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COST OF DIET STUDIES IN EAST PASTORAL AND CENTRAL AGROPASTORAL LIVELIHOOD ZONES OF SAMBURU COUNTY, KENYA

October 2021

COST OF DIET STUDIES IN EAST PASTORAL AND CENTRAL AGROPASTORAL LIVELIHOOD
ZONES OF SAMBURU COUNTY, KENYA, OCTOBER 2021

Award Number: 72DFFP19CA00003

Award Period: October 1, 2019 – September 30, 2024

Prepared for USAID

United States Agency for International Development

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This report is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents of this report are the responsibility of Mercy Corps and do not necessarily reflect the views of USAID or the United States Government.

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LIST OF ACRONYMS

BMI	Body Mass Index
COD	Cost of the Diet
COVID-19	Coronavirus 2019
CRS	Catholic Relief Services
CRTA	Crop Resources of Tropical Agriculture
DFSA	Development Food Security Activity
DHS	Demographic and Health Survey
EO	Energy Only
FGD	Focus Group Discussions
FHAB	Food Habits
GAM	Global Acute Malnutrition
HEA	Household Economy Approach
IFA	Iron/Folic Acid
IFPRI	International Food Policy Research Institute
KABP	Knowledge, Attitudes, Beliefs and Practices
KES	Kenya Shillings
KII	Key Informant Interviews
LZ	Livelihood Zone
MAD	Minimum Acceptable Diet
MEL	Monitoring, Evaluation and Learning
MIYCN	Maternal, Infant and Young Child Nutrition
MNCH	Maternal, Newborn and Child Health
MUAC	Mid Upper Arm Circumference
OFDA	Office of Foreign Disaster Assistance
PAM	Persistent Acute Malnutrition
PNC	Post Natal Care
SBC	Social and Behavioral Change
SC	Save the Children
SMART	Standardized Monitoring and Assessment of Relief and Transitions
TOT	Training of Trainers
US	United States
USAID	United States Agency for International Development
USG	United States Government
UHT	Ultra-High Temperature
VAD	Vitamin A Deficiency
VAS	Vitamin A Supplementation
WHO	World Health Organization
WRA	Women of Reproductive Age
WASH	Water, Sanitation and Hygiene

EXECUTIVE SUMMARY

Nawiri is a 5-year Development Food Security Activity (DFSA) program funded by USAID and implemented by a consortium¹ of partners led by Mercy Corps. The project involves research for the first two years to establish *What Works* to inform the co-creation of project design and implementation.

Save the Children, a member of the Nawiri consortium, developed the Cost of the Diet method and software to apply linear computer programming to identify the quantity and combination of local foods that would meet the average needs for energy of one or more individuals, as well as their recommended intakes of other macro- and micronutrients, all at the lowest possible financial cost. The Food Habits Diet meets the recommended intakes for energy, protein, fat and 13 micronutrients of an average family and is based on typical dietary habits of households in each livelihood zone.

After completing two Cost of the Diet studies in Turkana County in February and March 2021, Mercy Corps Nawiri in collaboration with the Ministry of Health undertook two Cost of the Diet studies in Samburu County's East Pastoral Livelihood Zone and the Central Agropastoral Livelihood Zone. These two studies, along with those in Turkana County and other research and learning inquires conducted by Nawiri, will contribute to:

- The design of nutrition-sensitive livelihood strategies and programming that enables poor households to maintain year-round nutrition security for women and children to support the sustainable reduction of Persistent Acute Malnutrition (PAM) in the face of shocks and stresses.
- The exploration of cost-effective options for strengthening local markets to increase local availability of nutritious foods for poor households.

The SMART Survey conducted in April-May 2021² at the end of the long rainy season reported that the global acute malnutrition (GAM) rate was 16.8% (compared to 15.8% in 2019); this is high and above the WHO-established emergency threshold of 15%. The Kenya Demographic and Health Survey (DHS) 2014 found 30.1% of children in Samburu County to be stunted (≤ -2 standard deviations height-for-age).³ The SMART Survey in 2021 found the prevalence of stunting to be 19.6%, a reduction from 29.3% in 2019. A Maternal, Infant and Young Child Nutrition (MIYCN) Knowledge, Attitudes, Beliefs and Practices (KABP) survey was carried out in Samburu County in 2018 and found relatively good breastfeeding practices up to one year of age, a lack of continued breastfeeding, and increased bottle feeding. Complementary feeding practices are poor and feeding during illness practices are not optimal. The Kenya DHS 2014 revealed 41.0% of women of reproductive age (WRA, age 15 to 49) to have a Body Mass Index lower than 18.5; along with Turkana County (45.3%) these were the worst values in the country. DHS national-level data showed adolescent WRA age 15 to 19 years to have the highest rates of low BMI among all WRA.

The Cost of the Diet (COD) analysis has shown that families can meet their nutritional needs with foods that are available in the market at the time of this study. The cost of a nutritious Food Habits Diet for an average family of eight in East Pastoral LZ is 1,089.25 KES (US\$10.09) daily or 397,575 KES (US\$3,681) annually. In Central Agropastoral LZ for an average family of eight, the cost was 1,029.79 KES (US\$9.54) daily or 375,873 KES (US\$3,480) annually. The cost of most food items, except for goat meat, goat milk and chicken eggs, were more expensive in East Pastoral LZ. In East Pastoral LZ, the gap between the cost of a nutritious Food Habits Diet

¹ Nawiri partners include Mercy Corps, Save the Children, RTI International, The BOMA project, Centre for Humanitarian Change, CARITAS Lodwar and Maralal, and the African Population and Health Research Center.

² SMART Survey Samburu County 2021 preliminary report.

³ Kenya Demographic and Health Survey 2014.

and household income available for food purchase (including the monetary value of the consumption of home production and minus necessary non-food expenditures) is 21,831 KES (US\$202) monthly or 261,966 (US\$2,426) annually for the Very Poor wealth group and 16,270 KES (US\$151) monthly or 195,235 KES (US\$1,808) annually for the Poor. There is no gap for the Middle wealth group. In Central Agropastoral LZ, the gap is 21,077 KES (US\$195) monthly or 252,927 (US\$2,342) annually for the Very Poor; 19,920 KES (US\$184) monthly or 239,038 KES (US\$2,213) annually for the Poor; and 10,257 KES (US\$95) monthly or 123,086 (US\$1,140) annually for the Middle wealth group.

In both livelihood zones there was limited availability of some key nutrient-dense foods including goat liver, fresh cow milk, soybean milk curd, lentils and green peas. In particular, for pregnant or lactating adolescent mothers who have the highest nutritional needs, a lack of chicken in both livelihood zones and beef or mutton in Central Agropastoral LZ would make it difficult to attain a nutritious diet. There are nutrient-dense foods with varying availability that families are not taking advantage of, including goat liver, soybean milk curd and small dried freshwater fish.

The cost of the diet for the youngest child age 12 to 23 months is only roughly three percent of the family's total cost. Inadequate child feeding practices is most likely the key limitation to a nutritious diet for this child. COD analysis of the cost-benefit of continued breastfeeding showed it to not only be nutritionally valuable but also to provide a significant savings for the family even when the higher nutritional needs of a lactating mother are met.

Modeling of options for the Nawiri Activity to support households showed that providing support for goat milk production year-round so that the smallest child and the lactating mother would receive a daily serving would reduce the cost of the diet by less than one percent in both livelihood zones. Although this cost savings is limited the nutrient contribution for the vulnerable mother and child would be significant. Supporting home garden production of dark leafy greens (and tomatoes in East Pastoral LZ and green peas in Central Agropastoral LZ) would reduce the cost of the diet by 16% and 29% respectively. Support for production of other vegetables, such as amaranth, solanum and bio-fortified orange flesh sweet potato do not reduce the cost of the diet much more but could be particularly useful to extend the period of harvest. Providing support for the Ministry of Health's (MOH) vitamin A supplementation (VAS) campaign reduces the cost of the diet minimally but could provide a valuable contribution to the healthy growth and development of children. Modeling a combination of these options could potentially decrease the cost of the diet by 26% to 40%.

I. INTRODUCTION⁴

Nawiri⁵ is a 5-year Development Food Security Activity (DFSA) program funded by USAID and implemented by a consortium⁶ of partners led by Mercy Corps. It is a partnership of Kenyan and international organizations committed to working with the county government to catalyze sustained reduction in persistent acute malnutrition in Samburu and Turkana Counties. The project involves research for the first two years to establish *What Works* which will inform the co-creation of project design and implementation. The Nawiri team is working collaboratively across partners and with county government and other key stakeholders to develop, refine, and ultimately jointly validate a living Learning Agenda that is both realistic and action-oriented.

In April 2021 two Cost of the Diet Studies were completed in Samburu County (after two had been completed in Turkana County between February and March) by Save the Children in collaboration with the Ministry of Health. The two studies in Samburu County were conducted in the East Pastoral Livelihood Zone (LZ) and the Central Agropastoral LZ. These livelihood zones have been defined by the relevant Kenyan government bodies, including the National Drought Management Authority and the Ministry of Agriculture, Livestock and Fisheries. Due to resource limitations for Cost of the Diet studies for the Nawiri Project, these two livelihood zones were chosen as they had not previously been assessed by the Cost of the Diet methodology. Also, the Global Acute Malnutrition rate for Samburu County remains above “emergency” designation.

The seasonal calendar for Samburu County includes four seasons (Table 1); we conducted these studies entering the long rainy season.

TABLE 1. SEASONAL CALENDAR FOR SAMBURU COUNTY

<i>Akamu</i> Dry season			<i>Akiporo</i> Long rains			<i>Aiit</i> Dry cool season			<i>Akicheres</i> Short rains		
JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

Samburu County is a county in the former Rift Valley Province of Kenya. It covers an area of roughly 8,000 mi² (21,000 km²) in northern Kenya where the Samburu people live. It stretches from the Wauso Ng’iro River in the north to the south of Lake Turkana and contains several National Reserves. Samburu County borders Turkana County to the northwest, Baringo County to the southwest, Marsabit County to the northeast, Isiolo County to the east and Laikipia County to the south. The largest town is the capital, Maralal, and the county consists of Samburu North, Samburu West and Samburu East sub-counties.

Samburu is a region of high temperature and low rainfall. The average mean temperature is 84 degrees Fahrenheit (29 degrees Celsius). More than 75% of the land in Samburu County is classified as “low potential” rangeland, receiving between 9.8 inches (250 mm) to 23.6 inches (600 mm) of rain annually; 7% of land is classified as medium-to-high-potential that is suitable for agricultural production and receives 23.6 inches (600 mm) to 35.4 inches (900 mm) of rain annually. There are several irrigation schemes in the county.⁷

⁴ Much of the information in this section comes from the following sources: Kenya National Bureau of Statistics (KNBS), Save the Children Household Economic Analyses conducted in Turkana County in 2021, along with a wikipedia entry on Samburu County retrieved July 1, 2021.

⁵ Nawiri is a Swahili word meaning “to thrive” and was adopted to replace the original NAWIRI acronym - Nutrition in ASALs Within Integrated Resilient Institutions.

⁶ Nawiri partners include Mercy Corps, Save the Children, RTI International, The BOMA project, Centre for Humanitarian Change, CARITAS Lodwar and Maralal, and the African Population and Health Research Center.

⁷ Samburu County Integrated Development Plan 2018 to 2022.

The majority of the population practices pastoralism to some degree. Cattle, goats and sheep constitute animal ownership in both livelihood zones in this COD study (East Pastoral LZ and Central Agropastoral LZ) Households in the East Pastoral LZ additionally possess camels and donkeys.⁸ The main crops grown are maize, beans, wheat, barley, pyrethrum and millet.⁹

The main paved road from Nairobi extends to Maralal, the county seat, center for Samburu West, and the major urban center for all of Samburu County. Roads then extend to the largest towns in the other two sub-counties: Baragoi in Samburu North and Wamba in Samburu East. Distances between these towns are considerable: Nairobi to Maralal is 210 miles (338 km) and takes about 8 hours on average, though longer if there is heavy traffic in the perimeter of Nairobi; Maralal to Baragoi is only 63 miles (101 km) but takes 2-1/2 hours at best and Maralal to Wamba is similar distance at 67 miles (108 km). The mobile network coverage of the county is 30% compared to 85% nationally.

The 2019 census¹⁰ lists a population of 310,327 for Samburu County, with a population density of 15 persons per square kilometer, and roughly 0.65% of the total population of Kenya (a little over 47.5 million). Compared to 2009 census data, the population growth rate is 4.45% per annum, compared to 3.0% nationally. Like many parts of Sub-Saharan Africa, the population skews heavily towards youth.

The under-age-five population in Samburu County is approximately 57,000. Report from the SMART Survey conducted in April-May 2021¹¹ at the end of the long rains season provides data on global acute malnutrition (GAM) rate for the county as a whole. The GAM rate reported is 16.8% (compared to 15.8% in 2019); of this, 3.2% is severe acute malnutrition (SAM). This GAM rate is high and above the WHO-established emergency threshold (15%).

The Kenya Demographic and Health Survey (DHS) 2014 found 30.1% of children in Samburu County to be stunted (≤ -2 standard deviations height-for-age).¹² SMART Survey in 2021 found the prevalence of stunting to be 19.6%, a reduction from 29.3% in 2019.

A Maternal, Infant and Young Child Nutrition (MIYCN) Knowledge, Attitudes, Beliefs and Practices (KABP) survey was carried out in Samburu County in 2018 with support from Unicef and USAID.¹³ Results (Table 1) found relatively good breastfeeding practices (up to one year of age) although the lack of the nutritional and health protective benefits of exclusive breastfeeding up to six months of age for almost one-quarter of children is a concern. Also, bottle feeding is almost double that found in MIYCN/KABP Survey 2017 in Turkana County.

TABLE 2. KABP SURVEY 2018

INDICATOR	PREVALENCE (%)
BREASTFEEDING PRACTICES	
Given colostrum	98.4
Initiation of breastfeeding within 1 hour of birth	83.7
Exclusive breastfeeding (0 to 6 months)	77.6

⁸ HEA Baseline 2016.

⁹ Samburu County Integrated Development Plan 2018 to 2022.

¹⁰ Kenya National Bureau of Statistics, *Kenya Population and Housing Census November 2019*.

¹¹ SMART Survey Samburu County 2021 preliminary report.

¹² Kenya Demographic and Health Survey 2014.

¹³ MIYCN/KAPB Survey Samburu County, February 2018.

Continued breastfeeding at 12 months of age	86.0
Continued breastfeeding at 24 months of age	41.1
Bottle feeding	26.8
COMPLEMENTARY FEEDING PRACTICES	
Minimum Dietary Diversity: % age 6-23 months (breastfed and non-breastfed) who received foods from \geq 4 food groups	59.6
Minimum Meal Frequency: % age 6-23 months (breastfed and non-breastfed) who receive food the minimum recommended number of times (by age) or more	35.9
Consumption of iron-rich foods (6-23 months)	21.1
FEEDING DURING ILLNESS	
Offered less breastmilk than usual	75.8
Offered less food than usual	16.4
WOMEN'S NUTRITION	
Minimum diet diversity (foods from \geq 5 food groups)	47.5

Complementary feeding practices are quite poor, with conflicting feeding practices during illness (high percentage reducing breastmilk but low percentage reducing solid food). Recommended complementary feeding practices include continued breastfeeding up to two years of age and beyond. The prevalence of continued breastfeeding at 24 months of age (only 41.1%) is of concern. Also of concern is the low percentage of children receiving iron-rich foods (21.1%).

The Kenya DHS 2014 revealed 41% of women of reproductive age (WRA, age 15 to 49) in Samburu County to have a Body Mass Index (BMI) lower than 18.5; along with Turkana County (45.3%), these were the worst values in the country. DHS national-level data showed adolescent WRA age 15 to 19 years to have the highest rates of low BMI among all WRA – this would be expected also in Samburu County. Undernourished WRA, including adolescents, are at higher risk of poor birth outcomes, including low birthweight babies, perpetuating intergenerational cycles of undernutrition and physiological vulnerability.¹⁴ The SMART Survey in 2021 in Samburu County found 12.6% of woman of reproductive age (13.2% among those pregnant or lactating) to have Mid Upper Arm Circumference (MUAC) below 21.0 cm.

“The risk of stunting is 33 percent higher among first born children of girls under 18 years in Sub-Saharan Africa and, as such, early motherhood is a key driver of malnutrition.”¹⁵ A meta-analysis of adolescent pregnancy in Africa found that approximately one-fifth of adolescent girls/women (age 10 to 19) become pregnant.¹⁶ A study done in Maternal Child Health Center services in low-income settlements around Nairobi, Kenya found that “the primary social support for pregnant and parenting adolescent teens comes from the (female) adolescent’s mother. The external family and male partners provide negligible support in the rearing of

¹⁴ Martorell, R. and Zangrone, A. *Intergenerational Influences on Child Growth and Undernutrition*. Paediatric Perinatal Epidemiology; July 2012.

¹⁵ USAID Kenya: Nutrition Profile, updated February 2018; citing Fink, et al. (2014) *Scaling Up Access to Family Planning May Improve Linear Growth and Child Development in Low and Middle-Income Countries*.

¹⁶ Mullu Kassa, G., et al. *Prevalence and determinants of adolescent pregnancy in Africa: A systemic review and meta-analysis*, Reproductive health 2018.

the child.” The study also found that food insecurity and lack of resources in general constrains mothers’ ability to directly support their adolescent daughters.¹⁷

Less than half of women achieve minimum diversification of the diet (47.5%). The MIYCN/KABP 2018 study found that only about one-tenth of women took iron, folic acid or combined iron/folic acid tablets (IFA) for the recommended 90 days or more during pregnancy, although three-quarters did take IFAs for some period of time during the pregnancy (≤ 60 days). One of the reasons given by mothers for not completing IFA supplementation was “forgetfulness” and there were no reported IFA stock outs, however some women reported side effects of nausea and vomiting that discouraged them from taking the supplement.

Kenya has been active in the area of food fortification, with mandatory fortification of salt with iodine established in 1978 and voluntary fortification of wheat/maize flours and cooking oil initiated in 2000 and mandated by 2012.¹⁸ However, samples tested have shown poor compliance with fortification standards. Results regarding mothers’ knowledge about fortification are mixed. The MIYCN study in 2018 found 68% of mothers to report consuming fortified maize flour and 63% fortified wheat flour. In the 2019 SMART Survey in Samburu County women were asked about food fortification -- only 9% of mothers to report having heard of fortification and knew of the fortification logo.

Kenya has had a successful vitamin A supplement distribution program. The Kenya National Micronutrient Survey 2011 showed at least 84.3% of children under age five had ever received vitamin A supplementation (VAS). The survey found vitamin A deficiency (VAD) to be fairly low in preschool children age 6 to 59 months (8.1% in rural areas). However, the report did caution that half of preschool age children had marginal levels of VAD.¹⁹ SMART Survey 2021 in Samburu County, however, found only 53% of children age 12 to 59 months to have received VAS twice or more in their lives.²⁰

The MIYCN/KABP 2017 showed overall knowledge of recommended MIYCN messages to be high and attitudes and perceptions to be positive, with a majority practicing positive responsive feeding. The majority also reported that cultural food restrictions (“taboos”) were no longer an issue. Yet there are clearly barriers to translating this into appropriate feeding practices on a daily basis. Household food insecurity and women’s workload were two key barriers noted, along with a lack of knowledge of how to prepare nutritious foods for infants and young children. Women’s food insecurity, in particular, influenced perceptions of having insufficient breastmilk. Conflict, violence and alcoholism were also noted as constraints to the proper care and feeding of children.

II. OBJECTIVES OF THE 2021 COST OF THE DIET STUDIES

These two studies in Samburu County, along with other research and learning inquiries conducted by Nawiri, will contribute to:

- The design of nutrition-sensitive livelihood strategies and programming that enables poor households to maintain year-round nutrition security for women and children to support the sustainable reduction of Persistent Acute Malnutrition (PAM) in the face of shocks and stresses.
- The exploration of cost-effective options for strengthening local markets to increase local availability of nutritious foods for poor households.

¹⁷ Kumar, M., et al. *Adolescent Pregnancy and Challenges in Kenyan Context: Perspectives from Multiple Community Stakeholders*, Global Social Welfare 2018.

¹⁸ Nutrition International, *Food Fortification in Kenya Policy Brief*, 2020.

¹⁹ Kenya Ministry of Health, *Kenya National Micronutrient Survey 2011*.

²⁰ SMART Survey Samburu County 2021 preliminary report.

The aim of these Cost of the Diet studies is to identify local foods that meet household needs for a healthy diet, estimate the minimum cost of a nutritious diet, and assess the degree to which constraints on availability and affordability prevent households in two different livelihoods zones in Turkana County from attaining a nutritious diet. The key objectives of these studies include:

- Identify the common locally consumed foods in each distinct livelihood zone.
- Identify the least expensive sources of locally available nutrient-rich foods.
- Assess the availability and affordability of preferred foods and/or nutrient-rich foods.
- Estimate the minimum cost of a healthy diet for different household compositions (for example, with a pregnant or lactating woman, with an adolescent mother, with a female adolescent, in a polygamous household, and other household compositions).
- Estimate the affordability of the diet according to wealth ranking.
- Use the Cost of the Diet software to analyze the cost and the nutrient content of nutritious foods appropriate for complementary feeding of infants and small children and improvements in maternal nutrition, both among female adolescents, other women of childbearing age, and pregnant adolescents or women.
- Develop models of the impact of potential interventions that might enable households to meet their nutrient requirements.
- Contribute input to the Nawiri longitudinal study and to the strengthening of nutrition information systems at the county level.

This study will complement Nawiri's other learning and research inquiries during phase I and contribute input to the design of interventions/strategies that are appropriate to the local context. Specifically, the study will:

- Contribute to the line of learning inquiry (No.2) on Strengthening MIYCN Behaviors to Ensure Optimal and Resilient Maternal and Child Nutrition by providing information on the types of locally available nutritious foods and accessibility and economic constraints to the consumption of a healthy diet. The Cost of the Diet studies will obtain information specific to the needs of adolescent mothers and other vulnerable women and children. Along with a more in-depth look at gender equality issues through the MIYCN SOW, the Cost of the Diet studies will inform SBC strategies to address the gap between MIYCN knowledge and practices for consumption of a mix of affordable and nutritious foods to improve the quality of the diet of children 6 to 23 months of age and women of reproductive age. Therefore, the study will identify feasible ways in which to modify some of the direct and underlying factors leading to PAM.
- Complement the line of learning inquiry (No.4) about Livelihoods, Poverty Graduation and Social protection because it will provide useful input to the design of programmatic strategies for market improvements and different on-farm and off-farm livelihood approaches. The Cost of the Diet analysis provides the affordability gap for a nutritious diet which can contribute information towards cash transfer and other social protection approaches.
- Provide baseline information on affordability and cost for nutritious foods for learning inquiry No.1, the longitudinal study of seasonality, shocks and factors influencing PAM, to track changes in affordability gap due to shocks and seasons, and adapt interventions to mitigate impacts.
- Provide information on food availability, preferred foods, desirable foods, and gaps in food availability for the Market Survey and learning inquiry 6: Strengthening local markets and regional supply chains to increase local access and availability of nutritious foods.

The Cost of the Diet focuses on good nutrition for an average family, based on household size in the target area. As the overarching goal of the Nawiri Project is “persistent acute malnutrition is sustainably reduced in Kenya’s arid and semi-arid lands”, the Cost of the Diet studies included additional focus on women of reproductive age – and in particular, adolescents – and young children under age three.

III. COST OF THE DIET RESEARCH METHODOLOGY

Save the Children developed the Cost of the Diet method and software to apply linear computer programming to select a combination of local foods in amounts that would meet the average needs for energy of one or more individuals, as well as their recommended intakes of protein, fat, and micronutrients, all at the lowest possible financial cost. The method enables public health nutritionists and food security specialists to estimate the cost and affordability of meeting energy and nutrient specifications using local foods, as the software selects the most nutritious and least expensive diet. Users can then create models of the effect of different interventions, such as agricultural production or market support, or of introducing novel or bio-fortified foods. As a practical tool, it highlights nutritious available local foods for promotion through SBC strategies, identifies nutrient-rich local foods as input to strategies to improve production availability and market access, displays information on the ratio between cost of foods and their contribution to the diet, and provides detail on the gap between households' purchasing power and the minimum cost of a nutritious diet as an input to the development of cash transfer programs.

A. DESCRIPTION OF FIELDWORK AND METHODOLOGY

For the Cost of the Diet research the following were conducted in each of the two livelihood zones – East Pastoral LZ and Central Agropastoral LZ:

1. Market Surveys in a sample of six markets in each livelihood zone that included the largest market (usually in the town where the sub-county seat of government is based), several comparatively mid-size markets, and small shops within villages.
2. Key Informant Interviews with 1 or 2 of the established Traders in the larger markets.
3. In villages, Focus Groups with two different sets of mothers with children under age three (mothers age 21 to 49 and adolescent mothers age 15 to 20) and from a variety of wealth groups (see 4. Below).
4. In other villages with different women²¹, Dietary Habits Interviews were conducted with 8 individual mothers from the two age groups noted above (15 to 20 and 21 to 49) and that represented the three wealth groups that were the focus of this study: the Very Poor, the Poor, and Middle wealth groups.

