
WHEAT, FLOUR, ALL-PURPOSE, 72% EXTRACT. (KENYA)	23	0	7
BEAN, KIDNEY, DRIED, RAW (KENYA)	15	0	14
LENTIL, WHOLE (EGYPT)	15	0	14
PEA, DRY (EGYPT)	15	0	7
COWPEA, UNCOOKED (KENYA)	15	0	7
BEAN, MUNG, RAW (KENYA)	15	0	7
PLANTAIN, AVERAGE (MEXICO)	10	0	7
PEAR, AVOCADO (INDONESIA)	42	0	7
KALE, RAW (KENYA)	15	0	7
CABBAGE, GREEN, RAW (KENYA)	15	0	7
TOMATO, RIPE, FRESH (SENEGAL)	10	0	14
ONION W/STALKS (INDIA)	5	0	14
SHEEP, RAW-EP (SENEGAL)	15	0	7
GOAT, RAW (KENYA)	15	0	14
CAMEL, FRESH MEAT (SENEGAL)	15	0	7
BEEF, MEDIUM FAT, RAW (KENYA)	15	0	7
LIVER (EGYPT)	8	0	7
HEART (EGYPT)	8	0	7
GOAT INTESTINES & STOMACH, RAW (KENYA)	8	0	7
FISH, DRIED, FRESH WATER (MEXICO)	10	0	7
EGG, CHICKEN, WHOLE, LOCAL (EGYPT)	20	0	7

Food list	Portion size (g)	Minimum contraint (No. Times/week)	Maximum contraint (No. Times/week)
POTATO, ENGLISH, RAW (KENYA)	25	0	7
VEGETABLE OIL (INDONESIA)	5	0	14
VEGETABLE FAT, KIMBO (KENYA)	5	0	14
OIL, VEGETABLE (WFP SPECS) (SUPPLEMENT)	5	0	14
MARGARINE, FORTIFIED (INDONESIA)	5	0	7
SUGAR, REFINED (MEXICO)	0.3	0	14
SALT, IODIZED (KENYA)	0.3	0	14
MILK, COW, PWD, WHOLE (KENYA)	5	0	7
MILK, COW, UHT (KENYA)	136	0	14
TOMATO, CONCENTRATE 28% (SENEGAL)	5	0	7
MAIZE, YELLOW, FLOUR (INDONESIA)	23	0	7
SORGHUM, WHOLE GRAIN (SENEGAL)	36	0	7