Half of the field team enumerators were male and half female; only women interviewed adolescent mothers for Focus Groups and Dietary Habits Interviews. Informed consent, approved by Save the Children's internal Ethics Review Committee, was obtained from all women of all ages. Local government officials, predominantly from the Ministry of Health, participated in the selection of markets and villages, led several sessions during Training of the Enumerators, and participated as supervisors during fieldwork (Photos 1 and 2). A list of the fieldwork team members and their position/affiliation can be found in Annex A.

Photos 1 and 2: Samburu County Nutrition Coordinator officiating COD training



²¹ National protocols to reduce the transmission of COVID-19 prohibited extended contact between the survey team and local women so different women participated in the focus groups and the Dietary Habits Interviews.

For all Cost of the Diet training and fieldwork activities the national protocols for minimizing the spread of COVID-19 were followed. Gloves and/or sanitizer were used for touching any food items; social distancing was practiced during training workshops, in the markets and during focus groups or household interviews with women; individual interview periods were limited; and masks were worn by the survey team and provided to those mothers surveyed.

Perhaps the greatest adjustment to protocols was that the Cost of the Diet lead expert had to work remotely with the field team as travel to Kenya from the USA was restricted due to COVID-19 (see Quality Control below). The guides used for the Cost of the Diet studies were developed in advance through consultation between the remote Cost of the Diet lead expert and the Cost of the Diet team leaders in Kenya. They included:

1. A Food List of food items commonly consumed and purchased by families from the three wealth groups were the focus of these studies. This Food List was used as the basis for both the Market Survey and for the Dietary Habits Interviews. Several food items were not available in the Food Composition Databases used by the COD software and were added by the COD lead expert, per the COD Guidelines. These included the fruit of the *Hyphaene compressa* palm tree (local name *doum* or *eng'ol*), *Crotalaria* leaves (local name *mito*), and *Solanum* leaves (local name *sujaa* or *managu*). Their nutrient composition was identified through internet search of research documents. Through similar research documentation, the food composition of meat from donkeys was identified as similar to that of horsemeat and entered as such into the database. Photographs of the ingredients and nutrient content of a locally prepared porridge mix known as *Ujimix* were taken by the COD team; this food item was entered into the database based upon its key ingredient – finger millet flour – and adjusted to reflect the nutrient content displayed on the packaging. The Food List was also adapted to include several wheat-based prepared foods; these were grouped under “wheat snacks (non-fried)” and “wheat dough, fried” and included *donut*, and *sconge* as “non-fried” and *mandazi*, *chapatti* and *ngumu* as “fried”.
2. A guide for conducting focus groups and recording responses among mothers of children age 6 months to three years. There were two guides with the guide for the adolescent mothers including a few questions in addition to those in the guide for mothers age 21 to 49.

For the Market Survey, a total of two traders (or more if needed to complete a survey of available food items from all or most of the food groups) in six markets in each of the two livelihood zones were conducted. Market Surveys were usually done in the morning when the greatest number of food items were still available for sale. In one instance in Lodwar town the enumerators returned early morning a second day when they found that a limited supply of vegetables and fruits had sold out by mid-morning the first day of the survey.

For the market survey, price was recorded and three samples offered at that price were weighed using a Nutricook NC-KSE5-EKO scale. In addition, for potentially large or cumbersome volumes the typical Salter 50 kg hanging scale (used to weigh small children) was available but was rarely utilized. For pre-packaged foods, such as spaghetti, the price and weight was recorded from the label. For foods sold by weight, such as meat, only one sample and price were taken. In general, no food items were paid for; however, survey team supervisors carried a small amount of money to occasionally purchase items such as meat that needed to be carved off the bone to be weighed, or milk that was poured into the survey team’s containers.

In the same geographic area as each market, Focus Group Discussions (FGD) were held with adolescent mothers age 15 to 20 with children under age 3 and, separately, mothers age 21 to 49 with children under age 3

for a total of 8 FGD in each LZ. On the last day in each LZ, an individual Dietary Habits Interview was conducted with 8 adolescent mothers age 15 to 20 with children under age 3 and with 8 mothers age 21 to 49 with children under age 3 in four different villages for a total of 32 Dietary Habits Interviews. These were divided among women from very poor, poor, and middle wealth status. The fieldwork schedule, with a list of the market survey sites and villages included for focus groups and Dietary Habits Interviews for the East Pastoral LZ and Central Agropastoral LZ can be found in Annex B. A map of the sites' location is in Annex C.

These two Cost of the Diet studies were done with a focus on the present season only, the end of a dry season and beginning of the long rains. Limited “light touch” Market Surveys are planned to be carried out during the



other three seasons to estimate seasonal variance to the cost of the diet. Additionally, these two COD studies included Key Informant Interviews with a few established Traders in the larger markets to ask about their marketing challenges and opportunities and obtain retrospective price data of key food items (in accord with the food items listed in the World Food Programme Minimum Expenditure Basket Kenya²²).

Photos 3 and 4: Market survey and focus group discussion in Samburu County

B. QUALITY ASSURANCE

Training of the field team was conducted in two stages: a 3 day Training of Trainers (TOT) was conducted for the COD team leaders, assistants and field supervisors to familiarize them with the methodology and to enable them to conduct the next week's 4 day Training of Enumerators. A detailed syllabus for the training workshop was provided by the remote COD lead expert. Daily discussion and review between the COD lead expert and the COD team leaders during both the TOT and the Training of Enumerators was held via a commonly used cloud platform for conferencing.

Concurrently with the three-day TOT, 2 half-days of training for data entry and use of the software was conducted by a Save the Children MIS specialist with support from the COD team lead. In similar fashion, the COD lead expert provided a detailed training syllabus and sample data entry forms and each training session ended with discussion and review via cloud platform conferencing.

Both the TOT training and the Training of Enumerators included experiential practice in becoming comfortable with weighing foods accurately both in the classroom and through visits to local markets. Focus group role plays were conducted using the focus group discussion guides which were slightly modified through feedback from training workshop participants.

Daily debrief and discussion was held between the remote COD lead expert and the COD team leaders throughout the fieldwork period. The fieldwork supervisors reviewed all Market Survey forms daily before handing over for data entry. The HIS specialist reviewed the quality of data entry daily. The software was then uploaded to a cloud platform site where the remote COD lead expert could download and review the data. At the end of the fieldwork, the Market Surveys were scanned and sent by email to the remote COD lead expert

²² Kenya Cash Working Group, *Minimum Expenditure Basket Interim Guidance Document-Kenya*, July 2019.

who conducted a 10% sample of data entry accuracy. There were virtually no errors found. This same procedure was followed for quality control of the Dietary Habits Interviews.

To ensure the quality of information relayed from focus groups, the focus groups were recorded and several team members took notes at each focus group. These recordings and notes were reviewed with a fieldwork supervisor who then summarized the responses in a single guide for each focus group and these were sent by email to the remote COD lead expert. After review of all focus group guides, a conference call was organized so that the remote COD lead expert could ask further probing questions of the fieldwork team. The fieldwork supervisors conducted the Key Informant Interviews with Traders; these forms were scanned and sent to the remote COD lead expert who then sent any questions by email to the supervisors.

C. SECONDARY DATA

Secondary data reviewed prior to the fieldwork included the following documents:

1. Kenya Demographic and Health Survey 2014.
2. Kenya National Bureau of Statistics, Population and Housing Census November 2019.
3. Kenya National Bureau of Statistics, Basic Report on Well-being, 2018.
4. IFPRI/SNV, Kenya Policy Atlas on Food and Nutrition Security and Resilience, June 2020
5. A Maternal, Infant and Young Child Nutrition (MIYCN) Knowledge, Attitudes, Beliefs and Practices (KABP) survey carried out in Samburu County in 2018 with support from Unicef and USAID.
6. Samburu SMART Survey June 2019.
7. USAID Kenya: Nutrition Profile, updated February 2018.
8. Reproductive Health, Kassa et al. *Prevalence and determinants of adolescent pregnancy in Africa: A systematic review and meta-analysis*, 2018.
9. Global Social Welfare, Kumar et al. *Adolescent pregnancy and challenges in Kenyan context: Perspective from multiple community stakeholders*, 2018.
10. Kenya Ministry of Health National Micronutrient Survey 2011.
11. Nutrition International, Policy brief on food fortification in Kenya, 2020.
12. Kenya Cash Working Group (July 2019). *Minimum Expenditure Basket: Interim Guidance Document, Kenya*.
13. Save the Children/Food Economy Group, *Arid Support Programme Resilience Measurement Report* 2016.
14. Save the Children/Food Economy Group, *Livelihood Profiles, Samburu County*, 2021.

IV. BRIEF DESCRIPTION OF LIVELIHOOD ZONES STUDIED IN SAMBURU COUNTY²³

The Nawiri Project is targeted to the geographic areas of Samburu County and Turkana County. Both counties have experienced decades of under-investment and marginalization with low levels of education and literacy, high dependence on natural resources and climate change impacts accelerated by population growth, environmental degradation and rapid demographic shifts.²⁴

²³ The information in this section, including the figures on wealth group characteristics, comes from Save the Children/Food Economy Group Household Economic Approach studies done in Samburu County in 2021.

²⁴ Turkana County Integrated Development Plan (CIDP) 2018-2022; Samburu CIDP 2018-2022.

Due to budget constraints for the Cost of the Diet studies, it was determined that only two could be completed in each of two counties. Cost of the Diet studies were completed in Fisheries Livelihood Zone and Lodwar Urban Livelihood Zone in Turkana County and are submitted in a separate report.

For Samburu County, the livelihood zones of East Pastoral LZ and Central Agropastoral LZ were chosen for study with a focus on the “very poor”, “poor” and “middle” wealth groups. Those in the “better off” wealth group were not included as it is anticipated that they can afford a nutritious diet.

Although Cost of the Diet studies have been done in other parts of Kenya, none had been done in Samburu County prior to these two present studies.

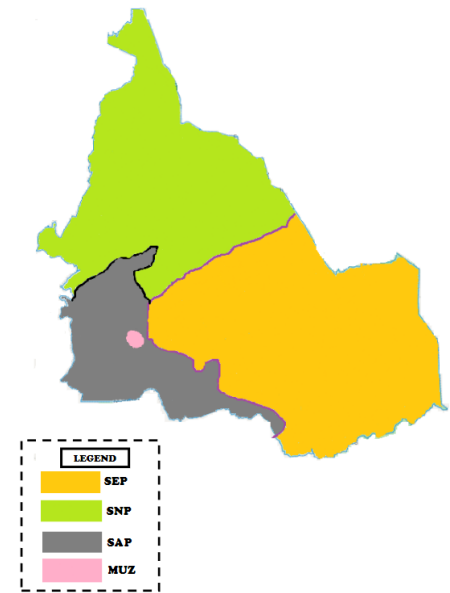


FIGURE 1. MAP OF SAMBURU COUNTY

A. SAMBURU EAST PASTORAL LIVELIHOOD ZONE

Samburu East Pastoral LZ (SEP in the legend for Figure 2 above, the map of Samburu County) is bordered by Samburu Northern Pastoral LZ to the northwest and west, Marsabit County to the north and east, Isiolo County to the south and Samburu Central Agropastoral LZ to the southwest.





Livestock rearing is the main economic activity supplemented by other income generating activities for poorer households such as charcoal production, firewood collection and sale, petty trade, domestic labor and construction labor.

It is a warm semi-arid, lowland livelihood zone with low and erratic levels of rainfall and is not suitable for arable farming. The natural vegetation includes rangelands, bushes and forest with the topography including hills and mountains. Several national reserves lie within this livelihood zone and there is some infrastructure for ecotourism.

There are two permanent rivers in this zone (the Ng’eny and the Lulu rivers), one semi-permanent river (the Ewaso Ng’iro) and as many as seven seasonal rivers. The key roads connect the main town of Wamba to Maralal, the capital of Samburu County, and Wamba to Isiolo and on to Marsabit and Moyale, the North Eastern Transport Corridor. Other roads in this livelihood zone are rough but graded to improved local standards. They are dusty during the dry season and sometimes impassable in the rainy season due to flooding.

Wealth groups in the East Pastoral LZ are characterized by the livestock they own, primarily camels, cattle, goats and sheep, along with mobile phones as a productive asset (see Table 3).

TABLE 3. CHARACTERISTICS OF WEALTH GROUPS IN EAST PASTORAL LZ

		Wealth Groups Characteristics				
		HH size	Number of wives	Land cultivated (acres)	Livestock	other productive assets
Very poor		8	1	0	0 camels; 2 cattle; 9 goats; 4 sheep; 7 chicken	1 mobile phone
Poor		8	1	0	1 camel; 6 cattle; 24 goats; 8 sheep; 3 chicken	2 mobile phones
Middle		8	2	0	4 camels; 19 cattle; 61 goats; 17 sheep; 1 donkey; 1 chicken	2 mobile phones
Better off		10	4	0	7 camels; 40 cattle; 106 goats; 42 sheep; 2 donkeys	3 mobile phones

0% 20% 40% 60%
% of households

In East Pastoral LZ the average household size is eight for the three wealth groups studied through COD methodology (Very Poor, Poor and Middle) and an average household size of eight was used in the COD diet analyses. Polygamy is typically practiced only by those in the “middle” and “better off” wealth group who can afford the expense of a much bigger family.

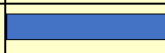
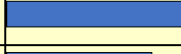

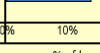
B. CENTRAL AGROPASTORAL LIVELIHOOD ZONE

Samburu Central Agropastoral LZ (SAP in the legend in Figure 2 above, the map of Samburu county) is bordered by Samburu Northern Pastoral LZ to the north, Samburu Eastern Pastoral LZ to the east, Turkana County to the west, and Laikipia and Isiolo Counties to the south. It surrounds the main town of Maralal and the Maralal Urban LZ (MUZ in Figure 2).

Crop production and livestock rearing are important economic activities in this livelihood zone, supplemented by other income generating activities for poorer households, such as casual work (agricultural labor, domestic labor, herding) and sale of bush products including charcoal production and firewood.

It is a semi-arid livelihood zone, although with better rainfall than in the lowland pastoral areas that surround it. The Siyia and Nkare Narok Rivers flow through this zone on a seasonal basis. The main road paved road from Nairobi passes through Maralal to Baragoi. Another road runs from Maralal to Archer’s Post via Wamba. Other roads in this livelihood zone are rough but graded to improved local standards. They are dusty during the dry season and sometimes impassable in the wet season due to flooding. The wealth group characteristics in Central Agropastoral LZ can be found in Table 4:

TABLE 4. CHARACTERISTICS OF WEALTH GROUPS IN CENTRAL AGROPASTORAL LZ

		Wealth Groups Characteristics					
		HH size	Wives	% FHH	Land areas cultivated (acres)	Livestock holdings	Other
Very poor		7-9 (8)	1	40-60%	0.25 - 0.5 acres	0 cattle, 0-3 goats, 2-5 sheep, 0-10 chickens	1 mobile phone
Poor		7-9 (8)	1	30-50%	0.25 - 0.75 acres	2-4 cattle, 3-8 goats, 5-10 sheep, 0-15 chickens	1 mobile phone
Middle		8-15 (11)	1-2	20-40%	1 - 1.5 acres	5-10 cattle, 5-15 goats, 10-25 sheep, 0-15 chickens	2 mobile phones
Better off		14-16 (15)	2	15-25%	1.5 - 3 acres	10-20 cattle, 15-35 goats, 25-60 sheep, 0-15 chickens	2-4 mobile phones, 0-1 motorcycle

0% 10% 20% 30%
% of households

The average household size among the Very Poor and Poor wealth groups was eight while for the Middle wealth group it was eleven; an average household size of eight was used in the Cost of the Diet Analyses. Polygamy is more common among the “better off” households who were not part of this Cost of the Diet study.

V. FOOD PATTERNS, DESIRABILITY AND AVAILABILITY IN EAST PASTORAL AND CENTRAL AGROPASTORAL LIVELIHOOD ZONES, SAMBURU COUNTY

For the Cost of the Diet studies a list of food items considered to be consumed or potentially available in markets were included in both the Dietary Habits Interview, to determine food patterns, and in the Market Survey to determine cost and availability. For East Pastoral LZ this food list included 87 food items, while for Central Agropastoral LZ the list included 91 food items with the inclusion of beef and beef offal.

In the two largest markets in the East Pastoral LZ, Archers Post and Wamba, about half of the 88 food items were for sale with a variety of grains, tubers, legumes, vegetables and fruits. In these two largest markets there were three options for meat: goat meat and goat intestines/stomach in both, plus either chicken or goat liver. Other markets and shops surveyed in East Pastoral LZ offered from 15 to 33 food items for sale with limited options for meat and few options for vegetables among those offering less food items (15 to 20) but from three to five vegetables and three to six fruits among those offering more food items (20 to 33).

In Central Agropastoral LZ, the three largest markets in Maralal town, Kisima and Suguta Marmar had between 49 and 61 food items available with a variety of grains, tubers, legumes, vegetables and fruits along with an average of four options for meat. Two mid-size markets offered from 33 to 36 food items for sale while the smallest had 24. The mid-size and smallest markets had a limited number of vegetables and fruits and few options for meat.

A total of 32 individual Dietary Habits Interviews were conducted in the East Pastoral LZ. The most commonly consumed food items²⁵ reported by more than 2/3 of households were: maize flour, maize grain, rice, potatoes, red beans, goat meat, chicken eggs, UHT cow milk (packaged milk pasteurized at Ultra High Temperature), fresh goat milk, fresh sheep milk, cabbage, onion, kale, tomatoes, large ripe bananas, hydrogenated vegetable oil, liquid vegetable oil, fried wheat snacks, brown sugar and Ujimix (commercial porridge mix).

More than half of households in East Pastoral LZ are said to often consume pasta, bread, wheat flour, varied color beans, green grams, goat intestines/stomach, fresh cow milk, Swiss chard, avocados, oranges and mangos. The diet is more varied than anticipated in East Pastoral LZ although close to half of households report they “rarely” or “never” consume pasta, wheat flour, green grams or mangos, while 1/3 “rarely” or “never” consume fresh cow milk, fresh sheep milk, Swiss chard, avocados, oranges or fried wheat snacks. The Dietary Habits Interviews are conducted in each village with 8 women that represent the three different wealth groups: the very poor households, poor households and middle income households. These food habits may represent purchasing power as much as food preferences.

A total of 32 individual Dietary Habits Interviews were conducted in the Central Agropastoral LZ. The most commonly consumed food items reported by more than 2/3 of households were: maize flour, maize grain, rice, potatoes, red beans, goat intestines/stomach, goat meat, chicken eggs, fresh cow milk, UHT cow milk, fresh goat milk, fresh sheep milk, cabbage, onions, Swiss chard, kale, avocados, oranges, tomatoes, large ripe

²⁵ Note that food item names are listed in their pre-cooked status as the Dietary Habits Interviews forms come from the Market Survey food items list.

bananas, mangos, hydrogenated vegetable oil, liquid vegetable oil, wheat snacks both fried and non-fried, white and brown sugar, and Ujimix (commercial porridge mix).

More than half of households in Central Agropastoral LZ are said to often consume pasta, bread, wheat flour and varied color beans while close to half report “rarely” or “never” consuming these food items.

The list of food items reported as frequently consumed was the same for both livelihood zones. The difference found was that a higher percentage of households in Central Agropastoral LZ report frequent consumption of goat intestines/stomach, fresh cow milk, Swiss chard, avocados, oranges and mangos than in East Pastoral LZ. Both livelihood zones report frequent consumption of fried wheat snacks (*mandazi, chapatti, ngumu*) while non-fried wheat snacks (*donut, sconge*) were only reported as frequently consumed in Central Agropastoral LZ.

Fish (raw, dried or salted) is reported as “rarely” or “never” consumed in both livelihood zones, although some dried fish is sold in both livelihoods zones. Donkey meat is not reported as consumed by any households and camel meat or pork are reported as “rarely” consumed in both livelihood zones; none of these were found in any market in either East Pastoral LZ or Central Agropastoral LZ.

Output from COD market survey analysis showing the average price of each food item and the summary results per food item of Dietary Habits Interviews can be found in Annex D for East Pastoral LZ and Annex E for Central Agropastoral LZ.

In focus group discussions in East Pastoral LZ, adolescent women (age 15 to 20) replied that their husbands/partner or other family members were the person who usually goes to the market, while the older group of women (age 21 to 49) stated the wife usually goes to the market. Both adolescent and older women provided a long list of foods that they make most of the decisions about purchasing, including maize, maize flour, rice, spaghetti, beans, green grams, cabbage and kale. Meat was not mentioned by any focus group.

In focus group discussions in Central Agropastoral LZ, responses from adolescent women (age 15 to 20) as to who usually goes to the market were split between wife, husband/partner and either wife or husband/partner while the older group of women (age 21 to 49) stated the wife usually goes to the market. Both age groups of women provided a long list of foods that they make most of the decisions about purchasing, including maize, maize flour, rice, spaghetti, wheat flour, beans, cooking oil, vegetables and fruits. The list from both age groups in Central Agropastoral LZ also included meat.

Adolescent mothers were also asked whether they live in their own house with their husband/partner or live with other family members. In East Pastoral LZ, most stated they lived in their own house while answers were evenly split in Central Agropastoral LZ.

Women in both age groups and in both livelihood zones noted opportunities for them to earn money through casual labor which they spend on food items, clothes, soap, utensils and shoes. A few mentioned paying to mill maize and buying medication for animals. A few of the adolescent mothers in East Pastoral LZ stated they were still in school, living with parents, and did not earn any money. Security concerns for going to the market were not mentioned by any age group of women in either livelihood zone, although adolescent mothers in Eastern Pastoral LZ mentioned a fear of elephant attacks. Most women prefer to buy at the closest market because of time constraints due to looking after animals and children and household chores. In East Pastoral LZ, most

women noted that they grow “very little” or “none” of the basic foods (maize, beans, rice) regularly consumed and buy “almost all” except for adolescent women in Wamba-Sora Doru who stated they grow about half and purchase half. Answers in Central Agropastoral LZ were more evenly distributed between grow “most”, “more than half”, “less than half” and “very little/none” and between both age groups of women.

A. GRAINS AND GRAIN-BASED PRODUCTS

For both East Pastoral LZ and Central Agropastoral LZ, the grains and grain-based products most reported as frequently eaten include MAIZE FLOUR (by 98% to 100% of households) followed by MAIZE GRAIN (84% to 91%) and RICE (93% to 100%). In focus group discussions, women of both age groups and in both livelihood zones often mention maize grain as being particularly difficult for small children to chew, but also mention that some small children do not like maize flour, either, or will not eat it plain but prefer it mixed with other foods.

The next most frequently mentioned carbohydrates in both livelihood zones are BREAD (56% to 60%), WHEAT FLOUR (53%) and PASTA (53% to 59%). As found in the COD studies in Turkana County, pasta comes in two pre-packaged sizes, 400 grams and 500 grams. Unlike what was found in Turkana County where both sizes were sold at the same price, the prices in both East Pastoral LZ and Central Agropastoral LZ vary commensurate with size.

MAIZE ON THE COB was reported as eaten often by 16% of households in East Pastoral LZ but only 6% of households in Central Agropastoral LZ. It was found for sale in markets in both zones.

OATS are not said to be consumed by any household in either livelihood zone though they were found for sale in both. MILLET, SORGHUM and WEETABIX are only reported as consumed by a small percentage of households in either livelihood zone (12%, 6% and 6% in East Pastoral LZ respectively; 3%, 3% and 6% in Central Agropastoral LZ respectively).

TABLE 5. COMPARATIVE PRICES OF AVAILABLE GRAINS AND GRAIN PRODUCTS IN BOTH LIVELIHOOD ZONES

GRAINS	EAST PASTORAL LZ	CENTRAL AGROPASTORAL LZ
Food Item	AVERAGE PRICE PER 100 GRAMS	AVERAGE PRICE PER 100 GRAMS
Maize grain	5.1 KES	4.3 KES
Maize flour	5.5 KES	4.9 KES
Sorghum	7.4 KES	15.0 KES
Wheat flour	8.1 KES	7.3 KES
Maize on the cob	8.6 KES	7.0 KES
Rice	10.1 KES	10.0 KES
Millet, finger	12.0 KES	10.2 KES
Pasta	12.4 KES	14.0 KES
Commercial porridge mix	14.3 KES	12.3 KES
Bread	14.6 KES	13.8 KES
Oats	25.0 KES	28.9 KES
Weetabix	69.5 KES	78.0 KES

Exchange rate average: US\$1 = 108 KES; April 2021

A variety of grains were available in every market in both livelihood zones. The cheapest available food item in the grains category was MAIZE GRAIN at 5.1 KES per 100 grams in East Pastoral LZ and 4.3 KES per 100 grams in Central Agropastoral LZ. Additional prices of grains and grain products can be found in Table 5.

Of the twelve food items surveyed in the grains category, most are cheaper in the Central Agropastoral LZ, except for sorghum, pasta, oats and Weetabix which are higher priced.

A local commercial grain mix of finger millet flour and maize flour, with a souring agent, used to prepare PORRIDGE (“Ujimix”) was available at half of markets at an average price of 14.3 KES in East Pastoral LZ; it was available at 5 out of 6 markets surveyed at 12.3 KES per 100 grams in Central Agropastoral LZ. It is reported as “usually” or “often” eaten by more than 2/3 of households in both livelihood zones.

Pasta, also referred to as SPAGHETTI, is mentioned by adolescent mothers as being particularly “enticing”, “modern”, “easy to cook” and said to provide “satiety”. Spaghetti was also mentioned by several focus groups as being a food that they would like to buy but that is rarely available in the market. One group of adolescent mothers in East Pastoral LZ mentioned that children are not familiar with spaghetti and do not know how to eat it. As in the Turkana COD studies, adolescent mothers mentioned that older people think cooked spaghetti looks like worms and do not eat it.

One focus group stated that BREAD was a desirable food item as it is soft, filling and desired by children. From a nutrition perspective, bread would not be considered a nutrient-dense option to satiate a child.

B. ROOTS AND TUBERS

POTATO was the only available tuber said to often be consumed by 94% to 96% of households in both livelihood zones. SWEET POTATOES are reported as “often” consumed by 9% and 3% of households in East Pastoral LZ and Central Agropastoral LZ respectively. BEETS are reported as “often” consumed by 6% and ARROWROOT by 3% of households only in East Pastoral LZ and not in Central Agropastoral LZ.

POTATOES were available in every market in both livelihood zones (see Table 6 for prices). SWEET POTATOES and ARROWROOT were for sale in the same three of six markets in East Pastoral LZ and the same two markets in Central Agropastoral LZ.

BEETS were available in only two markets in each livelihood zone; in East Pastoral LZ the price was very low in one market and one grocery store, thus bringing down the average price.

TABLE 6. COMPARATIVE PRICES OF AVAILABLE ROOTS AND TUBERS IN BOTH LIVELIHOOD ZONES

ROOTS AND TUBERS	EAST PASTORAL LZ	CENTRAL AGROPASTORAL LZ
Food Item	AVERAGE PRICE PER 100 GRAMS	AVERAGE PRICE PER 100 GRAMS
Potato	6.3 KES	5.2 KES
Sweet potato	7.5 KES	6.6 KES
Arrowroot	12.8 KES	15.7 KES
Beets	19.9 KES	34.5 KES

Exchange rate average: US\$1 = 108 KES; April 2021

POTATOES were mentioned by many women of both age groups and in both livelihood zones as being a food item they would like to buy but that is not often available at markets, yet potatoes were found in every market in both livelihood zones during these studies. Adolescent mothers noted that potatoes are “highly nutritious”, “delicious”, “soft” and “good for children”. Follow up research on seasonal variation in prices should include potatoes in the short list of food items.

SWEET POTATOES were noted as a desirable food item that is rarely available in East Pastoral LZ. Women noted as something new or different that is desirable that they enjoy “taking sweet potato or ARROWROOT with tea in the morning”.

C. LEGUMES, NUTS AND SEEDS

In East Pastoral LZ, RED BEANS were the legume reported to be frequently consumed by the greatest percentage of households (78%) though 15% reported “never” consuming them. In East Pastoral LZ a little over half of households are reported to also often consume VARIED COLOR BEANS and GREEN GRAMS.

In Central Agropastoral LZ, RED BEANS were also the legume most frequently consumed by households (69%), while 28% reported “never” consuming them. VARIED COLOR BEANS were the only other legume reported as consumed by at least half of households. GREEN GRAMS are reported as consumed often by only 22% of households.

LENTILS are reported as consumed often by only 15% of households in either livelihood zone and SOYBEAN MILK CURD was reported as consumed often by 19% of households in East Pastoral LZ but only 6% of households in Central Agropastoral LZ.

RED BEANS were available in five of six markets in East Pastoral LZ (Table 4). In the larger markets/stores, four or more types of legumes were for sale. In the smaller markets, only two or three types of legumes were available. In Central Agropastoral LZ, four of six markets had RED BEANS but all markets had at least four types of legumes for sale.

As seen in Table 7, VARIED COLOR BEANS are close to RED BEANS in price in both livelihood zones; some of these are coming from Uganda and are said to cook more quickly than most beans.

TABLE 7. COMPARATIVE PRICES OF AVAILABLE LEGUMES IN BOTH LIVELIHOOD ZONES

LEGUMES Food Item	EAST PASTORAL LZ		CENTRAL AGROPASTORAL LZ	
	AVERAGE PRICE PER 100 GRAMS	AVAILABILITY	AVERAGE PRICE PER 100 GRAMS	AVAILABILITY
Red beans	10.9 KES	5 of 6 markets	10.5 KES	4 of 6 markets
Varied color beans	10.5 KES	6 of 6 markets	10.8 KES	6 of 6 markets
Cowpea beans	12.0 KES	1 of 6 markets	12.0 KES	1 of 6 markets
Green gram	15.5 KES	4 of 6 markets	14.6 KES	5 of 6 markets
Lentils	23.6 KES	3 of 6 markets	19.4 KES	4 of 6 markets
Groundnut, roasted	42.0 KES	6 of 6 markets	62.2 KES	5 of 6 markets
Soybean milk curd	15.7 KES	1 of 6 markets	n.a.	n.a.

Exchange rate average: US\$1 = 108 KES; April 2021

GROUNDNUTS, roasted and shelled, are sold in small quantities and in many markets in both livelihood zones. SOYBEAN MILK CURD was available in only one market in East Pastoral LZ and not in Central Agropastoral LZ. SESAME SEEDS (*simsim*) were not sold in any market in either livelihood zone.

Women from both ages of focus groups and in both livelihood zones mentioned BEANS as being a cause of bloating during pregnancy and a cause of stomachache and diarrhea in children. Some women said that beans should not be eaten during pregnancy as they will result in a big baby and difficulty during childbirth.

Women in both livelihood zones described LENTILS and GREEN GRAMS as being a desirable food item that is not available in markets as often as they would like to buy. Lentils and green grams were only found in the largest markets in East Pastoral LZ. Lentils were only found in the largest markets in Central Agropastoral LZ also, but green grams were found in both the larger and mid-size markets. Women in Central Agropastoral LZ particularly mention that lentils can be eaten with all foods as an accompaniment and that green grams have less acidity and do not cause diarrhea.

In the two COD studies done in Turkana County, GROUNDNUTS were mentioned by almost all focus groups as prohibited for consumption during pregnancy as it would “add weight to the unborn child and cause complications during childbirth”. In Samburu County, this was only mentioned by one focus group in East Pastoral LZ.

D. MEAT AND OFFAL

In East Pastoral LZ, GOAT MEAT was the type of meat reported as frequently consumed by 72% of households and GOAT INTESTINES/STOMACH by 50%. GOAT LIVER and MUTTON are frequently eaten by about one-third of households. The meats/offal reported as “rarely” or “never” consumed included CAMEL MEAT (96%), CHICKEN (87%) and PORK (91%).

In Central Agropastoral LZ, GOAT INTESTINES/STOMACH is the type of meat/offal reported as frequently consumed by 75% of households, followed by GOAT MEAT (69%); about one-third also report consuming BEEF INTESTINES, MUTTON and LIVER often. The meats reported as “rarely” or “never” consumed included BEEF (81%), CAMEL MEAT (100%), CHICKEN (90%) and PORK (100%).

In both livelihood zones DONKEY MEAT was reported as never eaten by 100% of households.

In East Pastoral LZ, GOAT MEAT, GOAT INTESTINES/STOMACH, GOAT LIVER, CHICKEN or MUTTON were available for sale but most markets had only one option, either goat meat (often along with goat intestines/stomach) or mutton. The two larger markets had three options. GOAT LIVER was for sale in only one of the larger markets in East Pastoral LZ.

In Central Agropastoral LZ, GOAT MEAT, GOAT INTESTINES/STOMACH were available, along with BEEF, CHICKEN and MUTTON. One of the largest markets had six options, while another three markets had three or four options each. GOAT LIVER was widely available in four of six markets (Table 8).

TABLE 8. COMPARATIVE PRICES AND AVAILABILITY OF MEAT AND OFFAL IN MARKETS, IN DESCENDING ORDER OF AVAILABILITY

MEATS AND OFFAL FOOD ITEM	EAST PASTORAL LZ		CENTRAL AGROPASTORAL LZ	
	PRICE PER 100 GRAMS	AVAILABILITY	PRICE PER 100 GRAMS	AVAILABILITY
Goat meat	40.3 KES	4 of 6 markets	50.4 KES	5 of 6 markets
Goat intestines/stomach	31.3 KES	3 of 6 markets	38.7 KES	4 of 6 markets
Goat liver	51.6 KES	1 of 6 markets	42.0 KES	4 of 6 markets
Mutton	57.2 KES	2 of 6 markets	51.4 KES	2 of 6 markets
Beef	n.a.	n.a.	47.3 KES	2 of 6 markets
Chicken	45.0 KES	1 of 6 markets	51.4 KES	1 of 6 markets

Exchange rate average: US\$1 = 108 KES; April 2021

CAMEL MEAT and PORK were not found for sale in any market in either livelihood zone. BEEF INTESTINES, added to the Market Survey for Central Agropastoral LZ, was not found for sale in any market.

MEAT was mentioned by focus groups in Central Agropastoral LZ as being a desirable food item not often available at market. Usually women are commenting on food availability at the smallest local market that they prefer to go to due to time constraints from the daily workload.

Table 32 in the discussion section of this report shows the availability and cost of all types of animal-source food items.

E. EGGS

In East Pastoral LZ women reported 22% of households to eat CHICKEN EGGS five or more days a week while another 56% stated they were eaten “often” (one to four days per week). Chicken eggs were available at five of six markets at an average cost of 34.6 KES per 100 grams.

In Central Agropastoral LZ women reported 13% of households to eat CHICKEN EGGS five or more days a week while another 72% stated they were eaten “often”. Chicken eggs were available at all six markets surveyed at an average cost of 32.5 KES per 100 grams, slightly lower than the price in East Pastoral LZ.

Adolescent mothers in East Pastoral LZ remarked that chicken eggs were a desirable food as they are very nutritious, while adolescent mothers in Central Agropastoral LZ noted that consumption of chicken eggs helps to “put weight” on a child.

Eggs were not mentioned as taboo for small children under age two in either livelihood zone. However, in East Pastoral LZ there were comments that some children will not consume eggs as they “taste bad” or “make them vomit” and in Central Agropastoral LZ there was a comment that eggs could cause high blood pressure in children.

Taboos against the consumption of eggs during pregnancy was among the most frequently noted food prohibitions in both livelihood zones with a concern that egg consumption “would increase the weight of the unborn and cause complications during childbirth”.

F. FISH AND SEAFOOD

The COD studies done in Fisheries LZ and Lodwar Urban LZ in Turkana County found more than half of households to regularly consume small dried freshwater fish which were readily available in markets. However, for the two COD studies done in Samburu County, Dietary Food Habits Interviews found women to report that more than 90% of households never eat any type of fish. SMALL DRIED FRESHWATER FISH was available only at two stores in Wamba in East Pastoral LZ at an average price of 61.8 KES per 100 grams and at 1 store in Suguta Marmar in Central Agropastoral LZ at an average price of 44.2 KES per 100 grams, much lower than the price in East Pastoral LZ.

CANNED TUNA FISH was included on the food list but was reported as not consumed by households and was only found in the large markets/stores in Archers Post in East Pastoral LZ at an average price of 127.3 KES per 100 grams.

Many women expressed concerns about the hygienic state of fish sold in the market (“flies”, “smells bad”). However, women in East Pastoral LZ did describe small dried freshwater fish (*omena*) as a “new” food item that is desirable because they know other people in larger towns eat it. In East Pastoral LZ, women also listed fish as a desirable food item that is not often available in markets.

G. MILK AND MILK PRODUCTS

Various types of milk are a popular food item in East Pastoral LZ. Women report households are frequently consuming FRESH GOAT MILK (81%), Ultra High Temperature (UHT pasteurization) COW MILK (72%), FRESH COW MILK (63%) and FRESH SHEEP MILK (66%).

In East Pastoral LZ, POWDERED COW MILK is “rarely” or “never” reported as consumed by over 90% of households.²⁶

Similar to East Pastoral LZ, various types of milk are said to be frequently consumed in Central Agropastoral LZ, though at slightly lower percentages than in East Pastoral LZ for all milks except FRESH COW MILK where a higher percentage report frequent consumption. Women report households are frequently consuming FRESH GOAT MILK (72%), FRESH COW MILK (72%), UHT COW MILK (66%) and FRESH SHEEP MILK (63%).

In Central Agropastoral LZ, POWDERED COW MILK is often consumed by only 19% of households and CAMEL MILK by only 15% of households.

FRESH GOAT MILK is not usually sold in markets but rather sold by the cupful door-to-door. However, it was found for sale in one market in East Pastoral LZ at a higher price than door-to-door at 30 KES for 400 ml vs. 20 KES for 350 ml (door-to-door) giving an average price of 6.9 KES per 100 grams for East Pastoral LZ. In Central Agropastoral LZ it is sold for 30 KES per 350 ml giving an average price of 7.9 KES per 100 grams (Table 9).

²⁶ Fresh camel milk was inadvertently left off the Dietary Habits Interview form for East Pastoral LZ. However, as it is more expensive than fresh cow or goat milk per Market Survey, the Cost of the Diet software would not choose it for a cost efficient nutritious diet.

FRESH COW MILK was found for sale in only one market in Wamba in East Pastoral LZ at an average price of 7.7 KES per 100 grams and in two of six markets in Central Agropastoral at an average price of 6.1 KES per 100 grams. UHT COW MILK was available in every market surveyed in both livelihood zones at an average price of 13.7 KES per 100 grams in East Pastoral LZ and slightly cheaper at 12.7 KES per 100 grams in Central Agropastoral LZ. In five of the total of 12 markets surveyed in both livelihood zones it was the only milk available.

TABLE 9. COMPARATIVE PRICES AND AVAILABILITY OF MILK IN BOTH LIVELIHOOD ZONES

MILK Food Item	EAST PASTORAL LZ		CENTRAL AGROPASTORAL LZ	
	AVERAGE PRICE PER 100 GRAMS	AVAILABILITY	AVERAGE PRICE PER 100 GRAMS	AVAILABILITY
Fresh goat milk	6.9 KES	1 of 6 markets and door-to-door	7.9 KES	0 of 6 markets and door-to-door
Fresh cow milk	7.7 KES	1 of 6 markets	6.1 KES	2 of 6 markets
Powdered cow milk	48.0 KES	2 of 6 markets	120.0 KES	1 of 6 markets
UHT cow milk	13.7 KES	6 of 6 markets	12.7 KES	6 of 6 markets
Fresh camel milk	14.2 KES	2 of 6 markets	n.a.	n.a.
Fresh sheep milk	n.a.	n.a.	n.a.	n.a.

Exchange rate average: US\$1 = 108 KES; April 2021

POWDERED COW MILK was for sale in only two of six markets in East Pastoral LZ at an average price of 48.0 KES per 100 grams and in only one store in Central Agropastoral LZ in the main town of Maralal at an average price of 120.0 KES per 100 grams. Although the cost of powdered cow milk appears quite high, 100 grams is reconstituted into one liter of fluid milk so the cost per 100 grams of fluid milk would be 4.8 KES, the cheapest of all the milks available. However, safe water for reconstituting powdered milk is a concern in both livelihood zones and therefore it may not be worthwhile to encourage the purchase of powdered cow milk.

FRESH CAMEL MILK was sold at two of six markets in East Pastoral LZ, but not in Central Agropastoral LZ, at an average price of 14.2 KES per 100 grams. SHEEP MILK was not found in any market in either LZ during this survey (which did occur at the beginning of the heavy rains season).

In focus groups, MILK (cow or goat) was the food item most often mentioned as a desirable food item that has become less available with changing weather patterns.

H. VEGETABLES

In East Pastoral LZ, ONIONS (97%), KALE (94%), CABBAGE (88%), SWISS CHARD (63%), CARROTS (50%) and GREEN PEAS (*minji*; 41%) were the vegetables reported as frequently consumed. Around 10% of households were also reported to frequently consume ACORN SQUASH and SOLANUM LEAVES (*sujaa/managu*).

In Central Agropastoral LZ, the order for frequent vegetable consumption was CABBAGE (100%), ONIONS (100%), KALE (91%), SWISS CHARD (78%), CARROT (41%), SOLANUM LEAVES (41%), ACORN SQUASH (22%), GREEN PEAS (22%) and PUMPKIN LEAVES (*mbene elmuronge*; 9%).

In East Pastoral LZ, ONIONS and CABBAGE were available at all six markets surveyed and KALE was available at four. SWISS CHARD was available at three markets and GREEN PEAS (*minji*) were only found at two markets. Half of the markets surveyed had six types of vegetables available while the other half had two to four types available.

In Central Agropastoral LZ, similar to East Pastoral LZ, ONIONS and CABBAGE were available at all six markets surveyed and KALE was available at four. Half of the markets had from four to six types of vegetables available while half had only two or three types available.

Prices of all available vegetables in both livelihood zones are shown in Table 10. Prices are slightly higher for most vegetables in East Pastoral LZ, although that is not so for CARROTS or SQUASH.

TABLE 10. COMPARATIVE COSTS OF VEGETABLES AVAILABLE IN BOTH LIVELIHOOD ZONES, IN ASCENDING ORDER OF COST

VEGETABLES	EAST PASTORAL LZ	CENTRAL AGROPASTORAL LZ
Food Item	AVERAGE PRICE PER 100 GRAMS	AVERAGE PRICE PER 100 GRAMS
Cabbage	2.9 KES	2.5 KES
Carrots	5.5 KES	7.7 KES
Kale	5.8 KES	5.7 KES
Swiss chard	6.5 KES	7.4 KES
Acorn squash	11.1 KES	11.2 KES
Onion	13.5 KES	11.6 KES
Scallions / spring onion	15.1 KES	n.a.
Green peas	30.8 KES	29.6 KES

Exchange rate average: US\$1 = 108 KES; April 2021

Though reported as consumed, SOLANUM LEAVES were not found in any market; however, they are one of the key wild foods gathered during the rainy season.

ONIONS do not provide many nutrients and are one of the more expensive vegetables available. Yet they are consumed by 100% of households in both livelihood zones. This is likely due to the fact that onions can add a lot of flavor to a meal.

Women in both livelihood zones described GREEN PEAS (*minji*) as being a desirable food item that is not available in markets as often as they would like to buy. Women in Central Agropastoral LZ particularly mention that green peas are easy to cook with other foods. Other vegetables mentioned in both livelihood zones as being desirable but not often available in markets included KALE, SWISS CHARD (“spinach”), and CABBAGE. In East Pastoral LZ, COWPEA LEAVES and AMARANTH were also mentioned. One focus group in Central Agropastoral LZ noted that vegetables are only available early in the morning at markets.

I. FRUITS

In East Pastoral LZ, the fruits reported as frequently consumed by most households included TOMATOES (97%), LARGE RIPE BANANAS (88%), ORANGES (63%), AVOCADOS (63%) and MANGOS (56%).

Between 10% and 30% reported frequently consuming APPLES, PASSIONFRUIT, PAPAYA, PINEAPPLE, WATERMELON and LARGE UNRIPE BANANAS. Less than 10% also mentioned PEAR and the PALM FRUIT (*doum / eng'ol*) of the *hyphaene compressa* palm.

In Central Agropastoral LZ, the fruits reported as frequently consumed by most households included TOMATOES (100%), ORANGES (88%), LARGE RIPE BANANAS (75%), MANGOS (62%) and AVOCADOS (78%). Between 15% and 25% reported frequently consuming APPLES, COCONUT MILK, PASSIONFRUIT, PINEAPPLE, WATERMELON and LARGE UNRIPE BANANAS. Less than 10% also mentioned GRAPES and PAPAYA.

In East Pastoral LZ, the largest two markets had from nine to eleven types of fruit for sale, a mid-size market had seven and the remaining three smaller markets had from one to three types of fruit available. TOMATOES (average price 9.8 KES per 100 grams), ORANGES (9.2 KES) and LARGE RIPE BANANAS (5.5 KES) were available at all markets.

In Central Agropastoral LZ, a variety of fruits were available. In the three largest markets there were from nine to thirteen types of fruit for sale while in the remaining three markets there were four or five types of fruits available. Like East Pastoral LZ, all markets had TOMATOES (average price 8.1 KES per 100 grams), ORANGES (7.2 KES) and LARGE RIPE BANANAS (5.6 KES) available, but in addition all markets had AVOCADOS (8.7 KES). MANGOS, at an average price of 5.0 KES per 100 grams, were found in three of six markets.

A summary of the prices of key fruits available in both livelihood zones in Table 11.

TABLE 11. PRICES OF FRUITS FREQUENTLY CONSUMED IN BOTH LIVELIHOOD ZONES

FRUITS	EAST PASTORAL LZ	CENTRAL AGROPASTORAL LZ
Food Item	AVERAGE PRICE PER 100 GRAMS	AVERAGE PRICE PER 100 GRAMS
Tomato	9.8 KES	8.1 KES
Orange	9.2 KES	7.2 KES
Banana (large, ripe)	5.5 KES	5.6 KES
Avocado	7.6 KES	8.7 KES
Mango	n.a.	5.0 KES

Exchange rate average: US\$1 = 108 KES; April 2021

The prices of fruits that are frequently consumed were lower in Central Agropastoral LZ, as compared to East Pastoral LZ, except for BANANA (large, ripe) which was more or less the same and AVOCADO which was higher.

Oranges are well-known to contain vitamin C while mangos are rich in vitamins C and A. Tomatoes contain some vitamin A and a moderate amount of vitamin C but are much less nutrient dense when compared to dark green leafy vegetables. Large ripe bananas contain a moderate amount of important nutrients but are easy to eat for small children, an important factor when thinking about the family diet. Avocados are energy-dense with their unusually high (for a fruit) fat content. They are also soft for small children to eat.

AVOCADO was noted in focus groups in both LZ to be prohibited for consumption during pregnancy as it would “add weight to the unborn child and cause complications during childbirth”.

As seen in Table 12, most of the fruits available but yet not frequently consumed are much higher in price than those fruits that are frequently consumed.

TABLE 12. PRICES OF AVAILABLE FRUITS NOT AS FREQUENTLY CONSUMED IN BOTH LIVELIHOOD ZONES

FRUITS	EAST PASTORAL LZ	CENTRAL AGROPASTORAL LZ
Food Item	AVERAGE PRICE PER 100 GRAMS	AVERAGE PRICE PER 100 GRAMS
Apple	32.4 KES	31.7 KES
Grapes	n.a.	70.0 KES
Passionfruit	27.0 KES	22.6 KES
Pear	n.a.	n.a.
Pineapple	17.0 KES	10.8 KES
Tamarind	n.a.	12.2 KES
Watermelon	5.0 KES	5.9 KES
Coconut milk	35.0 KES	n.a.
Melon	10.4 KES	17.8 KES
Palm fruit (<i>doum/eng'ol</i>)	n.a.	n.a.
Papaya	5.6 KES	8.0 KES
Banana (large, unripe)	4.5 KES	4.7 KES

Exchange rate average: US\$1 = 108 KES; April 2021

PAPAYA was priced similar to other frequently consumed fruits but was only reported to be frequently consumed by 9% of households in East Pastoral LZ and 6% in Central Agropastoral LZ. Papaya is high in vitamins A and C and easy to eat by small children with few teeth. TAMARIND was found at only one market in Central Agropastoral LZ and was reported as “rarely” or “never” consumed by all households in both livelihood zones. It provides small amounts of vitamin C and calcium. If mixed to make a drink it should be mixed with safe water. LARGE UNRIPE BANANAS are among the lower-priced fruits and can provide a small amount of vitamins A and C.

Many types of fruits were among the foods most frequently mentioned by focus groups as being desirable but not often available. Tomatoes topped the list which included avocado, banana, mango and even passionfruit.

J. OILS AND FATS

In East Pastoral LZ, 84% of households are reported to frequently consume liquid VEGETABLE OIL while 67% report frequent consumption of HYDROGENATED VEGETABLE OIL. MARGARINE is only frequently eaten by 22% of households while 59% report “never” consuming it. VEGETABLE OIL (average price 23.5 KES per 100 grams) and HYDROGENATED VEGETABLE OIL (21.3 KES) were found at the same five markets. MARGARINE (43.4 KES) was only available at half of the six markets.

In Central Agropastoral LZ, 97% of households are reported to frequently consume liquid VEGETABLE OIL while 88% report frequent consumption of HYDROGENATED VEGETABLE OIL. MARGARINE is only frequently eaten by 28% of households while 44% report “never” consuming it. VEGETABLE OIL (average price 27.8 KES per 100 grams), HYDROGENATED VEGETABLE OIL (21.2 KES) and MARGARINE (45.0 KES) were found at all six markets.

The prices of available oils and fats can be found in Table 13.

TABLE 13. COMPARATIVE PRICES OF AVAILABLE OILS AND FATS IN BOTH LIVELIHOOD ZONES

OILS AND FATS	EAST PASTORAL LZ	CENTRAL AGROPASTORAL LZ
Food Item	AVERAGE PRICE PER 100 GRAMS	AVERAGE PRICE PER 100 GRAMS
Vegetable oil	23.5 KES	27.8 KES
Hydrogenated vegetable oil	21.3 KES	21.2 KES
Margarine, fortified	43.4 KES	45.0 KES

Exchange rate average: US\$1 = 108 KES; April 2021

Hydrogenated vegetable oil is cheaper in both livelihood zones and represents a potential cost savings for households as cooking oil is a key staple food item.

K. SUGARS, CONFECTIONARY AND CONDIMENTS

In East Pastoral LZ, BROWN SUGAR (average price 12.1 KES per 100 grams) is reported as often consumed by 93% of households with WHITE SUGAR (11.9 KES) by 44%. For SUGARCANE (28%), HONEY (12%) and JAGGERY (6%) frequent consumption is reported at much lower percentages.

BROWN SUGAR was available at four of six markets and WHITE SUGAR was available at three markets. SUGARCANE and JAGGERY were not available but HONEY was at two shops in one market area at an average price of 86.0 KES per 100 grams.

In Central Agropastoral LZ, BROWN SUGAR (average price 11.4 KES per 100 grams) is reported as often consumed by 97% of households with WHITE SUGAR (11.6 KES) by 69%. For SUGARCANE (25%), JAGGERY (16%) and HONEY (12%) frequent consumption is reported at much lower percentages.

BROWN SUGAR was available at all six markets while WHITE SUGAR was available at five. SUGARCANE (average price 3.3 KES per 100 grams) and JAGGERY (25.8 KES) were found at five of six markets. HONEY (125.0 KES) was only available in Maralal, the main town.

In East Pastoral LZ, FRIED WHEAT DOUGH SNACKS (*mandazi, chapatti, ngumu*) are reported as frequently consumed by 69% of households and were available in four of six markets at an average price of 19.1 KES per 100 grams. NON-FRIED WHEAT DOUGH SNACKS (*donut, sconge*) are reported as frequently consumed by 47% of households and were available in three of six markets at an average price of 27.4 KES per 100 grams.

Adolescent mothers in East Pastoral LZ mentioned that children love to eat CHAPATTI yet mothers also mentioned chapatti as a food item they did not trust to buy from the market due to concerns about hygiene during preparation.

In Central Agropastoral LZ, FRIED WHEAT DOUGH SNACKS are reported as frequently consumed by 88% of households and were available in all six markets at an average price of 14.7 KES per 100 grams. NON-FRIED WHEAT DOUGH SNACKS are reported as frequently consumed by 63% of households and were available in four of six markets at an average price of 14.9 KES per 100 grams.

In both livelihood zones 100% of families consume SALT frequently and salt was widely available in all markets at an average price of 4.8 KES per 100 grams in East Pastoral LZ and 5.8 KES in Central Agropastoral LZ. The iodization of salt with the micronutrient iodine has been mandatory in Kenya since 1978²⁷ with some early success in the reduction of goiter among the population. However, the 2011 Kenya National Micronutrient Survey found over half of the samples of salt in both urban and rural areas to not be optimally iodized.²⁸ The same survey found 30.1% of non-pregnant women in rural areas of Kenya to have iodine deficiency. Iodine is critical for physical and mental development from conception onwards.

LEMON and (canned, concentrated) TOMATO PASTE are categorized as condiments by the COD software. LEMON (average price 17.6 KES per 100 grams) is reported as “rarely” or “never” eaten by 91% of households in East Pastoral LZ. TOMATO PASTE (42.2 KES) is reported as often eaten by 25% of households and “never” eaten by 59%.

In Central Agropastoral LZ, LEMON (average price 17.8 KES per 100 grams) and (canned, concentrated) TOMATO PASTE (47.7 KES) are reported as “rarely” or “never” eaten by 97% and 100% of households, respectively.

L. WILD OR GATHERED FOODS

When developing the food list, two foods which are gathered were added to the food list as they are sometimes sold in markets: *Solanum nigrum* leaves (*sujaal/managu*) and the fruit of a palm tree (*doum/eng'ol*). Neither *Solanum* leaves nor the fruit of the palm tree were found in any market in either livelihood zone. *Solanum* leaves, a good source of vitamins A and C and calcium, was reported by all focus groups to be a wild food that is gathered during the rainy season and that can be eaten by everyone (one focus group out of eight stated “everyone except young children”).

In the two COD studies done in Turkana County, *doum/eng'ol*, the fruit of a local palm tree (*hyphaene compressa*) was a wild food mentioned in all focus groups as being gathered during the dry season and consumed by everyone. COD analysis for Fisheries LZ in Turkana County included this palm tree fruit as it is a good source of energy and calcium. It was not mentioned in any focus group in either livelihood zone in Samburu County and, in Dietary Habits Interviews, 94% of women in East Pastoral LZ and 100% of women in Central Agropastoral LZ reported never consuming this fruit.

A long list of wild or gathered foods was obtained during focus group interviews (Annex F); little information was readily available on their scientific names and/or nutrient content.

VI. OTHER INFORMATION FROM KEY INFORMANT INTERVIEWS AND FOCUS GROUPS

Besides the Market Surveys and Dietary Habits Interviews, focus groups were conducted with adolescent mothers age 15 to 20 with children under age three and mothers age 21 to 49 with children under age three. Key

²⁷ Nutrition International (2020). *Food Fortification in Kenya: Policy Brief*.

²⁸ Kenya Ministry of Health (2011). *Kenya National Micronutrient Survey*.

Informant Interviews were also conducted with several of the established traders in the larger markets in each livelihood zone.

A. CONSUMER AND TRADER CONCERNS

In focus group discussions, women were asked what foods they did not trust to purchase at markets and why. Women in Central Agropastoral LZ mentioned fish as smelling bad and having an unattractive appearance; fish were not mentioned in Eastern Pastoral LZ focus groups. There were a variety of concerns about maize flour – that it is sometimes bitter, that it might be expired, that it might not be safe if the bag is not sealed. There was even mention of the possibility of “toxins”; the COD team noted that there has been education about aflatoxins in the zone. There was a general concern about packaged food items being expired, regardless of the expiration dates noted on the item.

All groups mentioned concerns about purchased vegetables or tubers “going rotten fast”. In Eastern Pastoral LZ there was a particular concern about not wanting kale that was cut-up already; women prefer to cut the kale themselves. Weevil infestation of beans and maize was mentioned by groups in Eastern Pastoral LZ, along with a concern that some beans take a long time to cook. Some even mentioned a belief that bread is injected with human blood (to add nutrients), that tomatoes are injected with formalin to make them ripe and big, and/or that rice might be plastic signifying a general distrust with the commercial sector.

More in-depth Key Informant Interviews were undertaken with two Traders in each livelihood zone. In response to the question “What are the biggest obstacles to selling more food?” almost all Traders mentioned high prices from wholesale as a key obstacle, along with competition from other Traders and customer debt that is never paid. The cost of transporting their supplies, coupled with poor road infrastructure, was also a concern for all.

When asked what types of infrastructure improvements they would like to see for markets the main answers were: (a) permanent walls vs. temporary walls for food stands; (b) a bigger market; (c) improvements in garbage collection; and (d) improvements to the immediate road infrastructure of the market and between the main market and outlying markets in the sub-county so they can provide supply to the smaller centers.

B. EFFECTS OF THE CORONAVIRUS PANDEMIC

Traders mentioned multiple effects of the coronavirus pandemic that have led to decreased profits. Lockdowns at times impacted their own market and at other times the locations of their wholesale supply. High prices in general also contributed to “customer burn-out”, along with fear of the disease which reduced the frequency of visits to the markets and the overall customer population. Food items “go bad” due to lack of customers and customers avoid buying vegetables as they are not fresh and “go bad” quickly, contributing to a circular chain of negative effects.

During Key Informant Interviews with Traders they were asked about the price (retrospectively during the year 2020) of 9 food items taken from the list of foods in the World Food Programme Minimum Expenditure Baskets.²⁹ All Traders commented that prices have gone up due to the coronavirus pandemic.

In response to the question “Has the coronavirus pandemic changed things at markets?” women in all focus groups mentioned higher prices of food items and lower prices for selling livestock. They noted limited or reduced availability of some food items (particularly vegetables) and reduced movement of goods that come from other parts of the country. Handwashing points, wearing of masks and “not touching foodstuffs” were common changes cited. Women also specifically mentioned “no interaction or socialization between buyer and

²⁹ Kenya Cash Working Group (July 2019). *Minimum Expenditure Basket: Interim Guidance Document, Kenya.*

seller” and “a deterioration of the relationship between buyer and seller”, along with a focus on crowd reduction and a lack of gatherings at markets.

The closure of markets or reduction of market days was a concern for all, while improvements in market hygiene were considered a positive effect. Another positive effect noted was reduced food expenses due to a reduction in the number of visitors to the home. In Central Agropastoral LZ there was mention of “the introduction of cashless payment”.

C. DESIRABLE FOODS NOT ALWAYS AVAILABLE AT MARKETS

In focus groups both adolescent mothers and older mothers were asked if there were foods they would like to buy but that were not often available at markets. In Central Agropastoral LZ women mentioned meat, lentils, green peas, potatoes, spaghetti, vegetables (kale, tomatoes, cabbage, Swiss chard and onions) and fruits (banana, mango, avocado and passionfruit). One group noted that vegetables are only available early in the morning. In Eastern Pastoral LZ, the same foods were mentioned plus fish, sweet potatoes and wheat flour.

One group in Central Agropastoral LZ mentioned chapattis as desirable and not often available but concerns about the hygiene of chapattis and other prepared foods at the market were also mentioned by mothers.

Two focus groups of mothers age 21 to 49 in Eastern Pastoral LZ (and one group in Central Agropastoral LZ, in Lpet-pet) stated there were no foods unavailable that they desired.

D. FOODS LESS AVAILABLE DUE TO CHANGING WEATHER

In focus groups both adolescent mothers and older mothers were asked if there were any desirable foods that are less available in the markets specifically due to changing weather patterns. The most frequent responses to this question were milk and dark green leafy vegetables (kale, solanum leaves, amaranth, cowpea leaves, Swiss chard).

Other food items also mentioned were: meat, sorghum, green peas, potatoes, pumpkin, beans and fruits (avocados, mangos). Responses were similar between livelihood zones, although one focus group in Eastern Pastoral LZ stated there were no foods less available due to changes in weather.

E. SOCIAL AND BEHAVIORAL CHANGE STRATEGY INPUT

Adolescent mothers were asked if there are “new foods” that younger people like to eat and that older people do not. Spaghetti (pasta) was mentioned by all, noting that it is “tasty”, “easy to cook”, “nutritious”, “enticing” and “modern”. As in Turkana County, in both livelihood zones in Samburu County it was also mentioned that older people claim it looks like worms and do not like to eat it. Several groups noted that older people do not know how to prepare wheat flour. In Central Agropastoral LZ, potatoes were specifically mentioned as being “soft”, “delicious” and “good for children”.

Adolescent mothers appear to have received some nutrition education as they mentioned the “vitamins” found in vegetables and chicken eggs.

So-called “junk foods” were not assessed during the Market Survey as the Cost of the Diet software would not choose to recommend these for a cost-efficient nutritious diet; however, during focus groups women were asked how often they purchased “sweets, snacks or drinks for your children or grandchildren”.

In East Pastoral LZ, all eight focus groups with women of both age ranges responded “once or twice a week” with a few individual women in two groups reporting only “once or twice a month”. In Central Agropastoral LZ, the response from three out of four focus groups in each age group of women was “once or twice a week” while the fourth response from both age groups was “once or twice a month”.

Unfortunately, similar to that found in the two COD studies done in Turkana County, there are many taboos against nutrient-dense foods for pregnant women in the two livelihood zones studied in Samburu County. The reason for their prohibition is that “they will make the baby grow big and cause complications during childbirth.”

Eggs, avocados, groundnuts, liver and milk diluted with water are the most frequent food items mentioned in East Pastoral LZ as taboo to consume during pregnancy. Beans are prohibited because they cause bloating. There are several prohibitions against milk from “other families” and also from cows with foot and mouth disease. Similar to Turkana County, there are prohibitions against eating meat from animals that are deceased but were not slaughtered.

Half of the focus groups with adolescent mothers in East Pastoral LZ said there were no foods prohibited during pregnancy.

In Central Agropastoral LZ, eggs and avocados were mentioned for the same reason, along with wheat flour, fruit and “snacks”. Beans are prohibited not only because they cause bloating but also because they will contribute to a large baby and complications during childbirth.

Women in focus groups were asked two different questions: “What foods are not permitted (taboo) for small children under age two?” and “What foods will children not eat even if mothers try to give to them?” It is not clear if focus group members differentiated between the two questions; combined responses are presented in Table 14 below. Specific taboos noted were for meat or offal from animals slaughtered during rituals – this is always taboo for children to eat.

TABLE 14. REASONS FOR NOT GIVING CERTAIN FOODS TO SMALL CHILDREN UNDER AGE TWO

FOOD ITEM CATEGORY	EAST PASTORAL LZ	REASON	CENTRAL AGROPASTORAL LZ	REASON
GRAINS	Maize grain	Hard to chew; causes indigestion	Maize grain	Hard to chew; causes stomachache
			Maize flour	Can cause itching in throat; difficult to swallow/chew
			Ujimix	Rough texture
BEANS	Beans	Causes stomach upset; causes bloating; causes diarrhea	Beans	Causes stomachache; causes diarrhea; causes constipation; causes rash for small babies
VEGETABLES	Kale	Hard to chew	Kale	Children dislike the taste

	Cooked cabbage	Children dislike the taste	Cabbage	Children dislike the taste / smell; difficult to chew
	Cowpea leaves	Bitter	Most vegetables	Hard to chew
EGGS	Eggs	Children vomit	Eggs	Causes high blood pressure
MEAT			Mutton	Some children are allergic (and some adults also)
			Meat	Children do not like the taste; difficult to chew
			Meat stock/soup	Too fatty
MILK			Milk	Children prefer breastmilk
FRUIT			Mangos	Sour
OTHER	Honey before teething	Causes illness		

Half of the focus groups among adolescent mothers and among mothers age 21 to 49 in East Pastoral LZ stated there were no foods taboo or not given to small children. As can be seen in Table 14, there were more specific food items mentioned as prohibited or not given to children in Central Agropastoral LZ, particularly in relation to meats.

VII. COST OF THE DIET STANDARD ANALYSES

The Cost of the Diet software uses the Market Survey information and Dietary Habits Interviews to calculate four standard analyses:

- **ENERGY ONLY (EO):** This diet meets only the recommended energy, or calorie, needs of an average family in each livelihood zone.
- **MACRONUTRIENTS:** This diet meets the recommended intakes for energy, protein and fat for an average family in each livelihood zone, but does not meet each individual’s micronutrient needs.
- **NUTRITIOUS DIET:** This diet meets the recommended intakes for energy, protein, fat and 13 micronutrients for every member of an average family in each livelihood zone by selecting the most cost-efficient nutrient-dense foods available, without taking into account household food preferences.
- **FOOD HABITS DIET:** This diet meets the recommended intakes for energy, protein, fat and 13 micronutrients of an average family but is based on typical dietary habits of households in each livelihood zone.

Based on HEA data, an average family size of 8 was entered for standard analyses for East Pastoral LZ and for Central Agropastoral LZ. The “standard family” in the COD software includes the following members:

TABLE 15. STANDARD FAMILIES FOR COST OF THE DIET ANALYSES FOR EAST PASTORAL AND CENTRAL AGROPASTORAL LIVELIHOOD ZONES, SAMBURU COUNTY

Eight family members	Age
Child, either sex	12 to 23 months
Child, either sex	6 to 7 years
Child, either sex	8 to 9 years
Child, either sex	10 to 11 years
Child, either sex	12 to 13 years
Child, either sex	14 to 15 years
Man, 50 kg, moderately active	30 to 59 years
Woman (lactating), 45 kg, moderately active	30 to 49 years

The COD software assumes that the CHILD AGE 12 -23 MONTHS is breastfeeding (and includes breast milk as a food item for that child in any standard analysis) and therefore that the WOMAN AGE 30 TO 49 YEARS is lactating.

A. COST OF THE DIET EAST PASTORAL LZ

Based on the Food List, the Market Survey and Dietary Habits Interviews in East Pastoral LZ looked at 87 food items in 12 food groups including: grains and grain-based products; roots and tubers; legumes, nuts and seeds; meat and offal; fish and seafood; eggs; milk and milk products; vegetables; fruits; oils and fats; sugars and confectionary; herbs, spices and condiments. Breast milk for the child age 12 to 23 months constituted the 88th food item in the database.

- **ENERGY ONLY DIET, EAST PASTORAL LZ**

The diet calculated by the COD software to meet only the energy needs for an average family in East Pastoral LZ would cost 269.14 KES (US\$2.49) daily or 98,235 KES (US\$509.58) annually. It includes four different foods selected from only two food groups: maize grain, maize flour and sorghum which are the cheapest among the food items in the GRAINS food group. BREASTMILK is the second food group and is apportioned only for the youngest child age 12 to 23 months.

- **MACRONUTRIENTS DIET, EAST PASTORAL LZ**

The diet calculated by the COD software to meet only the energy, protein and fat needs for an average family in East Pastoral LZ would cost 276.70 KES (US\$2.56) daily or 100,995 KES (US\$935.14) annually. It includes 5 foods from 3 food groups: Breastmilk; Maize grain, maize flour and sorghum (GRAINS similar to the Energy Only diet), plus the locally produced HYDROGENATED VEGETABLE OIL to meet the recommended levels of fats for all family members' diet.

This diet meets the caloric and fat needs for all household members. Although this diet exceeds the protein requirements for an average family in East Pastoral LZ, the needs for all ESSENTIAL AMINO ACIDS to form COMPLETE PROTEIN must be taken into consideration. Only animal source foods contain all essential amino acids, thus vegetarian diets need to mix food groups to “fill in” the essential amino acids missing from each food group. For example, the traditional combination of maize and beans provides complete protein through the lysine and tryptophan found in beans but lacking in maize and the methionine found in maize but lacking in

beans. As this Macronutrient Diet only contains grains and no beans or animal source foods, the protein would not be considered adequate for growth.

The standard analysis for the Macronutrients Diet also does not take into consideration the micronutrient needs of the family. It is lacking in eight important micronutrients: Vitamin B12, calcium, vitamin A, vitamin C, folic acid, pantothenic acid, iron and vitamin B2 (Table 16).

TABLE 16. PERCENT OF FAMILY’S MICRONUTRIENT NEEDS MET BY THE MACRONUTRIENTS DIET, EAST PASTORAL LZ

Vitamin A	Vitamin C	Vitamin B1	Vitamin B2	Niacin	Pantothenic Acid	Vitamin B6	Folic Acid	Vitamin B12	Calcium	Iron	Magnesium	Zinc
6.1	6.4	180.3	89.4	166.7	53.8	121.4	34.9	3.2	5.7	56.2	327.5	128.4

Among those micronutrients that this diet does not even provide half of the family’s needs are some that are extremely important. Vitamin B12 is critical for the formation of red blood cells and a lack leads to macrocytic (“pernicious”) anemia while a lack of iron, also needed to form red blood cells, causes microcytic anemia. Calcium is recognized for its role in bone growth and maintenance. Besides its role in night vision, vitamin A also has a role in strengthening the body’s defenses against respiratory disease. Vitamin C has several key roles in the body, including the repair of tissues. Folic acid contributes to a range of functions in the body, including the formation of red blood cells. Meeting folic acid requirements during pregnancy can help prevent neural tube birth defects and may have a role in preventing preterm birth.

- **NUTRITIOUS DIET, EAST PASTORAL LZ**

The diet calculated by the COD software to meet all of the macronutrient and micronutrient needs for an average family in East Pastoral LZ would cost 469.86 KES (US\$4.35) daily or 171,499 KES (US\$1,588) annually.

It includes 12 foods from 8 food groups. In addition to breastmilk for the child age 12-23 months, the foods chosen by food group are shown in Table 17. Note that unlike the Food Habits Diet (see below), the Nutritious Diet does not take into account existing family dietary habits.

TABLE 17. FOOD GROUPS AND FOOD ITEMS SELECTED FOR A NUTRITIOUS DIET IN THE EAST PASTORAL LZ

FOOD GROUP	FOOD ITEMS
GRAINS	Maize grain and maize flour for almost all family members. Wheat flour is only included for the lactating mother. Millet is exchanged for maize flour for children age 10 to 13, a period of rapid growth.
LEGUMES	Varied color beans and soybean milk curd for all family members.
MEATS AND OFFAL	Goat liver, for all family members with extra portions for the lactating mother.

FISH AND SEAFOOD	Dried freshwater fish for children age 10 to 11.
VEGETABLES	Two to four portions of acorn squash for all family members plus kale for children age 10 to 15 years.
FRUITS	Avocado for most family members.
OILS AND FATS	Hydrogenated vegetable oil for all family members.

Wheat flour in addition to maize flour is included for the lactating mother with high nutrient needs. Wheat is higher than maize in protein, niacin, pantothenic acid, folic acid and zinc. Millet flour, which is much higher in calcium than maize flour, is exchanged for maize for children age 10 to 13 which is a period of rapid growth. Dried freshwater fish, also high in calcium, is also added to the nutritious diet for a child age 10 to 11; it is not commonly eaten by the majority of households in East Pastoral LZ.

Soybean milk curd also is not consumed by most households in East Pastoral LZ; however it is chosen by the COD software for all family members for a nutritious cost-efficient diet. It provides most of the calcium, iron, zinc and folic acid requirements for all. Varied color beans are slightly cheaper than red beans in East Pastoral LZ which is why they are chosen by the COD software. Beans provide protein and iron, along with other micronutrients.

Goat liver is nutrient-dense food chosen for a nutritious diet for all family members (with extra portions allocated to the lactating mother with high nutrient needs) and which is consumed often by only one-third of households in East Pastoral LZ. It provides the majority of the family's vitamin B12 needs and a large portion of vitamin A needs, along with protein and other micronutrients.

It should be noted that most of the family's needs for vitamin C are met through the consumption of acorn squash. Kale is added to complete multiple micronutrient needs of children age 10 to 15 years during a period of rapid growth.

Hydrogenated vegetable oil, which is cheaper than liquid vegetable oil in East Pastoral LZ, is chosen to provide calorie-dense fat to the diet.

Table 18 shows that the challenge faced by the COD software to achieve 100% of all nutrition requirements for the family was due to challenges in reaching 100% of requirements for vitamin A, pantothenic acid, folic acid and calcium.

TABLE 18. PERCENT OF FAMILY'S MICRONUTRIENT NEEDS MET BY THE NUTRITIOUS DIET, EAST PASTORAL LZ

Vitamin A	Vitamin C	Vitamin B1	Vitamin B2	Niacin	Pantothenic Acid	Vitamin B6	Folic Acid	Vitamin B12	Calcium	Iron	Magnesium	Zinc
100.0	151.4	255.6	117.3	271.0	100.0	192.5	100.0	119.6	100.0	171.3	718.5	197.4

The high percentage of magnesium in this Nutritious Diet is not of concern (the COD software will NOT exceed the internationally-recognized upper limits of nutrient requirements). It comes predominantly from the maize and soybean milk curd food items. The human intestine can adjust to reduce the amount of a nutrient absorbed in the gut when there is an abundance regularly consumed. High doses of micronutrients are of concern when taking supplements as a large amount is taken in at one time rather than throughout the day so the body has less opportunity to reduce absorption.

- **FOOD HABITS DIET, EAST PASTORAL LZ**

The diet calculated by the COD software to meet all macronutrient and micronutrient needs for an average family in East Pastoral LZ while taking into account their typical dietary food patterns would cost 1,089.25 KES (US\$10.09) daily or 397,575 KES (US\$3,681) annually. THIS IS MUCH MORE THAN THE COST OF THE NUTRITIOUS DIET and the main reason for this is that the standard family includes a “child, either sex, age 14 to 15”. As the female child age 14 to 15 has very high micronutrient needs, especially for iron, the Food Habits Diet struggles to meet the IRON requirements which are best met through consumption of relatively expensive animal source foods (see additional COD analysis for the female adolescent in the next section).³⁰

The less costly Nutritious Diet attained the total iron requirements of the family predominantly through the inclusion of soybean milk curd in the diet, which is high in iron. Families in East Pastoral LZ do not often eat this food item. They also do not often consume goat meat, or any other meat, and do not consume dried freshwater fish (which was a source of many micronutrients for families in the COD analyses done for Fisheries LZ and Lodwar Urban LZ in Turkana County). These dietary habits limitations on animal-source foods made it difficult for the COD analysis for the Food Habits Diet meet the iron requirements of the family.

Based on Dietary Habits Interviews, the COD analysis cannot exceed two to three servings per day of red beans. As beans are a source of iron, the Food Habits Diet includes additional portions of green grams and varied color beans for several family members (including the smallest child age 12 to 23 months) and, in addition, lentils for the child age 14 to 15 and the lactating mother.

A chicken egg and chicken meat is allocated, along with a large portion of goat intestines/stomach, only for the child age 14 to 15 and the lactating mother and these food items contribute to the high daily cost (Table 19). Note that goat liver is not provided to the child age 14 to 15 as the diet already exceeds this child’s requirement for vitamin A and goat liver is very high in vitamin A. Powdered cow milk, which is a very cost-effective form of milk, is provided to almost all family members. Goat milk is higher than cow milk in vitamin A which is why it is only allocated as an additional milk-based food item for the child age 10 to 11 and the child age 12 to 13.

³⁰The female adolescent’s nutritional requirements for IRON are roughly three times that of the male, primarily due to menses and storage needs for future pregnancy. The COD software analyzes for the highest requirement when calculating for a child either sex.

TABLE 19. PORTIONS OF FOOD ITEMS PER FAMILY MEMBER (PLUS STABLE MAIZE), DAILY FOOD HABITS DIET, EAST PASTORAL LZ

Food Habits Diet, East Pastoral Livelihood Zone, Samburu County	Beans, red	Green grams	Lentils	Beans, varied color	Chicken meat	Goat intestines/stomach	Goat meat	Goat liver	Chicken egg	Milk, cow, powdered,	Milk, goat, fresh	Swiss chard	Cabbage	Green peas	Kale	Avocado	Tomatoes	Hydrogenated oil	Tomato paste,	Breast milk
Child (either sex) 12-23 months	2	1	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	1	0	1
Child (either sex) 6-7 years	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	1	0	1	0	0
Child (either sex) 8-9 years	1	0	0	1	0	0	0	1	0	1	0	0	0	0	1	1	0	1	0	0
Child (either sex) 10-11 years	2	1	0	1	0	0	1	1	0	1	1	1	0	0	1	1	0	1	0	0
Child (either sex) 12-13 years	3	1	0	1	0	0	0	1	0	1	1	0	0	0	1	1	0	1	0	0
Child (either sex) 14-15 years	2	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	2	1	1	0
Man, 30-59y, 50 kg, moderately active	0	0	0	1	0	0	0	1	0	1	0	0	0	0	1	1	0	1	0	0
Woman, lactating, 30-49y, 45 kg, moderately active	2	1	1	1	1	1	1	0	1	0	0	1	0	1	2	1	0	1	1	0

As powdered cow milk requires safe water for reconstitution, COD analysis was done again for the Food Habits Diet while eliminating powdered cow milk as an option. The analysis chose fresh cow milk for the adolescent age 14 to 15 years and increased the number of family members allocated fresh goat milk. The cost of the diet increases by a little over one percent to 1,101.11 KES (US\$10.20) daily and 401,904 KES (US\$3,721) annually.

Kale is allocated to all family members with an additional portion for the lactating mother and provides significant amounts of vitamin A, vitamin C, folic acid, calcium and iron to the diet.

Swiss chard, which cooks down to an easily consumable portion size (the COD analysis does not assign more food than can reasonably be ingested into the stomach), is allocated to the child age 12 to 23 months, the child 10 to 11 years, the child 14 to 15 years and the lactating mother, all of whom have additional micronutrient needs. Cabbage is also allocated to the child age 14 to 15 and green peas both to this child and to the lactating mother.

Tomatoes and canned tomato paste appear to be added to the Food Habits Diet as another way to provide some calcium and iron to the diet of the child age 14 to 15, with the Food Habits Diet just meeting 100% of that child's needs for these two nutrients. As the relatively expensive canned tomato paste was only allocated to the child age 14 to 15 and the lactating mother, a COD analysis was done eliminating the option of canned tomato paste. The cost was almost the same, with a greater portion of tomatoes assigned to the child age 14 to 15 and the lactating mother. Tomatoes were available in all markets; however, canned tomato paste has a good shelf life so both options are worth considering. Avocado, which is high in unsaturated fat and therefore calorie-dense, also provides contributions to almost all micronutrient needs.

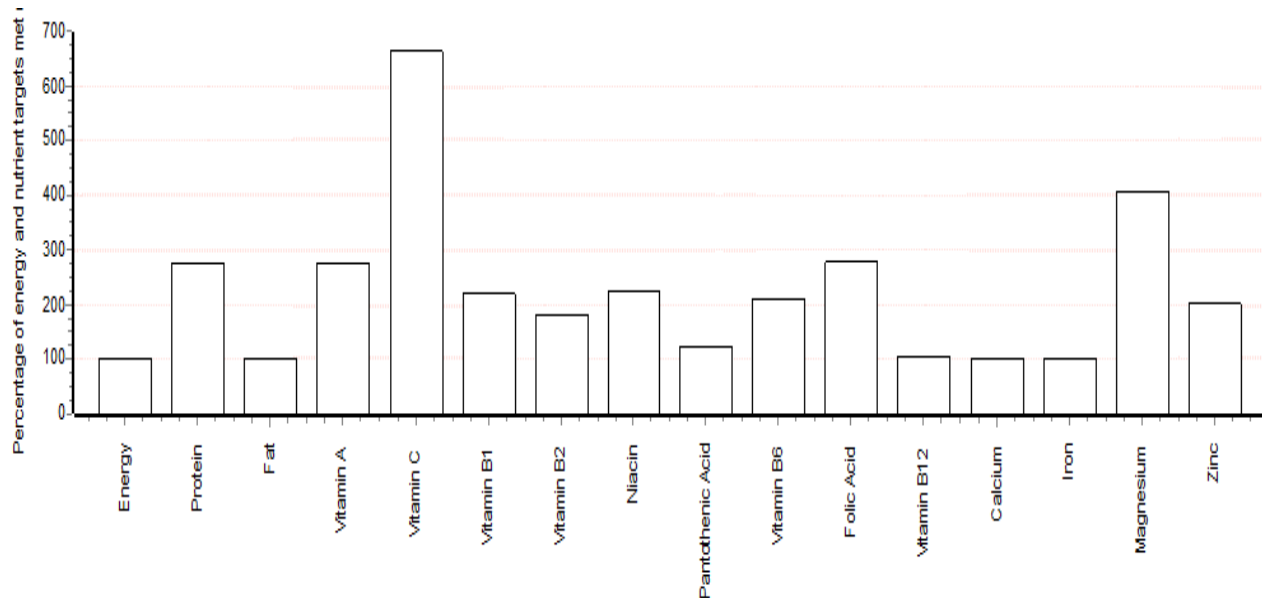
Like the Nutritious Diet, the Food Habits Diet includes maize grain, maize flour, wheat flour and millet (see above under Nutritious Diet for more discussion of nutrient contributions of each grain.)

Hydrogenated vegetable oil, which is cheaper than liquid vegetable oil in East Pastoral LZ and acceptable according to Dietary Habits, is chosen to provide calorie-dense fat to the diet.

Note that if the sex of the oldest child is changed from "either sex" to MALE age 14 to 15 in the standard family of eight COD analysis, the cost of the Food Habits Diet is reduced to 780.91 KES (US\$7.23) daily and 285,034 KES (US\$2,639) annually. **This is 28 percent lower** than the cost of the Food Habits Diet for a standard family of eight with the oldest child "either sex" age 14 to 15 where the COD analysis selects for the highest micronutrient needs between either a male and female. The female adolescent has high iron needs. (See more analysis of the cost of the diet for a pregnant or lactating female adolescent in the next section.)

All in all, the Food Habits Diet for the average family of eight in East Pastoral LZ includes 24 food items from 10 food groups including grains, legumes, meat and offal, eggs, milk and milk products, vegetables, fruits, oils and condiments (tomato paste), along with breast milk. Figure 3 below shows the percent of nutrient needs of the family met by the Food Habits Diet. The challenge faced in achieving 100% of micronutrient needs was due to the requirements for vitamin B12 (only from animal source foods), calcium and iron.

FIGURE 2. PERCENT OF FAMILY’S NUTRIENT NEEDS MET BY THE FOOD HABITS DIET, EAST PASTORAL LZ



As noted above, although protein needs are exceeded this is not all complete protein with the essential amino acids needed for growth and repair of the body. Complete protein comes from animal-source foods including goat meat, goat liver, goat intestines/stomach, chicken meat, chicken egg, and milk and/or the right combinations of complementary protein from non-animal-source foods. For more detail on the nutritional contribution of each food item see Annex G where the contribution of each food item is shown as the contribution to the entire family’s needs.

B. COST OF THE DIET ANALYSIS: COST BENEFIT OF BREAST MILK, EAST PASTORAL LZ

The Cost of the Diet software automatically assigns breast milk to the child age 12 to 23 months in any standard family, including the standard family of eight analyzed for East Pastoral LZ. It is impossible to override this element of the analysis. However, if we change the age of the child to 24 to 35 months we can get some idea of the additional cost of the diet for the family if breastfeeding is not continued, taking into account that the child age 24 to 35 months has an energy requirement 20% higher than the child age 12 to 23 months.

The cost of a Food Habits Diet for a family of eight with the youngest child age 24 to 35 months, not breastfeeding and mother not lactating in East Pastoral LZ is 1,184.47 KES (US\$10.97) daily and 432,330 KES (\$4,003) annually. As shown below, analysis of the dietary needs of lactating women show that nutritional needs are very high during this life period. Even with the reduction in cost to the family of food assigned to a mother who is no longer breastfeeding, the diet for a standard family with a NON-breastfeeding child is **34,755 KES (US\$322) more annually, or 8.7% more,** than the cost of a Food Habits Diet for a standard family of eight with a child age 12 to 23 months that is receiving continued breastfeeding. Even if this additional cost is reduced by 20% (the difference in caloric needs between the child age 12 to 23 months and the child age 24 to 35 months) this is still 27,804 KES (US\$257) more annually. The nutritional value of breast milk for infants and young children is well documented. This demonstrates the economic value to the household of continued breastfeeding for the child age 12 to 24 months.

C. COST OF THE DIET ANALYSES: FEMALE ADOLESCENTS, EAST PASTORAL LZ

Two different COD analyses were done to look at the increased nutritional needs of female adolescents: (a) comparing the cost of a diet for a pregnant adolescent 15 to 16 years of age to the cost for a pregnant woman age 30 to 49, last trimester of pregnancy for both, and (b) comparing the cost of the diet for a lactating adolescent mother age 15 to 16 to the cost for a lactating mother age 30-49, with infant age 7 to 12 months for both.

- **COST OF THE DIET ANALYSIS: PREGNANT ADOLESCENT COMPARED TO WOMAN AGE 30 TO 49**

COD Analysis of the daily nutrient needs and the cost of the Food Habits Diet for a **pregnant adolescent age 15 to 16 were compared to the needs of a pregnant woman age 30 to 49** in East Pastoral LZ. The analysis was done for the last trimester of pregnancy for both when nutrient needs are highest.

A nutritious Food Habits Diet for a pregnant adolescent mother age 15 to 16 costs **51 percent more** than that for a pregnant woman age 30 to 49:

- Pregnant adolescent age 15 to 16: 372.36 KES (US\$3.45) daily; 135,911 KES (US\$1,258) annually
- Pregnant woman age 30 to 49: 247.27 KES (US\$2.29) daily; 90,253 KES (US\$836) annually

To meet the micronutrient needs (particularly iron) of the pregnant women, relatively expensive animal-source food items are included in the diet (Table 20).

As also seen in Table 20, portion sizes for the pregnant adolescent are larger than those for the pregnant woman age 30 to 49 years for all food items except kale. In addition to powdered cow milk, fresh cow milk is chosen instead of the cheaper fresh goat milk for the pregnant female age 15 to 16 years. This is because, with the challenge to meet iron needs, the limits for vitamin A are reached for the pregnant adolescent. Kale is high in both in the iron which is needed and vitamin A, the need for which has been achieved through other food items in the diet. Cow milk is much lower in vitamin A than goat milk.

TABLE 20. COMPARISON OF DAILY QUANTITY IN GRAMS OF FOOD ITEMS, IN ADDITION TO STAPLE GRAINS, FOR A FOOD HABITS DIET FOR A PREGNANT ADOLESCENT AGE 15 TO 16 VERSUS A PREGNANT WOMAN AGE 30 TO 49 YEARS, EAST PASTORAL LZ

Food Habits Diet, East Pastoral Livelihood Zone, Samburu County	Beans, red	Green grams	Lentils	Beans, varied color	Chicken meat	Goat intestines/stomach	Goat meat	Chicken egg	Milk, cow, fresh	Milk, cow, powdered,	Swiss chard	Cabbage	Green peas	Kale	Avocado	Hydrogenated oil	Tomato paste, concentrated
Female age 15-16y, pregnancy, third trimester	125	62	47	62	47	78	47	125	65	41	296	25	203	252	94	8	3
Female age 30-49y, pregnancy, third trimester	115	58	43	58	43	72	43	115	0	1	274	0	35	441	86	3	3

Conversion of dry and liquid weights: 1 ounce = approximately 28 grams; 8 ounces = 1 cup; 16 ounces = 1 pound.

The Food Habits Diet for the standard family allocated to most family members goat liver as a cost-effective nutrient-dense food item. But, as goat liver is high in vitamin A, it is not chosen for the pregnant females. Rather, additional meat sources are included in the diet, such as chicken meat, chicken egg, and goat intestines/stomach. The pregnant adolescent is allocated 94 grams (3.4 ounces) of chicken and goat meat plus 78 grams (2.8 ounces) of goat intestines/stomach and two chicken eggs (125 grams).

With the Dietary Food Habits limits to the staple red (kidney) beans, multiple types of legumes are included in the diet to add micronutrients (particularly calcium and iron) similar to the Food Habits Diet for the standard family. The pregnant adolescent is allocated 296 grams (10.6 ounces) of red beans, green grams, lentils and varied color beans.

Similar to the diet for the standard family, canned tomato paste is added as another way to provide some calcium and iron to the diet. As noted for the Food Habits Diet for the standard family in East Pastoral LZ, although canned tomato paste is relatively expensive it has a good shelf life after purchase and is an option worth considering. If COD analysis is done eliminating canned tomato paste as an option, tomatoes are chosen and the cost of the diet increases.

As noted for the Food Habits Diet for the standard family, there is concern about accessing safe water to reconstitute powdered milk. Additional COD analysis was done of the cost of the diet for a pregnant adolescent

age 15 to 16 and a pregnant women age 30 to 49 to eliminate the option of powdered cow milk. Additional fresh cow milk is the replacement. As the powdered cow milk was primarily allocated to the pregnant adolescent, the cost of the diet increases by 2.9 percent for the pregnant adolescent [382.87 KES (US\$3.55) daily and 139,746 KES (US\$1,294) annually] while the increase for the pregnant woman age 30 to 49 is negligible.

- **COST OF THE DIET ANALYSIS: LACTATING ADOLESCENT COMPARED TO WOMAN AGE 30 TO 49**

COD Analysis of the daily nutrient needs and cost of the Food Habits Diet for a **lactating adolescent mother age 15 to 16 were compared to the needs of a lactating mother age 30 to 49**, both with a child 7 to 12 months of age in East Pastoral LZ.

A Food Habits Diet for an adolescent mother age 15 to 16 breastfeeding a child 7 to 12 months of age costs **42 percent more** than that for a breastfeeding mother age 30 to 49:

- Adolescent age 15 to 16 with lactation of a child 7 to 12 months of age: 357.26 KES (US\$3.31) daily; 130,399 KES (US\$1,207) annually
- Woman age 30 to 49 with lactation of a child 7 to 12 months of age: 251.49 KES (US\$2.33) daily; 91,793 KES (US\$850) annually

Protein needs are highest during the third trimester of pregnancy, but micronutrient needs are highest when breastfeeding a child between age 7 and 12 months. When balancing these needs and selecting the most cost-efficient yet acceptable Food Habits Diet based on Dietary Food Habits in East Pastoral LZ, the cost for the lactating adolescent is a bit lower than the cost during the third trimester of pregnancy.

For the lactating mother age 30 to 49 the cost is a bit higher than during the third trimester of pregnancy. However, what is important to note is that the cost of the diet for the adolescent is always higher than that for the mother age 30 to 49, whether during pregnancy or during continued breastfeeding.

The food items and quantities in grams chosen for both the breastfeeding adolescent and the mother age 30 to 49 are almost identical to the food items and quantities in grams chosen by COD analysis for the diet during the third trimester of pregnancy (Table 21).

As seen in Table 21, fresh cow milk and cabbage, which were allocated only to the adolescent during pregnancy, is not chosen for the diet during lactation and this is primarily what slightly reduces the cost of the diet. For the breastfeeding mother age 30 to 49, a larger quantity of green peas is allocated, which makes the cost of the diet slightly higher than that during pregnancy.

TABLE 21. COMPARISON OF DAILY QUANTITY IN GRAMS OF FOOD ITEMS, IN ADDITION TO STAPLE GRAINS, FOR A FOOD HABITS DIET FOR A LACTATING ADOLESCENT AGE 15 TO 16 VERSUS A LACTATING WOMAN AGE 30 TO 49 YEARS, EAST PASTORAL LZ

Food Habits Diet, East Pastoral Livelihood Zone, Samburu County	Beans, red	Green grams	Lentils	Beans, varied color	Chicken meat	Goat intestines/stomach	Goat meat	Chicken egg	Milk, cow, powdered,	Swiss chard	Green peas	Kale	Avocado	Hydrogenated oil	Tomato paste,
Female age 15-16 years, lactation of 7-12 month child	125	62	47	62	47	78	47	125	28	296	194	262	94	12	3
Female age 30-49 years, lactation of 7-12 month child	115	58	43	58	43	72	43	115	0	274	44	433	86	3	3

Conversion of dry and liquid weights: 1 ounce = approximately 28 grams; 8 ounces = 1 cup; 16 ounces = 1 pound.

COD analysis was repeated, eliminating the option of powdered cow milk due to concerns about accessing safe water for reconstitution. Additional fresh cow milk is the replacement. As the powdered cow milk was primarily allocated to the pregnant adolescent, the cost of the diet increases by 1.8 percent for the lactating adolescent [363.76 KES (US\$3.37) daily and 132,772 KES (US\$1,229) annually] while there is no increase for the lactating woman age 30 to 49.

D. COST OF THE DIET STANDARD ANALYSES, CENTRAL AGROPASTORAL LZ

Based on the Food List, the Market Survey and Dietary Habits Interviews in Central Agropastoral LZ looked at 91 food items in 12 food groups including: grains and grain-based products; roots and tubers; legumes, nuts and seeds; meat and offal (four more food items -- beef and beef offal -- were added to the food list used for East Pastoral LZ); fish and seafood; eggs; milk and milk products; vegetables; fruits; oils and fats; sugars and confectionary; herbs, spices and condiments. Breastmilk for the child age 12 to 23 months is the 92nd food item.

- **ENERGY ONLY DIET, CENTRAL AGROPASTORAL LZ**

The diet calculated by the COD software to meet only the energy needs for an average family in Central Agropastoral LZ would cost 209.14 KES (US\$1.94) daily or 76,335 KES (US\$706.81) annually. It includes four different foods selected from only two food groups: maize grain and maize flour with the addition of wheat flour only for the lactating mother, with these food items all in the GRAINS food group. BREASTMILK is the

second food group and is apportioned to the youngest child age 12 to 23 months. In East Pastoral LZ, sorghum was added to maize grain and maize flour for the Energy Only Diet. It was the third cheapest grain available and was reported as consumed by families. In Central Agropastoral LZ, wheat flour is the third cheapest grain available, while sorghum is relatively expensive and was not reported as consumed by families.

- **MACRONUTRIENTS DIET, CENTRAL AGROPASTORAL LZ**

The diet calculated by the COD software to meet only the energy, protein and fat needs for an average family in Central Agropastoral LZ would cost 233.30 KES (US\$2.16) daily or 85,155 KES (US\$78.47) annually. It includes 5 foods from 3 food groups. Maize grain, maize flour and wheat flour (GRAINS similar to the Energy Only diet) are included, however the amount of maize flour is reduced and red beans (LEGUMES) are added to meet protein levels in a cost-efficient manner. The locally produced HYDROGENATED VEGETABLE OIL is added to the diet to meet the recommended levels of fats for all family members.

This diet meets the caloric and fat needs for all household members. Although this diet (and the Energy Only Diet) exceed the protein requirements for an average family in Central Agropastoral LZ, the needs for all ESSENTIAL AMINO ACIDS to form COMPLETE PROTEIN must be taken into consideration. Only animal source foods contain all essential amino acids, thus vegetarian diets need to mix food groups to “fill in” the essential amino acids missing from each food group. This Macronutrient Diet accomplishes this by including legumes and grains together.

The standard analysis for the Macronutrients Diet also does not take into consideration the micronutrient needs of the family. It is lacking in eight important micronutrients: Vitamin B12, calcium, vitamin A, vitamin C, folic acid, pantothenic acid, iron and vitamin B2 (Table 22).

TABLE 22. PERCENT OF FAMILY’S MICRONUTRIENT NEEDS MET BY THE MACRONUTRIENTS DIET, CENTRAL AGROPASTORAL LZ

Vitamin A	Vitamin C	Vitamin B1	Vitamin B2	Niacin	Pantothenic acid	Vitamin B6	Folic acid	Vitamin B12	Calcium	Iron	Magnesium	Zinc
5.8	6.5	187.0	95.1	167.4	49.1	127.7	37.4	3.2	5.0	55.0	343.1	134.6

Among those micronutrients that this diet does not provide roughly half of the family’s needs are some extremely important micronutrients. Vitamin B12 is critical for the formation of red blood cells and a lack leads to macrocytic (“pernicious”) anemia while a lack of iron, also needed to form red blood cells, causes microcytic anemia. Calcium is well-recognized for its role in bone growth and maintenance. Besides its role in night vision, vitamin A also has a role in strengthening the body’s defenses against respiratory disease. Vitamin C has several key roles in the body, including the repair of tissues. Folic acid contributes to a range of functions in the body, including the formation of red blood cells. Meeting folic acid requirements during pregnancy can help to prevent neural tube birth defects and may also have a role in preventing preterm birth. Pantothenic acid is integral to multiple metabolic functions.

- **NUTRITIOUS DIET, CENTRAL AGROPASTORAL LZ**

The diet calculated by the COD software to meet all of the macronutrient and micronutrient needs for an average family in Central Agropastoral LZ would cost 649.22 KES (US\$6.01) daily or 236,964 KES (US\$2,194) annually.

It includes 13 foods from seven food groups. In addition to breastmilk for the child age 12-23 months, Table 23 shows the food chosen by food group.

TABLE 23. FOOD GROUPS AND FOOD ITEMS SELECTED FOR A NUTRITIOUS DIET IN THE CENTRAL AGROPASTORAL LZ

FOOD GROUP	FOOD ITEMS
GRAINS	A combination of maize grain, maize flour and wheat flour for all family members.
LEGUMES	Varied color beans for almost all family members with additional red beans and green grams for the child age 12 to 23 months, the child (either sex) age 14 to 15 years, and the lactating mother.
MEATS AND OFFAL	Goat liver, for all family members with a larger portion size for the lactating mother and the child (either sex) age 14 to 15 years. An additional portion of goat meat only for the child (either sex) age 14 to 15 years.
FISH AND SEAFOOD	Dried freshwater fish for all family members with additional servings for the child age 10 to 11, the child (either sex) age 14 to 15, and the lactating mother.
VEGETABLES	Kale for all family members except the child (either sex) age 14 to 15 who is apportioned a large serving of Swiss chard.
FRUITS	Avocado for most family members.
OILS AND FATS	Hydrogenated vegetable oil for all family members.

Note that unlike the Food Habits Diet (see below), the Nutritious Diet does not take into account existing family dietary habits. For this reason, goat liver and dried freshwater fish, which are rich in micronutrients, are apportioned to all family members, even though they are not reported as eaten by even one-third of households.

The nutritional requirement for iron for the child (either sex) age 14 to 15 years is high as the female adolescent has iron loss through menses and iron needs for storage for future pregnancies. For this reason goat meat is included in the diet of the child age 14 to 15 years. The female adolescent has high micronutrient needs in general and Swiss chard is assigned to this child while kale is apportioned to all other family members. Although kale is somewhat higher than Swiss chard in vitamins A and C, folic acid, calcium and zinc, the Swiss chard cooks down to a small volume and an extra-large portion size for the adolescent is assigned in this Nutritious Diet. The total volume for an individual's stomach to comfortably contain is also calculated into the Cost of the Diet analyses.

Varied color beans and red beans are close to the same price in Central Agropastoral LZ and both are apportioned to different family members. Beans provide protein and iron, along with other micronutrients.

Avocado has been chosen for every Nutritious Diet calculated during this learning period for the Nawiri Project, in both livelihood zones studied in Turkana County and now in both livelihood zones studied in Samburu County. It clearly is a nutrient-dense fruit and cost-efficient addition to the diet. In Turkana County, mention was made of women being frustrated at purchasing avocados only to find them to be rotten when cut open at home. This was not noted in Samburu County, but unfortunately avocado was noted in Samburu County and in Turkana County as a food item prohibited during pregnancy as it would add weight to the unborn child and cause “complications during childbirth”.

Hydrogenated vegetable oil, which is cheaper than liquid vegetable oil in Central Agropastoral LZ, is chosen to provide calorie-dense fat to the diet.

Table 24 shows that the challenge faced by the COD software to achieve 100% of all nutrition requirements for the family was due to challenges in reaching 100% of requirements for vitamin C, pantothenic acid and iron.

TABLE 24. PERCENT OF FAMILY’S MICRONUTRIENT NEEDS MET BY THE NUTRITIOUS DIET, CENTRAL AGROPASTORAL LZ

Vitamin A	Vitamin C	Vitamin B1	Vitamin B2	Niacin	Pantothenic acid	Vitamin B6	Folic acid	Vitamin B12	Calcium	Iron	Magnesium	Zinc
225.4	100.0	197.3	136.3	283.6	102.8	173.3	207.2	679.8	140.7	103.1	402.1	216.0

Although vitamin A requirements are exceeded, no individual’s allocation exceeds the limits of acceptable vitamin A consumption. However this amount of vitamin A would not be recommended on a daily basis as vitamin A is accumulated and stored in the body. As most of the vitamin A comes from the allocation of goat liver to all family members it is unlikely that this much vitamin A would be consumed every day. The high percentage of magnesium in this Nutritious Diet is not of concern (the COD software will NOT exceed the internationally-recognized upper limits of nutrient requirements). The human intestine can adjust to reduce the amount of many nutrients absorbed in the gut when there is an abundance regularly consumed. High doses of micronutrients are primarily only of concern when taking supplements as a large amount is taken in at one time rather than throughout the day so the body has less opportunity to reduce absorption.

- **FOOD HABITS DIET, CENTRAL AGROPASTORAL LZ**

The diet calculated by the COD software to meet all macronutrient and micronutrient needs for an average family in Central Agropastoral LZ while taking into account their typical dietary food patterns would cost 1,029.79 KES (US\$9.54) daily or 375,873 KES (US\$3,480) annually. As found for the Food Habits Diet in the East Pastoral LZ, this is roughly 150% of the cost of the Nutritious Diet calculated through COD analysis for the Central Agropastoral LZ. The main reason for this is that the child age 14 to 15 has very high micronutrient needs. The Food Habits Diet struggles to meet the adolescent’s iron and calcium requirements which are best

met through consumption of relatively expensive animal source foods (see additional COD analysis for the female adolescent in the next section).³¹

The less costly Nutritious Diet attained the total iron requirements of the family predominantly through the inclusion in the diet of all family members small dried freshwater fish which are high in iron and calcium (partly from the small bones of the fish which are easily consumed). Small dried freshwater fish are not included in the COD analysis for the Food Habits Diet as they are reported to NEVER be consumed by 91% of households in Central Agropastoral LZ.

Based on Dietary Habits Interviews, the COD analysis cannot exceed two to three servings per day of red beans. As beans are a source of iron, both the Nutritious Diet and the Food Habits Diet include red beans, varied color beans and green grams in the diet. To try to reach iron requirements, among other micronutrients, the Food Habits Diet also allocates lentils and green peas for the adolescent and additional lentils for the lactating mother (Table 25).

Among many important micronutrient contributions, animal-source foods is the only source of vitamin B12 and these add to the cost of the Food Habits Diet. The Food Habits Diet allocates beef, chicken meat, chicken egg, goat intestines/stomach and mutton to the adolescent and the lactating mother. The youngest child age 12 to 24 months is also allocated a serving of beef and a chicken egg. The other family members' needs for vitamin B12 are met through two servings of fresh cow milk, including the adolescent. Only the lactating mother and a few other family members, is assigned a serving of goat liver. Cow milk and goat meat or goat intestines/stomach are reported as frequently consumed by around two-thirds of households. Goat liver, beef and mutton are reported as frequently consumed by about one-third of households. The remainder of the animal-source foods in the Food Habits Diet are not reported as frequently eaten by many households so the Food Habits Diet assigns a singly serving of a variety of these meats rather than multiple servings of any one of these meats. It should be noted that in Central Agropastoral LZ fresh cow milk is slightly cheaper than goat milk.

³¹The female adolescent's nutritional requirements for IRON are roughly three times that of the male, primarily due to menses and storage needs for future pregnancy. The COD software analyzes for the highest requirement when calculating for a child either sex.

TABLE 25. PORTIONS OF FOOD ITEMS PER FAMILY MEMBER (PLUS STAPLE MAIZE), DAILY FOOD HABITS DIET, CENTRAL AGROPASTORAL LZ

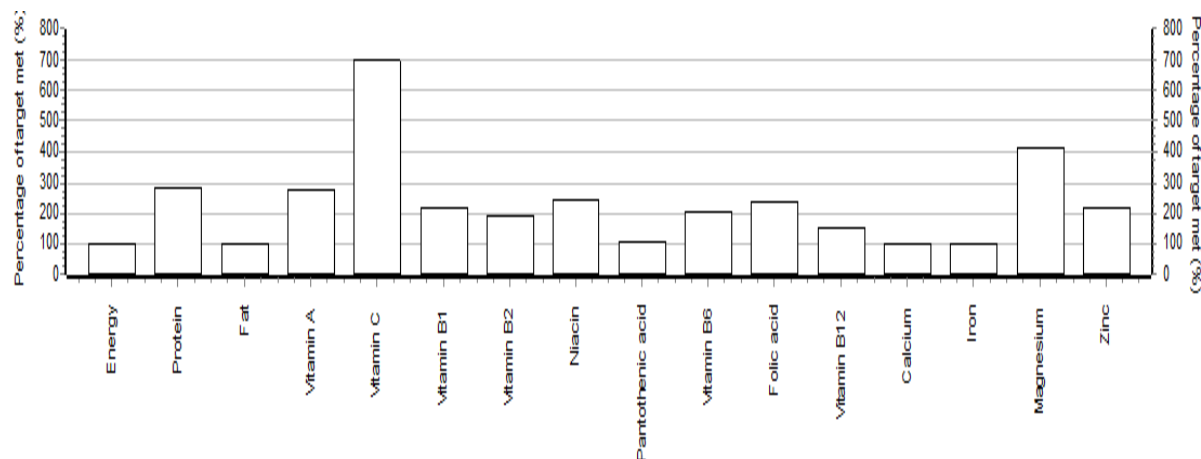
Food Habits Diet, Central Agropastoral Livelihood Zone, Samburu County	Beans, red	Green grams	Lentils	Beans, varied color	Beef meat	Chicken meat	Goat	Goat meat	Mutton	Goat liver	Chicken egg	Milk, cow, fresh	Swiss chard	Green peas	Kale	Avocado	Hydrogenated oil
Child (either sex) 12-23 mo.	1	1	0	1	0	0	0	1	0	0	1	0	0	0	2	0	1
Child (either sex) 6-7 years	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	2
Child (either sex) 8-9 years	1	0	0	1	0	0	0	0	0	1	0	2	0	0	1	1	2
Child (either sex) 10-11 y	1	1	0	1	0	0	0	0	0	0	1	2	0	0	1	0	2
Child (either sex) 12-13 y	1	1	0	1	0	0	0	0	0	0	1	2	0	0	1	0	2
Child (either sex) 14-15 y	1	1	1	1	1	1	1	1	1	0	1	2	1	1	1	0	1
Man, 30-59y, 50 kg, active moderately	0	0	0	0	0	0	0	0	0	1	0	1	0	0	2	1	1
Woman, 20-49y, lactating, 45 kg, active moderately	1	1	1	1	1	0	1	1	1	1	1	0	1	0	2	1	1

The Food Habits Diet allocates the staple maize as a grain and maize flour to all family members (maize flour only for the child age 12 to 23 months due to findings from focus group discussions). In addition, wheat flour is allocated to almost all family members along with one portion of commercial porridge mix (“Ujimix”) to several family members (child age 12 to 24 months, child age 6 to 7 years, child age 10 to 11 and child age 12 to 13).

Like the analysis for the Nutritious Diet, kale is allocated to family members and provides most of the requirements for vitamin A and vitamin C, along with some calcium, iron and zinc. The adolescent is allocated Swiss chard and green peas also while the lactating mother is allocated Swiss chard. Hydrogenated oil, the type of oil/fat reported as frequently consumed by the greatest number of households in Central Agropastoral LZ, meets the family members’ needs for fat in the diet, along with fat found in animal-source food items and in avocado.

Figure 4 shows the percent of nutrient needs of the family met by the Food Habits Diet. The challenge faced in achieving 100% of micronutrient needs was due to the requirements for calcium and iron.

FIGURE 3. PERCENT OF FAMILY’S NUTRIENT NEEDS MET BY THE FOOD HABITS DIET, CENTRAL AGROPASTORAL LZ



As noted previously, although protein needs are exceeded this is not all complete protein with the essential amino acids needed for growth and repair of the body. Complete protein comes from animal-source foods and/or the right combinations of complementary protein from non-animal-source foods. For more detail on the nutritional contribution of each food item see Annex H where the contribution of each food item is shown as the contribution to the entire family’s needs.

E. COST OF THE DIET ANALYSIS: COST BENEFIT OF BREAST MILK, CENTRAL AGROPASTORAL LZ

The Cost of the Diet software automatically assigns breast milk to the child age 12 to 23 months in any standard family, including the standard family of eight analyzed for Central Agropastoral LZ. It is impossible to override this element of the analysis. However, if we change the age of the child to 24 to 35 months we can get some idea of the additional cost of the diet for the family if breastfeeding is NOT continued, taking into account that the child age 24 to 35 months has an energy requirement 20% higher than the child age 12 to 23 months.

The cost of a Food Habits Diet for a family of eight with the youngest child age 24 to 35 months, not breastfeeding and mother not lactating in Central Agropastoral LZ is 1,127.00 KES daily and 411,354 KES annually. As shown below, analysis of the dietary needs of lactating mothers shows their nutritional needs are very high during this life period. Even with the reduction in cost to the family of food assigned to a mother who is no longer breastfeeding, the diet of a standard family with a NON-breastfeeding child is **35,481 KES (US\$329) more annually or 9.5% more** than the cost of a Food Habits Diet for a standard family of eight with a child age 12 to 23 months that is receiving continued breastfeeding. Even if this additional cost is reduced by 20% (the difference in caloric needs between the child age 12 to 23 months and the child age 24 to 35 months) this is still 28,385 KES (US\$263) more annually. The nutritional value of breast milk for infants and young children is well documented. This demonstrates the economic value to the household of continued breastfeeding for the child age 12 to 24 months.

F. COST OF THE DIET ANALYSES: FEMALE ADOLESCENTS, CENTRAL AGROPASTORAL LZ

Two different COD analyses were done to look at the increased nutritional needs of female adolescents: (a) comparing the cost of a diet for a pregnant adolescent 15 to 16 years of age to the cost for a pregnant woman age 30 to 49, last trimester of pregnancy for both, and (b) comparing the cost of the diet for a lactating adolescent mother age 15 to 16 to the cost for a lactating mother age 30-49, with infant age 7 to 12 months for both.

- **COST OF THE DIET ANALYSIS: PREGNANT ADOLESCENT COMPARED TO WOMAN AGE 30 TO 49**

COD Analysis of the daily nutrient needs and the cost of the Food Habits Diet for a **pregnant adolescent age 15 to 16 were compared to the needs of a pregnant woman age 30 to 49** in Central Agropastoral LZ. The analysis was done for the last trimester of pregnancy for both when nutrient needs are highest.

A nutritious Food Habits Diet for a pregnant adolescent mother age 15 to 16 costs **35 percent more** than that for a pregnant woman age 30 to 49:

- Pregnant adolescent age 15 to 16: 325.83 KES (US\$3.02) daily; 118,927 KES (US\$1,101) annually
- Pregnant woman age 30 to 49: 241.45 KES (US\$2.24) daily; 88,128 KES (US\$816) annually

To meet the micronutrient needs (particularly iron) of the pregnant women, relatively expensive animal-source food items are included in the diet (Table 26).

TABLE 26. COMPARISON OF DAILY QUANTITY IN GRAMS OF FOOD ITEMS, IN ADDITION TO STAPLE GRAINS, FOR A FOOD HABITS DIET FOR A PREGNANT ADOLESCENT AGE 15-16 VERSUS A PREGNANT WOMAN AGE 30-49 YEARS, CENTRAL AGROPASTORAL LZ

Food Habits Diet, Central Agropastoral Livelihood Zone, Samburu County	Beans, red	Green grams	Lentils	Beans, varied color	Beef meat	Chicken meat	Goat	Goat meat	Mutton	Chicken egg	Milk, cow, fresh	Swiss chard	Green peas	Kale	Hydrogenated oil
Female age 15-16 years, pregnancy, third trimester	62	62	47	62	47	47	78	47	47	125	499	296	3	269	11
Female age 30-49 years, pregnancy, third trimester	58	58	43	58	43	0	38	43	43	115	0	274	0	456	10

Conversion of dry and liquid weights: 1 ounce = approximately 28 grams; 8 ounces = 1 cup; 16 ounces = 1 pound.

As seen in Table 25, portion sizes for the pregnant adolescent are larger than those for the pregnant woman age 30 to 49 years for all food items except kale. The pregnant adolescent is also allocated chicken meat and a large quantity (499 grams, more than 2 cups) of fresh cow milk. For the pregnant adolescent a total of 233 grams (a bit more than 8 ounces or 0.5 pound) of red beans, green grams, lentils and varied color beans is allocated along with a total of 188 grams (almost 7 ounces) of beef, chicken, goat and mutton meat. In addition she is allocated 78 grams (2.8 ounces) of goat intestines/stomach and approximately two chicken eggs (125 grams).

As was found in the analysis for a pregnant adolescent and a pregnant woman age 30 to 49 years in East Pastoral LZ, the Food Habits Diet provides more than the daily requirement for vitamin A. For this reason, although goat liver was allocated for all family members in the Food Habits Diet for Central Agropastoral LZ, it is not assigned to the pregnant adolescent or woman age 30 to 49 years as it is high in vitamin A. Iron and calcium needs are met through multiple sources of legumes and animal-source foods. As the adolescent is allocated fresh cow milk, which also contains vitamin A, she is allocated less kale than the woman age 30 to 49 years.

• COST OF THE DIET ANALYSIS: LACTATING ADOLESCENT COMPARED TO WOMAN AGE 30 TO 49

COD Analysis of the daily nutrient needs and cost of the Food Habits Diet for a **lactating adolescent mother age 15 to 16 were compared to the needs of a lactating mother age 30 to 49**, both with a child 7 to 12 months of age in Central Agropastoral LZ.

A Food Habits Diet for an adolescent mother age 15 to 16 breastfeeding a child 7 to 12 months of age costs **30 percent more** than that for a breastfeeding mother age 30 to 49:

- Adolescent age 15 to 16 with lactation of a 7 to 12 month old child: 311.63 KES (US\$2.89) daily; 113,745 KES (US\$1,053) annually
- Woman age 30 to 49 with lactation of a 7 to 12 month old child: 238.72 KES (US\$2.21) daily; 87,132 KES (US\$807) annually

Protein and micronutrient needs are high during the third trimester of pregnancy and also when breastfeeding a child between age 7 and 12 months. Achieving these nutritional requirements in the most cost-efficient manner requires consumption of animal-source foods, even though these are generally more expensive than grains or legumes. The cost of the Food Habits Diet for a pregnant or a lactating adolescent age 15 to 16 or a woman age 30 to 49 are similarly high in Central Agropastoral LZ. However, what is important to note is that the cost of the diet for the adolescent is always higher than that for the mother age 30 to 49, whether during pregnancy or during continued breastfeeding.

The food items and quantities in grams chosen for both the breastfeeding adolescent and the mother age 30 to 49 are almost identical to the food items and quantities in grams chosen by COD analysis for the diet during the third trimester of pregnancy (Table 27).

TABLE 27. COMPARISON OF DAILY QUANTITY IN GRAMS OF FOOD ITEMS, IN ADDITION TO STAPLE GRAINS, FOR A FOOD HABITS DIET FOR A LACTATING ADOLESCENT AGE 15-16 VERSUS A LACTATING WOMAN AGE 30-49 YEARS, CENTRAL AGROPASTORAL LZ

Food Habits Diet, Central Agropastoral Livelihood Zone, Samburu County	Beans, red	Green grams	Lentils	Beans, varied color	Beef meat	Chicken meat	Goat intestines/stomach	Goat meat	Mutton	Goat liver	Chicken egg	Milk, cow, fresh	Swiss chard	Kale	Avocado	Hydrogenated oil
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Female age 15-16 years, lactation of 7-12 month old child	62	62	47	62	47	42	78	47	47	0	125	318	296	280	0	15
Female age 30-49 years, lactation of 7-12 month old child	58	58	43	58	43	0	44	43	43	3	115	0	274	357	8	9

Conversion of dry and liquid weights: 1 ounce = approximately 28 grams; 8 ounces = 1 cup; 16 ounces = 1 pound.

The Food Habits Diet for the lactating adolescent is very similar to that for the pregnant adolescent. The difference is that the quantity of fresh cow milk is reduced from 499 grams (more than 2 cups) per day to 318 grams (approximately 1-1/2 cups) per day and the amount of kale is increased while green peas is no longer included as a food item. For the lactating woman age 30 to 49, the Food Habits Diet is similar to that for pregnancy with the addition of a small amount of goat liver and avocado, along with the elimination of green peas. Both females still need significant amounts of legumes, meat and other animal-source foods.

VIII. MODELING INTERVENTIONS TO THE COST OF THE DIET

Using the COD software to model the impact on the cost of the diet of various activities is somewhat crude. Models cannot estimate the actual cost to the household of introducing any activity and the modeling output generally assumes that supported food items will be eaten by all family members every day. Few interventions can provide that much output. However, it does give an idea of the relative value, or reduction to the cost of the diet, of different options.

A. SUPPORT FOR GOAT MILK PRODUCTION

In East Pastoral LZ, fresh cow milk was slightly more expensive than fresh goat milk; in Central Agropastoral LZ, this was the opposite with fresh cow milk cheaper. COD analysis allocated powdered cow's milk to most family members for the Food Habits Diet in East Pastoral LZ and goat milk for the adolescent. In Central Agropastoral LZ, fresh cow milk was allocated to most family members.

Reducing the cost of goat milk to a negligible 1 KES decreases the cost of the Food Habits Diet in East Pastoral LZ by 144.56 KES (US\$1.34) daily and 52,765 KES (USE\$489) annually and in Central Agropastoral LZ by 162.43 KES (US\$1.50) daily and 59,288 (\$549) annually, with every family member receiving from 100 ml (one-third cup) for the youngest child to approximately 600 ml (more than two cups) for the oldest child.

Assuming this level of milk production might be difficult to achieve, if goat milk consumption is limited to the smallest child age 12 to 23 months and the lactating mother, the daily cost of the Food Habits Diet in East Pastoral LZ is reduced by 4.44 KES (US\$0.04) daily and 1,373 KES (US\$12.71) annually and in Central Agropastoral LZ by 4.43 KES (US\$0.04) daily and 615 KES (US\$5.69) annually.

Due to concerns about reconstituting powdered cow milk with safe water, the Food Habits Diet which allocated powdered cow milk to most family members was recalculated eliminating this option. The result was that goat milk was allocated to most family members and fresh cow milk to the adolescent. When using this dietary cost, reducing the cost of fresh goat milk to a negligible 1 KES decreases the cost of the Food Habits Diet in East Pastoral LZ only slightly more, by 148.82 KES (US\$1.38) daily and 54,317 KES (US\$503) annually.

Regardless of the savings to the cost of the diet, the nutritional contribution of a serving daily of fresh goat milk for the household is substantial.

B. SUPPORT FOR COW MILK PRODUCTION

Reducing the cost of cow milk to a negligible 1 KES decreases the cost of the Food Habits Diet in East Pastoral LZ by 68.63 KES (US\$0.64) daily and 25,050 KES (US\$232) annually. However, due to concerns about reconstituting powdered cow milk with safe water, the Food Habits Diet was recalculated eliminating this option and goat milk was allocated to most family members and fresh cow milk to the adolescent. When using this dietary cost, reducing the cost of fresh cow milk to a negligible 1 KES decreases the cost of the Food Habits Diet in East Pastoral LZ to a greater degree, by 93.09 KES (US\$0.86) daily and 33,978 KES (US\$315) annually.

As fresh cow milk was slightly cheaper than goat milk in Central Agropastoral LZ, the COD analysis allocated fresh cow milk to most family members. The reduction of the cost of cow milk to a negligible 1 KES decreases the cost of the Food Habits Diet in Central Agropastoral LZ by 157.28 KES (US\$1.46) daily and 57,407 KES (US\$532) annually. This is slightly less than the potential savings from support for goat milk production (see above).

Regardless of the savings to the cost of the diet, the nutritional contribution of a serving daily of fresh cow milk for the household is substantial.

C. SUPPORT FOR HOME GARDEN PRODUCTION OF DARK LEAFY GREENS

In East Pastoral LZ, kale, Swiss chard, cabbage and tomatoes were allocated to family members for a nutritious Food Habits Diet. In Central Agropastoral LZ, kale, Swiss chard and green peas were allocated for a nutritious Food Habits Diet.

COD analysis of support for home garden production of kale, Swiss chard and cabbage in East Pastoral LZ showed a reduction in the cost of the diet by 138.42 KES (US\$1.28) daily. The nutritious Food Habits Diet for East Pastoral LZ allocated tomatoes and concentrated tomato paste. If TOMATOES are added to the home garden production support the reduction in the cost of the diet is even greater at 171.34 KES (US\$1.59) daily, with tomatoes now allocated to almost all family members. If home garden production of dark leafy greens and tomatoes could be maintained throughout the year the savings could add up to 62,539 (US\$579) in East Pastoral LZ or approximately 16%. Additional support for production of amaranth and solanum (*sujaa/managu*) did not reduce the cost of the diet any further, primarily because the vegetables included (kale, Swiss chard, cabbage and tomatoes) provide similar nutrients.

COD analysis of support for home garden production of kale, Swiss chard and green peas in Central Agropastoral LZ showed a reduction in the cost of the diet by 296.68 KES (US\$2.75) daily. If home garden production could be maintained throughout the year the savings could add up to 108,287 KES (US\$1,003) in Central Agropastoral LZ or approximately 29%. It should be noted that green peas are a highly nutritious food item and the reduction in their cost from home garden support results in COD analysis allocating large portions of green peas to all family members. Similar to that found for East Pastoral LZ, additional support for production of amaranth and solanum did not reduce the cost of the diet any further.

D. SUPPORT FOR PRODUCTION OF ORANGE-FLESHED SWEET POTATO

Unfortunately, because the COD analysis for the Food Habits Diets for East Pastoral LZ and Central Agropastoral LZ struggles to reach the calcium and iron requirements for families with foods that are available and that align with families' broad food habits, the diets provide more than the required amount of vitamin A as

foods high in calcium and iron (e.g. animal-source foods, kale) are also quite high in vitamin A. Orange-fleshed sweet potato is quite high in vitamin A but not particularly high in calcium and iron, the limiting micronutrients in these diets.

Adding an option to include bio-fortified orange-fleshed sweet potato at a negligible cost of 1 KES daily does not reduce the cost of the diet in East Pastoral LZ and reduces the cost of the diet in Central Agropastoral LZ by 5.28 KES (US\$0.05) daily and 1,926 KES (US\$17.83) annually.

The promotion of orange-fleshed sweet potato and its provision of calories and vitamin A to the diet can be a positive contribution in East Pastoral LZ and Central Agropastoral LZ in Samburu County as it is unlikely that many families will provide the amount of animal-source foods and kale or Swiss chard to all family members as is allocated in the Food Habits Diets for both livelihood zones and therefore vitamin A may be lacking in the typical diet at present. It should be noted that kale (*Sukuma*) has been chosen by COD analysis for every one of the four livelihood zones studied during this period (Fisheries LZ and Lodwar Urban LZ in Turkana County and East Pastoral LZ and Central Agropastoral LZ in Samburu County) and fills much of the vitamin A requirement for families. Orange-fleshed sweet potato may be a good option if it can be harvested at periods when kale is not available. In addition, cooked orange-fleshed sweet potato is soft and easily consumed by infants and young children age 6 to 23 months and can be an important food item during the complementary feeding period.

E. VITAMIN A SUPPLEMENTATION

Kenya has a longstanding vitamin A supplementation (VAS) program for children 6 to 59 months of age and for mothers in the immediate post-partum period. However, recent SMART Survey in 2019 found only 30% of children age 12 to 59 months in Samburu County to have received at least two vitamin A supplements.

The Food Habits Diet for East Pastoral LZ allocates goat meat, Swiss chard and kale to the child age 12 to 23 months, and all are sources of vitamin A. In Central Agropastoral LZ goat meat, chicken egg and kale are allocated to the child age 12 to 59 months and all are sources of vitamin A. In both livelihood zones, the Food Habits Diet exceeds the child's vitamin A requirements. Modeling for VAS does not result in a reduction in the cost of the diet in East Pastoral LZ; in Central Agropastoral LZ the cost of the diet is reduced by 3.25 KES (US\$0.03) daily and 1,186 KES (US\$10.98) annually.

The Food Habits Diet is an ideal diet which it may not be consumed at present by the child age 12 to 23 months, so VAS is likely to be an important contribution to a child's nutritional status. The importance of vitamin A for healthy growth and development of children underscores the value of a well-functioning VAS program.

F. COMBINING MODELING OPTIONS

The COD software was used to look at the impact on the cost of the Food Habits Diet if households received support from a combination of the options available.

For East Pastoral LZ this included having the child age 12 to 23 months receive VAS and the entire family benefit from support for goat milk production and home gardens with dark leafy greens (kale, Swiss chard and cabbage), tomatoes and orange-fleshed sweet potato. For the average family of eight with these combined options the cost of the Food Habits Diet in East Pastoral LZ is reduced by 282.10 KES (US\$2.61) daily or 102,965 KES (US\$953) annually, **a savings of 26 percent of the cost of the diet.**

For Central Agropastoral LZ this included having the child age 12 to 23 months receive VAS and the entire family benefit from support for goat milk production and home gardens with dark leafy greens (kale and Swiss chard), green peas and orange-fleshed sweet potato. For the average family of eight with these combined

options the cost of the Food Habits Diet in Central Agropastoral LZ is reduced by 411.70 KES (US\$3.81) daily or 150,269 KES (US\$1,391) annually, **a savings of 40 percent of the cost of the diet.**

VIII. DISCUSSION OF FINDINGS FROM THE STUDIES

A. AVAILABILITY OF A NUTRITIOUS DIET

The COD analysis has shown that families in **East Pastoral LZ** can meet their nutritional needs with foods that are available in the markets. Among important categories of nutrient-dense food items, meat other than goat meat (i.e. goat liver and chicken) and cow milk (both fresh and powdered) had limited availability that would affect the ability of families to meet their nutritional needs. Particularly, goat liver was chosen by COD analysis for almost all family members and was only found in one of six markets. For the higher needs of the adolescent child age 14 to 15 and the lactating mother, chicken meat was chosen (to avoid the high vitamin A content of goat liver due to the high vitamin A content of the diet overall) and was only found in one of six markets. Although goat milk is sold door-to-door and was included in the COD analysis, the analysis chose powdered cow milk for almost all family members as a cost-effective food item and it was only found in two of six markets. As noted previously, powdered milk would either need to be reconstituted with safe drinking water or added dry to cooked wet porridges or stews.

The COD analysis added chicken eggs to the diet for the adolescent child and lactating mother and these were available in five of six markets. For the Nutritious Diet in East Pastoral LZ, the COD software selected soybean milk curd. This was only found in one market.

Due to Daily Food Habits limits on meat consumption and consumption of red beans, other legumes including varied color beans, green grams and lentils were included in the diet. Red beans and varied color beans were available in almost all markets, followed by green grams in four of six markets. Lentils, which were allocated to the adolescent child and lactating mother, could be a concern as they were only available in three of six markets in East Pastoral LZ.

The COD analysis assigned kale to almost all family members and allocated cabbage, Swiss chard, and green peas specifically to the adolescent child and lactating mother. Cabbage and kale were available in almost all markets; however, Swiss chard was only available in three and green peas only in two of six markets.

Solanum leaves were not found for sale in any market in East Pastoral LZ, however they were mentioned in focus groups as an important wild food that is gathered when rain facilitates its growth. Solanum leaves were available in a few markets and selected by the COD software for nutritious diets in the COD analysis done for Fisheries LZ and Lodwar Urban LZ in Turkana County. As wild foods are “free”, their gathering for consumption should be promoted.

Avocado, tomato and canned tomato paste concentrate were the only fruits chosen by the COD analysis of the Food Habits Diet. Avocado was allocated to all family members except the smallest child age 12 to 23 months and provides a significant amount of calorie-dense fat and other micronutrients including folic acid and iron. It was found in two of six markets. Tomato was allocated only to the child age 14 to 15 and was found in all six markets. Even though relatively expensive, canned tomato paste is nutrient-dense as it is concentrated. It was allocated to the child age 14 to 15 and to the lactating mother and was for sale in four of six markets. Both tomato and tomato paste provide small additional amounts of calcium and iron to the diet. As noted previously, tomatoes are cheaper than canned tomato paste but canned tomato paste has a good shelf life after purchase so both food items are worth consideration.

Based on Dietary Habits, the Food Habits Diet achieves the family's nutritional needs but results in slightly excess vitamin A for the child of either sex age 15 to 16. If families could afford more animal source foods the adolescent's high need for iron (and other key micronutrients) could be met without consuming as much kale or Swiss chard, which are both quite high in vitamin A and other key micronutrients.

The limited availability of some key nutrient-dense foods – particularly lentils, chicken meat, cow milk (fresh and powdered), Swiss chard, green peas and avocado -- would be of concern for achieving a nutritious diet for a pregnant adolescent, a pregnant women, a lactating adolescent or a lactating mother in East Pastoral LZ.

COD analysis has shown that families in **Central Agropastoral LZ** can meet their nutritional needs with foods that are available in the markets. Among important categories of nutrient-dense food items, goat meat, goat intestines/stomach and goat liver were available in four or five of the six markets surveyed. Beef meat and mutton were allocated to the adolescent and the breastfeeding mother, while chicken was also allocated to the adolescent and these were only found in one or two markets.

The Food Habits Diet allocated chicken eggs to all family members and were found for sale in every market surveyed. Fresh cow milk, however, was also allocated to every family member but was only found in two markets. Approximately two servings of fresh cow milk was allocated to a nutritious diet for a pregnant or lactating adolescent. **The lack of access to fresh cow milk could be a severely limiting factor for a pregnant or lactating adolescent.** Fresh cow milk was cheaper than goat's milk in Central Agropastoral LZ; however, goat milk was also said to be sold door-to-door in many communities. UHT cow milk was widely available in all markets at a cost almost double that of fresh cow milk.

A variety of legumes were available in almost all markets including red beans, varied color beans, green grams and lentils.

Soybean milk curd, an important nutrient-dense food item selected for the Nutritious Diet for East Pastoral LZ, was not found in any market in Central Agropastoral LZ and was not reported as eaten by very many households.

The COD analysis assigned kale to almost all family members and allocated Swiss chard specifically to the adolescent child and lactating mother, along with green peas specifically for the adolescent child. Kale was for sale in four out of six markets in Central Agropastoral LZ while Swiss chard was found in three. Green peas were only found in one of the larger markets in Maralal. Women in focus groups in Central Agropastoral LZ specifically mentioned green peas as being a desirable food item that was not often available. Half of the markets had from four to six types of vegetables that could possibly substitute for Swiss chard or green peas in the diet at a higher cost. Avocado was the only fruit selected and it was allocated to several family members and to a lactating woman age 30 to 49 years. All six markets surveyed had avocados for sale.

Based on Dietary Habits, the Food Habits Diet achieves the family's nutritional needs but results in about three times the amount of vitamin A required by all family members combined. If families could afford more animal source foods their needs for iron (and other key micronutrients) could be met without consuming as much kale or Swiss chard, which are both quite high in vitamin A and other key micronutrients. The limited availability of some key nutrient-dense foods – beef, chicken, fresh cow milk, Swiss chard and green peas -- would be of concern for achieving a nutritious diet for a pregnant adolescent, a pregnant women, a lactating adolescent/mother in East Pastoral LZ.

B. AFFORDABILITY OF A NUTRITIOUS DIET

It was notable that most food item prices were higher in East Pastoral LZ than in Central Agropastoral LZ although some nutrient-dense food items were cheaper, such as goat meat (10.1 KES less), fresh goat milk (1.0 KES less) and chicken eggs (2.1KES less).

In East Pastoral LZ the “cost” of the diet cannot be met by the Very Poor or Poor wealth groups. As seen in Table 28, the “gap” between income available for food purchase and the cost of a nutritious Food Habits Diet in East Pastoral LZ is 261,966 KES (US\$2,426) annually or 21,831 KES (US\$202) monthly for the Very Poor and 195,235 KES (US\$1,808) annually or 16,270 KES (US\$151) monthly for the Poor. There is no gap for the Middle wealth group.

TABLE 28. GAP BETWEEN HOUSEHOLD INCOME AVAILABLE FOR FOOD PURCHASE AND THE COST OF A NUTRITIOUS FOOD HABITS DIET IN EAST PASTORAL LZ

SAMBURU COUNTY EAST PASTORAL LIVELIHOOD ZONE	WEALTH GROUPS		
	VERY POOR	POOR	MIDDLE
Total Annual Income available for nutritious diet 2021 (KES)	135,609	202,340	411,534
Annual Cost of the Food Habits Diet 2021 (KES)	397,575	397,575	397,575
Annual GAP in Kenya Shillings	261,966	195,235	No gap
Annual GAP in US Dollars (US\$1 = 108 KES)	2,426	1,808	No gap
Monthly GAP in Kenya Shillings	21,831	16,270	No gap
Monthly GAP in US Dollars (US\$1 = 108 KES)	202	151	No gap

It is worth noting that the cost of a Nutritious Diet calculated by the COD software for a standard family in East Pastoral LZ (and which does not take into account Dietary Habits) is 171,499 KES (\$1,588) annually which is much less than the cost of the Food Habits Diet (397,575 KES/US\$3,681 annually). The reduced cost as compared to the Food Habits Diet is due to the Nutritious Diet meeting many of the family’s nutrient needs through consumption of soybean milk curd and dried freshwater fish (which are not consumed by many families and therefore not selected for the Food Habits Diet). The Nutritious Diet also allocates a greater amount of goat liver for all family members (which is reported as “rarely” or “never” consumed by roughly 65% of households). Families could achieve a nutritious Food Habits Diet at a lesser cost if they began to include these food items more regularly into their dietary habits.³²

In Central Agropastoral LZ the “cost” of the diet also cannot be met by any of the wealth groups in the study. As seen in Table 29, the “gap” between income available for food purchase and the cost of a nutritious Food Habits Diet in Central Agropastoral LZ is 252,927 KES (US\$2,342) annually or 21,077 KES (US\$195) monthly for the Very Poor, 239,038 KES (US\$2,213) annually or 19,920 KES (US\$184) monthly for the Poor, and 123,086 KES (US\$1,140) annually or 10,257 KES (US\$95) monthly for the Middle wealth group.

³² COD software also chooses acorn squash for a Nutritious Diet; however, squashes vary widely in their actual nutrient content depending upon their maturity and water content.

TABLE 29. GAP BETWEEN HOUSEHOLD INCOME AVAILABLE FOR FOOD PURCHASE AND THE COST OF A NUTRITIOUS FOOD HABITS DIET IN CENTRAL AGROPASTORAL LZ

SAMBURU COUNTY CENTRAL AGROPASTORAL LIVELIHOOD ZONE	WEALTH GROUPS		
	VERY POOR	POOR	MIDDLE
Total Annual Income available for nutritious diet 2021 (KES)	122946	136835	252787
Annual Cost of the Food Habits Diet 2021 (KES)	375873	375873	375873
Annual GAP in Kenya Shillings	252927	239038	123086
Annual GAP in US Dollars (US\$1 = 108 KES)	2342	2213	1140
Monthly GAP in Kenya Shillings	21077	19920	10257
Monthly GAP in US Dollars (US\$1 = 108 KES)	195	184	95

It is worth noting that the cost of a Nutritious Diet calculated by the COD software for a standard family in Central Agropastoral LZ (and which does not take into account Dietary Habits) is 236,964 KES (\$2,194) annually which is much less than the cost of the Food Habits Diet (375,873 KES/US\$3,480 annually) and which could be met by the Middle wealth group. The reduced cost as compared to the Food Habits Diet is due to the Nutritious Diet meeting many of the family’s nutrient needs through consumption of dried freshwater fish (which are not consumed by many households and therefore not selected for the Food Habits Diet), goat liver for all family members (which is reported as “rarely” or “never” eaten by 68% of households). Families could achieve a nutritious Food Habits Diet at a lesser cost if they began to include these food items more regularly into their dietary habits.

In addition to analyzing the affordability of a nutritious diet for the entire household, the COD software also provides information on the cost of the diet for each family member. Table 30 shows that the cost of the diet for the child age 12 to 23 months, who is receiving a good deal of nourishment from breastmilk, is only 3.0% of the total cost for the family in East Pastoral LZ and 3.8% in Central Agropastoral LZ. The food items specifically allocated to this child in both livelihood zones are relatively available in both livelihood zones. The challenge might be to change infant and young child feeding habits so that the most nutritious food items are regularly included in this child’s diet.

TABLE 30. DAILY COST OF THE FOOD HABITS DIET FOR INDIVIDUAL FAMILY MEMBERS

FAMILY MEMBERS	East Pastoral LZ			Central Agropastoral LZ		
	Individual cost		% of total family cost	Individual cost		% of total family cost
	KES	US\$		KES	US\$	
Child, either sex, age 12-23 months	32.70	0.30	3.0%	39.43	0.37	3.8%
Child, either sex, age 6 to 7 years	49.06	0.46	4.5%	48.10	0.44	4.7%
Child, either sex, age 8 to 9 years	61.84	0.57	5.7%	60.93	0.56	5.9%
Child, either sex, age 10 to 11 years	105.49	0.98	9.7%	115.02	1.06	11.2%

Child, either sex, age 12 to 13 years	97.12	0.90	8.9%	99.90	0.93	9.7%
Child, either sex, age 14 to 15 years	407.90	3.78	37.4%	347.23	3.22	33.7%
Man, 50 kg, moderately active	83.63	0.77	7.7%	80.46	0.75	7.8%
Woman (lactating), 45 kg, moderately active	251.49	2.33	23.1%	238.72	2.21	23.2%
TOTAL	1,089.25	10.09	100.0%	1,029.79	9.54	100.0%

Table 30 shows that the cost of the diet for the child “either sex” age 14 to 15 years is the highest portion of the cost of the diet for the entire household at 37.4% in East Pastoral LZ and 33.7% in Central Agropastoral LZ, followed by the lactating mother at 23.1% in East Pastoral LZ and 23.2% in Central Agropastoral LZ.

This proportionally high cost, the limited availability of some of the nutrient-dense food items allocated to the child age 14 to 15 and the lactating mother, and the existing typical dietary food habits for these two family members are all a challenge to achieve a nutritious diet.

COD analysis automatically allocates breast milk to the youngest child age 12 to 23 months. COD analysis was done to see the effect on the cost of the diet of NOT continuing breastfeeding. **It should be noted that analysis of the cost-benefits of continued breastfeeding show that the investment in a nutritious diet for the lactating mother is more cost-efficient than discontinuing breastfeeding.**

As noted in the analysis for a pregnant or lactating adolescent age 15 to 16 years, the relative cost of the diet is even higher than for the pregnant or lactating mother age 30 to 49 and therefore cost and limited availability of some of the key nutrient-dense food items are a challenge for the pregnant or lactating adolescent. (See below for more on social and behavioral change.)

It is important to remember that the COD analysis is not specifically a menu planner. It calculates whether all the nutritional requirements of a family can be met with the food items that are available in markets and chooses which food items meet these requirements on a daily basis at the lowest cost. This information is then extrapolated to a weekly, monthly and annual cost. For example, for East Pastoral LZ both the Nutritious Diet and the Food Habits Diet identify avocado as a cost-effective source of needed nutrients but it would not be likely that every family member would be able to eat an avocado every day of the week. However, this information tells us that avocados are nutrient-dense, worth purchasing and worth supporting through market-based or agricultural interventions. The other food items selected for both the Nutritious Diet and the Food Habits Diet provide similar information.

C. FINDINGS FROM DIETARY HABITS INTERVIEWS AND FOCUS GROUPS

There are several nutrient-dense cost-effective foods available that are not reported as frequently consumed by most families and that could be contributing to a nutritious diet. There are also some nutrient-dense cost-effective foods that have limited availability, but it is not clear whether this is possibly due to low demand. Soybean milk curd and lentils are only reported as frequently consumed by approximately one-third of households and have varying availability in markets. Avocados are reported as frequently consumed by only 60% of households in East Pastoral LZ and 75% in Central Agropastoral LZ (Table 31).

TABLE 31. COST AND AVAILABILITY OF SOME NUTRIENT-DENSE FOOD ITEMS

Food Item	East Pastoral LZ		Central Agropastoral LZ	
	Cost	Availability	Cost	Availability
Soybean milk curd	15.7 KES	1 of 6 markets	n.a.	n.a.
Lentils	23.6 KES	3 of 6 markets	19.4 KES	5 of 6 markets
Avocado	7.6 KES	4 of 6 markets	8.7 KES	6 of 6 markets

Soybean milk curd, when selected by COD analysis for the Nutritious Diet in East Pastoral LZ, provided most of the family's calcium, iron, zinc and folic acid requirements. Although lentils provide similar nutrients as other legumes which are commonly eaten, if they are added to the consumption of red beans or varied color beans they can help meet micronutrient needs that are lacking if the diet has limited meat consumption. Avocado has been selected for every Nutritious Diet and Food Habits Diet for the four livelihood zones in the Nawiri COD study (two in Turkana and two in Samburu) showing that it is a nutrient-dense cost-effective food item that would be advantageous for all households to consume.

It is known that animal source foods are usually the most nutrient-dense foods available. Table 32 shows the relative cost of key animal source foods (affordability) and their availability in East Pastoral LZ and Central Agropastoral LZ.

TABLE 32. COST OF ANIMAL SOURCE FOODS AND THEIR AVAILABILITY IN MARKETS

Food Item	East Pastoral LZ		Central Agropastoral LZ	
	Cost	Availability	Cost	Availability
Chicken eggs	34.6 KES	5 of 6 markets	32.5 KES	6 of 6 markets
Chicken meat	45.0 KES	1 of 6 markets	51.4 KES	1 of 6 markets
Goat meat	40.3 KES	4 of 6 markets	50.4 KES	5 of 6 markets
Goat intestines/stomach	31.3 KES	3 of 6 markets	38.7 KES	4 of 6 markets
Goat liver	51.6 KES	1 of 6 markets	42.0 KES	4 of 6 markets
Mutton	57.2 KES	2 of 6 markets	51.4 KES	2 of 6 markets
Beef	n.a.	n.a.	47.3 KES	2 of 6 markets
Fish, small dried freshwater	61.8 KES	1 of 6 markets	44.2 KES	1 of 6 markets

As noted previously, the COD software chooses small dried freshwater fish as a nutrient-dense cost-effective food item in both livelihood zones yet it is reported as frequently eaten by only roughly 5% of households in either livelihood zone. In focus groups women did identify fish as a desirable food item that is not always available at markets. One focus group even described fish as a “new” food item that is considered desirable because it is known that “people living in larger towns eat it”. Dried freshwater fish is a very nutrient-dense food item, partly because it is dried, and it can contribute significant micronutrients to the diet (particularly calcium from the crushed small bones). However, women in several focus groups also described fish as undesirable to purchase in the market due to flies and bad smells.

Chicken eggs were selected by the COD software as nutrient-dense and cost-effective and are reported as frequently eaten by most households. However, it is one of the few food items reported as causing problems if fed to small children (see below).

Among the meat and offal food items available, more than half of women reported only goat meat (69% to 72%) and goat intestines/stomach (50% to 75%) as most frequently consumed. Goat liver, the most nutrient-dense meat available, is only reported as frequently consumed by approximately one-third of households in either livelihood zone. The Food Habits Diet also allocated chicken meat to the pregnant or lactating adolescent age 15 to 16 and to the pregnant or lactating mother age 30 to 49. Dietary Habits Interviews found chicken meat to be “often” consumed by only around 10% of households.

Over half of households report frequent consumption of fresh goat milk (80% East Pastoral LZ, 52% Central Agropastoral LZ) and fresh cow milk (63% East Pastoral LZ, 52% Central Agropastoral LZ). Powdered cow milk was not reported as frequently consumed in either livelihood zone but was selected by COD analysis as nutrient-dense and cost-effective. As noted previously, powdered cow milk is a food item that could be of concern if safe water is not used for its reconstitution. However, it can easily be added dry to fortify maize porridge in which the water has been boiled along with the maize. It is worth noting that Dietary Habits Interviews found a high percentage of households to report frequent consumption of UHT cow milk and, though more expensive than other milks, it was available in every market in both livelihood zones. UHT cow milk could provide similar nutrients as fresh cow milk.

Of concern are the specific taboos against consumption of key nutrient-dense food items during pregnancy which was noted in focus group discussions with women. Taboos against the consumption of eggs during pregnancy was among the most frequently noted food prohibition in both East Pastoral LZ and Central Agropastoral LZ with a concern that egg consumption “would increase the weight of the unborn and cause complications during childbirth”. Avocados, groundnuts, goat liver and milk diluted with water were also frequently mentioned in East Pastoral LZ as prohibited during pregnancy. Foods that are prohibited for lactating mothers was not investigated during the COD fieldwork but would be of additional interest for planning social and behavioral change activities.

The KAPB-MIYCN Survey in Samburu County 2018 found only 21% of children to be receiving iron-rich foods (no other micronutrient was surveyed). Maize and beans are key sources of iron but this iron is absorbed into the body less than iron from animal-source foods (it should be noted that adding some type of acidic food, such as tomatoes, can help increase the bioavailability of iron from maize and beans).

In focus groups there were few foods mentioned as prohibited for small children but many foods named as problematic to feed to small children, including eggs which were mentioned in both livelihood zones. Other nutrient-dense animal-source foods were not mentioned in East Pastoral LZ but several were additionally mentioned in Central Agropastoral LZ including meat, meat stock/soup, mutton and milk. Although mothers mention a preference for maize flour for children, as maize grain is difficult to chew, it was also noted that many children do not like plain maize flour. This is an opportunity to offer recipes that complement maize porridge with additional food items to provide a balanced meal.

Although COD analysis did not choose these food items, mothers did mention potatoes, sweet potatoes and large ripe bananas (which were available in every market) as being good foods for children. Because they are not difficult to chew they are very appropriate for small children and can provide many key nutrients for the

child age 12 to 23 months. Even though these are not the cheapest food items, the child age 12 to 23 months only needs small amounts to complement breast milk.

It should be noted that two of the wild / gathered foods mentioned in focus groups (Annex F) and for which nutritionally information is available are good sources of micronutrients (e.g. Solanum leaves and amaranth leaves) and should be promoted for consumption. Although modeling showed that their addition to home garden production of kale, Swiss chard and cabbage in East Pastoral LZ or green peas in Central Agropastoral LZ did not further reduce the cost of the diet, they could be good additions to the garden if they can be harvested at different times and/or are more resistant to drought or pests.

In focus groups, mothers most often mentioned kale as one of the desirable food items that are not always available in markets. Market Survey found kale for sale in all markets in East Pastoral LZ and four of six markets in Central Agropastoral LZ. COD analysis selects kale for the Food Habits Diet in both livelihood zones and as a critical food item for achieving a nutritious diet for the pregnant or lactating adolescent age 15 to 16 and for the pregnant or lactating mother age 30 to 49 in both livelihood zones. Women in focus groups mentioned a particular concern about not wanting kale that was cut-up already; women prefer to cut the kale themselves. Women also identified other green vegetables as desirable and with limited availability and COD analysis has shown these to also be important for a nutritious diet, including green peas and Swiss chard.

All groups mentioned concerns about purchased vegetables or tubers “going rotten fast”. There was also concern about weevil infestation of beans and maize purchased at market, along with a concern that some beans take a long time to cook.

The majority of mothers in both livelihood zones report buying “sweets, snacks or drinks” for children at least once or twice a week. Ways in which to better utilize these expenditures towards a nutritious food item should be considered. Wheat flour “snack” food items, both fried and non-fried, were also reported as frequently consumed by 70% of households in East Pastoral LZ and almost 100% of households in Central Agropastoral LZ, even though concern about hygiene during their preparation was mentioned in focus groups. These wheat snacks cost roughly about 15 KES in Central Agropastoral LZ and between 20 KES and 30 KES in East Pastoral LZ. Some consumption of fried foods is good for small children as they are energy-dense and provide calories in a small portion; however, the addition of vegetable oil or hydrogenated vegetable oil to maize porridge would be a better (and cheaper) option.

D. MODELING POTENTIAL ACTIVITIES

Potential support for goat milk production, cow milk production, home garden production of dark green leafy vegetables and tomatoes, production of orange flesh sweet potato, and/or for MOH vitamin A supplementation (VAS) campaigns were modeled to see their effect on the cost of a nutritious Food Habits Diet in East Pastoral LZ and Central Agropastoral LZ.

In East Pastoral LZ, support for goat milk production resulted in a greater annual cost savings for the diet than support for cow milk production. In Central Agropastoral LZ the cost savings was similar for either goat milk or cow milk, though slightly greater for goat milk. Support for either goat or cow milk production is encouraged as these food items provide substantial nutritional contribution to the diet.

Support for home garden production of dark green leafy vegetables (kale and Swiss chard in both livelihood zones, plus cabbage and tomatoes in East Pastoral LZ or green peas in Central Agropastoral LZ) provided the

greatest reduction to the cost of the diet among potential activities that were modeled. Adding other vegetables that are sometimes gathered, such as amaranth and solanum, did not further reduce the cost of the diet.

Because these above-mentioned vegetables not only provide significant amounts of vitamin A but also calcium and iron, the addition of bio-fortified orange flesh sweet potato did not further reduce the cost of the diet in East Pastoral LZ and provided a negligible reduction in Central Agropastoral LZ. All of these food items are likely to have slightly different harvest periods and therefore can each be of value in contributing to a nutritious diet.

As VAS is targeted only to one member of the standard family – the youngest child age 12 to 23 months – support for MOH campaigns does not significantly reduce the cost of the family diet. However, the importance of vitamin A for health growth and development should be kept in mind.

Modeling for a combination of potential activities (goat milk production, home gardens, orange flesh sweet potato production and VAS) showed a potential reduction of 26% of the cost of the diet in East Pastoral LZ and 40% in Central Agropastoral LZ. Maintaining all of these activities throughout the year would be difficult without support for access to some type of irrigation and/or fodder. Home garden production potential is highest during the two rainy seasons, and rainfall also has an effect on goat milk production. The VAS program calls for supplementation every six months and therefore should be supported twice yearly.

X. RECOMMENDATIONS

1. SBC strategy:

- The COD analysis is based on the assumption that the child age 12 to 23 months has the benefit of continued breastfeeding. Nawiri's plans for promotion of continued breastfeeding and support for Baby Friendly Community Initiatives are highly recommended. COD analysis done to show the cost-benefit of continued breastfeeding should be widely shared with mothers and persons of influence and added to education about the nutritional and health benefits of continued breastfeeding.
- COD analysis shows that the needs of a female adolescent and an adolescent mother (during pregnancy and during continued breastfeeding) are the highest among all household members. This information should be disseminated widely and to all persons who have influence over the female adolescent's diet. In any efforts to promote delayed marriage and/or pregnancy this COD information on nutrient needs of the female adolescent should be included.
- COD analysis of a Nutritious Diet selects several nutrient-dense foods that are not consumed frequently by the majority of households: dried freshwater fish, soybean milk curd, and goat liver. Promotion of even the occasional consumption by infants and young children (and pregnant and lactating women of all ages, but particularly adolescent women) is highly recommended. Role models could be found among those women who do purchase and provide these foods for their family.
- Available nutrient content information for some of the local foods that are mentioned by women as being gathered and consumed by almost all family members shows these foods to have particular nutrient strengths to contribute to the diet, particularly dark leafy greens. Dissemination of awareness of their value if strongly encouraged.
- There are many taboos against pregnant women eating nutrient-dense foods out of fear of complications during childbirth if the baby is "large". SBC promotion of nutrient-dense foods as supporting the health of the developing fetus (along with collaboration with MOH, see below) might influence some of the early causes of the high levels of Persistent Acute Malnutrition (PAM) found in the zone.

2. Livelihoods activities:

- Any activities that increase household income available for food purchase and are accompanied by education on the most cost-efficient ways to use this income to improve the diet of women and vulnerable children will be of benefit. The COD analysis has provided this information on cost-effective nutrient-dense foods and this information should be disseminated through income-generating strategies.
- A focus on the female adolescent for income-generating activities would assist this most vulnerable group to achieve a nutritious diet as women in both age groups state they can make decisions over food purchases, particularly when using income they have earned.
- Modeling of the effect of potential activities showed reductions to the cost of the diet from support for home gardens with dark leafy greens, goat milk production and cow milk production, in that order, although all are somewhat similar in their cost reduction effect.

3. Markets and infrastructure:

- Women commented favorably on improvements in hygiene at markets as part of coronavirus prevention efforts and unfavorably on the hygiene of some of the nutrient-dense foods such as fish and meat. Traders mention a need for better garbage collection and improvements to market infrastructure. This would be good to pursue with local government.
- Larger central markets have a good variety of nutritious food items while smaller outlying markets are more limited. Supporting connections between these markets so that the larger central markets are not only vendors in their market but become suppliers to the smaller outlying markets could help households access a nutritious diet.

4. Collaboration with the Ministry of Health (MOH):

- Low birth weight is likely a contributing factor to the high levels of PAM in the zone. In focus groups during the COD studies, women cited nutrition knowledge acquired from trusted Community Health Workers (CHWs). Working with CHWs to tackle the taboos against consumption of nutrient-dense foods during pregnancy, strengthening nutrition counseling during ante-natal care, and supporting links to safe delivery services available through the MOH is indicated.
- Kenya MOH's vitamin A supplementation (VAS) program has had good success over time but VAS requires continual outreach, especially in difficult to reach areas. Logistic and coordination support can help contribute to a successful VAS program.

5. Integration:

- A combination of support for VAS campaign, goat milk production, home garden production, and production of bio-fortified orange flesh sweet potato, showed reductions to the cost of the diet by 26 percent in East Pastoral LZ and 40 percent in Central Agropastoral LZ. Integration of activities should be a focus for as many households as possible.

6. Follow on:

- “Light touch” market surveys should be continued once during each season for a period of a year to gather additional information on availability and affordability. If the WFP Minimum Expenditure Food Basket is used, potatoes should be included as they are a commonly consumed food item in these livelihood zones.

XI. ANNEXES

ANNEX A: COD FIELDWORK TEAM

Samburu County COD Study Team				
No.	Name	sex	Designation	Role
MOH & SCI Staff				
1	PAULA LENANGUYA	F	Nutritionist-MOH	Supervisor
2	DELPHINA KAAMAN	F	County Nutrition Coordinator	Supervisor
3	GEOFFREY MUKURIA	M	M&E Coordinator-MOH	Supervisor
4	JOSEPH GICHUKI GICHUHI	M	Sub-County Health Records and Information Officer	Supervisor
5	JOSEPH ROTICH	M	Sub-County Community Health Systems Focal Person	Data Clerk
6	Thomas Ejore	M	Field Health and Nutrition Advisor SCI	COD Lead Assistant
7	Titus Leokoe	M	Field Health and Nutrition Advisor SCI	COD Lead Assistant
8	June Cherutich	F	Health and Nutrition Officer SCI	Supervisor
9	Joseph Emase	M	MIS Officer SCI	Data Clerk
10	Andrew Ngitira	M	Nutrition officer-SCI	Supervisor
11	Haliman Kidenye	F	Nutrition officer-SCI	Supervisor
12	Charles Akuom	M	M&E Officer SCI	Data Clerk
13	DANIEL KIMATHI	M	Sub-County Nutrition Officer - Samburu Central	Supervisor
14	AUGUSTINE LKEITAN	M	County Community Health System Focal Person	Supervisor
15	JOSPHAT LUVUZE	M	Sub-County Community Health Systems Focal Person	Supervisor

Research Assistants				
	Name	Gender	Role	
1	STEPHANIE N LENGAINA	F	Research Assistant	
2	LEKOPIEN ANNITAH	F	Research Assistant	
3	PRISCA NANYU	F	Research Assistant	
4	SANIWA ROSE	F	Research Assistant	
5	SELENGEI LEPARKIRAS	F	Research Assistant	
6	HILLARY LEMPUSHUNA	F	Research Assistant	
7	JOYCE LETIKIRICH	F	Research Assistant	

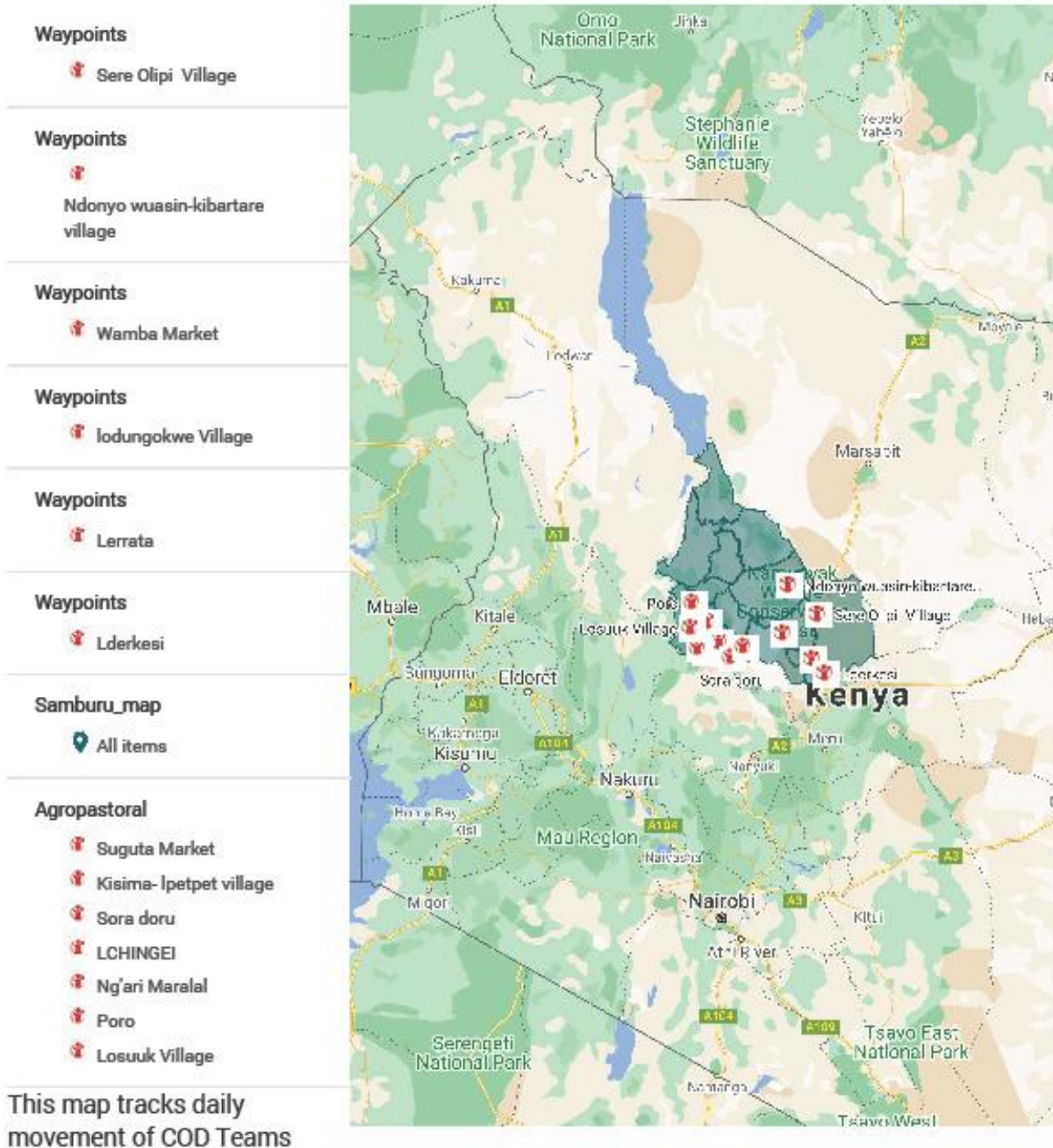
Research Assistants			
	Name	Gender	Role
8	MOHAMMED ABDILLAHI	M	Research Assistant
9	LEMONGI PETER	M	Research Assistant
10	LENAWAKUTUK JOHN FELIX	M	Research Assistant
11	FABIO LABARU LETOOLE	M	Research Assistant
12	LEKISAAT SYLVIA SAIMPIAN	F	Research Assistant
13	PURITY KOECH	F	Research Assistant
14	SAMMY LESOKOYO	M	Research Assistant
15	RICHARD LOPEYOK	M	Research Assistant
16	EDWIN LENDEKE	M	Research Assistant

ANNEX B: COD FIELDWORK SCHEDULE SAMBURU

Activity	COD Samburu East Pastoral Livelihood Zones				
	19/04/2021_Monday	20/04/2021_Tuesday	21/04/2021_Wednesday	22/04/2021_Thursday	23/04/2021_Friday
Morning – market surveys	<p>Team, A, B, C, D (Supervisor does Key Informant Interview with 1-3 sellers)</p> <p>Supervisor to interview 1-3 traders at Wamba Market.</p>	<p>Team A: Lodung’okwe Market/nearby shops</p> <p>Team B: Wamba Market/nearby shop</p> <p>Mobilization/Preparation for FGDs:</p> <p>Team C: Lodung’okwe - 50KM</p> <p>Team D: Wamba - Sordo</p>	<p>Team C: Ndony Wasin Market/nearby shops</p> <p>Team D: Sere Olipi Market/nearby shops</p> <p>Mobilization/preparation for FGDs:</p> <p>Team A: Ndonyo Wasin</p> <p>Team B: Sere Olipi</p>	<p>Team A: Archers Market/nearby shops</p> <p>Team B: Lerrata_small market/nearby shops</p> <p>Identification HH with adolescent/WR A for FFQ:</p> <p>Team C: Archers – Lderkesi/Loruba</p> <p>Team D: Lerrata</p>	<p>All teams to Archers Post : Review forms for handwriting clarity, errors, etc.</p>
Afternoon – FGD or Food Frequency Questionnaire.	<p>Drop off market survey forms for data entry and drive to next location</p>	<p>Team A at Village 1: Lodung’okwe – 50KM FGD WRA mothers age 21-49 with children <3</p> <p>Team C: Village 1 <i>FGD adolescent mothers age 15-20 with children <3</i></p> <p>Team B at Village 2: Wamba -Sordo: FGD mothers age 21-49 with children <3</p> <p>Team D: Village 2 FGD mothers age 15-20 with children <3</p>	<p>Team C at Village 3: Ndonyo Wasin – Kibarte/Lang’ata FGD mothers age 21-49 with children <3</p> <p>Team A: Village 3 FGD adolescent mothers age 15-20 with children <3</p> <p>Team D at Village 4: Sere Olipi Village – Town/Centre FGD mothers age 21-49 with children <3</p> <p>Team B: Village 4 FGD mothers age 15-20 with children <3</p>	<p>Team A at Village 5: Archers - Lderkesi/Loruba FFQ 8 mothers age 21-49 w/children <3</p> <p>Team C: Village 5 FFQ 8 mothers age 15-20 w/children <3</p> <p>Team B at Village 6: Lerrata – A & B FFQ 8 mothers age 21-49 w/children <3</p> <p>Team D: Village 6 FFQ 8 mothers age 15-20 w/children <3</p>	<p>Summarize FGD women age 20-49</p> <p>Summarize FGD women age 15-20</p> <p>Summarize FFQ</p>

Activity	COD Samburu Agropastoral Livelihood Zones				
	26/04/2021_Monday	27/04/2021_Tuesday	28/04/2021_Wednesday	29/04/2021_Thursday	30/04/2021_Friday
Morning – market surveys	<p>Team, A, B, C, D (Supervisor does Key Informant Interview with 1-3 sellers)</p> <p>Supervisor to interview 1-3 traders at Maralal Market.</p>	<p>Team A: Kisima Market/nearby shops</p> <p>Team B: Suguta Market/nearby shop</p> <p>Mobilization/Preparation for FGDs: Team C: Kisima – Lpetpet Team D: Suguta - Lorien</p>	<p>Team C: Porro_market/nearby shops</p> <p>Team D: Loosuk_market/nearby shops</p> <p>Mobilization/preparation for FGDs: Team A: Porro - Ntashata Team B: Loosuk – Ngweta</p>	<p>Team A: Kirimon - Sora Doru Market/nearby shops</p> <p>Team B: Maraal market/nearby shops</p> <p>Identification HH with adolescent/WR A for FFQ: Team C: Sora Doru Team D: Maralal</p>	<p>All teams to Maralal: Review forms for handwriting clarity, errors, etc.</p>
Afternoon – FGD or Food Frequency Questionnaire.	<p>Drop off market survey forms for data entry and drive to next location</p>	<p><u>Team A at Village 1:</u> Kisima - Lpetpet FGD WRA mothers age 21-49 with children <3 Team C: Village 1 <i>FGD adolescent mothers age 15-20 with children <3</i></p> <p><u>Team B at Village 2:</u> Suguta – Lorien/Lchingei: FGD mothers age 21-49 with children <3 Team D: Village 2 FGD mothers age 15-20 with children <3</p>	<p><u>Team C at Village 3:</u> Porro – Nshata FGD mothers age 21-49 with children <3 Team A: Village 3 FGD adolescent mothers age 15-20 with children <3</p> <p><u>Team D at Village 4:</u> Loosuk Village – Ngwata FGD mothers age 21-49 with children <3 Team B: Village 4 FGD mothers age 15-20 with children <3</p>	<p><u>Team A at Village 5:</u> Sora Doru- A & B FFQ 8 mothers age 21-49 w/children <3 Team C: Village 5 FFQ 8 mothers age 15-20 w/children <3</p> <p><u>Team B at Village 6:</u> Sora Maralal – Ng’ari FFQ 8 mothers age 21-49 w/children <3 Team D: Village 6 FFQ 8 mothers age 15-20 w/children <3</p>	<p>Summarize FGD women age 20-49</p> <p>Summarize FGD women age 15-20</p> <p>Summarize FFQ</p>

SAMBURU COUNTY COD STUDY DAILY MOVEMENT TRACKING



ANNEX D: RESULTS OF MARKET SURVEY AND DIETARY HABIT INTERVIEWS WITH EAST PASTORAL LZ

Market Survey Analysis Summary: Nawiri Samburu County		DIETARY HABITS INTERVIEW ANALYSIS SUMMARY					
Samburu East Pastoral LZ	Average Price Per 100g	FOOD NAME		Percentage of interview respondents			
	Season 1	Local Name	English Name	Usually (5 days + per week)	Often (1-4 days per week)	Rarely (Once a year, once a month etc.)	Never
Grains and grain-based products		Grains and grain-based products					
Maize, grain, dried	5.09		Maize, dried, grain	6.25	78.13	6.25	9.38
Maize flour	5.45		Maize, flour, dry	68.75	31.25	0.00	0.00
Maize, on the cob, white	8.56		Maize, on the cob, white	3.13	12.50	21.88	62.50
Millet, finger, grain or flour	12.01		Millet, finger, grain or flour	6.25	6.25	21.88	65.63
Oats	25.00		Oats	0.00	0.00	0.00	100.00
Pasta	12.42		Pasta	12.50	46.88	31.25	9.38
Sorghum, grain or flour	7.42		Sorghum, grain or flour	0.00	6.25	34.38	59.38
Ujimix	14.27		Ujimix	34.38	40.63	12.50	12.50
Rice	10.12	mchele	Rice	34.38	59.38	6.25	0.00
Bread	14.63	mkate	Bread	25.00	31.25	15.63	28.13
Wheat, grain or flour	8.14	ngano/Ing'anoyio	Wheat, grain or flour	9.38	43.75	43.75	3.13
Weetabix (Cereal, high protein)	69.50	Weetabix	Cereal, high protein	0.00	6.25	6.25	87.50
Roots and tubers		Roots and tubers					
Beet root	19.94		Beet root, red	0.00	6.25	3.13	90.63
Potato	6.27		Potato	34.38	59.38	3.13	3.13
Arrowroot	12.75	Ndume	Arrowroot	0.00	3.13	3.13	93.75
Sweet potato	7.51	Nkuashe	Sweet potato	0.00	9.38	12.50	78.13
Legumes, nuts and seeds		Legumes, nuts and seeds					
Bean, kidney, red, dried	10.87		Bean, kidney, red, dried	37.50	40.63	6.25	15.63
Soybean, top of milk, dried	15.70	soya	Soybean, top of milk, dried	0.00	18.75	9.38	71.88
Cowpea, dried	11.97	'ng'imare'	Cowpea, dried	0.00	15.63	12.50	71.88
Lentil, dried	23.55	kamande	Lentil, dried	6.25	9.38	6.25	78.13
Varied color beans	10.47	naragwe	Bean, pinto, mature	18.75	37.50	18.75	25.00
Green gram	15.47	Ndengu, mbaazi	Green gram, whole, dried	12.50	40.63	9.38	37.50
Groundnut/peanut, roasted, shelled	41.95	njugu	Peanut, roasted, shelled	0.00	12.50	9.38	78.13
Sesame seed	n.a.	simsim	Sesame, seed	0.00	0.00	3.13	96.88

Meat and offal		Meat and offal					
Camel meat	n.a.		Camel, meat	0.00	3.13	50.00	46.88
Chicken, ready to cook	n.a.		Chicken, ready to cook	0.00	6.25	65.63	28.13
Chicken meat	45.00		Chicken, meat	0.00	12.50	65.63	21.88
Goat intestines/stomach	31.27		Goat, intestines/stomach	0.00	50.00	40.63	9.38
Goat meat	40.30		Goat, meat	12.50	59.38	25.00	3.13
Pork meat	n.a.		Mutton, meat	0.00	0.00	0.00	0.00
Mutton meat	57.17		Pork, meat	0.00	0.00	9.38	90.63
Goat liver	51.55		Goat liver	0.00	34.38	59.38	6.25
Donkey meat	n.a.		Donkey meat (horse)	0.00	0.00	0.00	100.00

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	Season 1	Local Name	English Name	Usually (5 days + per week)	Often (1-4 days per week)	Rarely (Once a year, once a month etc.)	Never
Fish, seafood, amphibians and invertebrates		Fish, seafood, amphibians and invertebrates					
Fish, tuna, packed	127.27		Fish,tuna, packed	0.00	0.00	0.00	0.00
Fish, any type, raw	n.a.	Any type	Fish, raw	0.00	9.38	9.38	81.25
Fish, any type, salted	n.a.	Any type	Fish, salted	0.00	0.00	3.13	96.88
Fish, small, dried, freshwater	61.80		Fish, small, dried, freshwater	0.00	3.13	3.13	93.75
Eggs and egg products		Eggs and egg products					
Egg, chicken	34.60		Egg, chicken	21.88	56.25	9.38	12.50
Milk and milk products		Milk and milk products					
Milk, cow, fresh	7.66		Milk, cow, fresh	25.00	37.50	15.63	21.88
Milk, cow, powdered, whole	48.00		Milk, cow, powdered, whole	3.13	6.25	37.50	53.13
Milk, cow, UHT	13.68		Milk, cow, UHT	28.13	43.75	18.75	9.38

Milk, goat, fresh	6.89		Milk, goat, fresh	43.75	37.50	3.13	15.63
Milk, powdered, fortified	n.a.		Milk, powdered, fortified	0.00	12.50	18.75	68.75
Milk, camel, fresh	14.24		Milk, camel, fresh	0.00	0.00	0.00	0.00
Milk, sheep, fresh	n.a.	Kule ee Nkera	Milk, sheep, fresh, whole	31.25	34.38	6.25	28.13

Vegetables and vegetable products		Vegetables and vegetable products					
Cabbage	2.90		Cabbage, green or white	15.63	71.88	9.38	3.13
Carrot	5.46		Carrot	6.25	43.75	12.50	37.50
Onion	13.52		Onion	68.75	28.13	0.00	3.13
Onion, spring or scallion	15.09		Onion, spring or scallion	0.00	15.63	15.63	68.75
Squash, butternut	11.17		Squash, butternut	0.00	9.38	9.38	81.25
Swiss chard	6.50		Chard, swiss	12.50	50.00	12.50	25.00
Cowpea leaves	n.a.	Kunde	Leaf, cowpea	9.38	0.00	9.38	81.25
Pumpkin leaves	n.a.	Mbene elmuronge	Leaf, pumpkin	0.00	3.13	3.13	93.75
Peas, green	30.81	Minji	Pea, green	6.25	34.38	12.50	46.88
Solanum	n.a.	sujaa / managu	Solanum	0.00	12.50	15.63	71.88
Kale	5.76	Sukuma	Kale	15.63	78.13	6.25	0.00

Market Survey Analysis Summary: Nawiri Samburu County		DIETARY HABITS INTERVIEW ANALYSIS SUMMARY					
Samburu East Pastoral LZ	Average Price Per 100g	FOOD NAME		Percentage of interview respondents			
	Season 1	Local Name	English Name	Usually (5 days + per week)	Often (1-4 days per week)	Rarely (Once a year, once a month etc.)	Never
Fruit and fruit products		Fruit and fruit products					
	32.36		Apple, with skin	0.00	15.63	9.38	75.00
	7.55		Avocado	3.13	59.38	31.25	6.25

Coconut, milk	35.00		Coconut,milk	0.00	0.00	0.00	0.00
Grapes	n.a.		Grapes	0.00	0.00	3.13	96.88
Melon	10.37		Melon,average	0.00	0.00	0.00	0.00
Orange	9.20		Orange	6.25	56.25	21.88	15.63
Passion fruit	26.97		Passion fruit	0.00	37.50	15.63	46.88
Pear	n.a.		Pear	0.00	6.25	18.75	75.00
Pineapple	17.02		Pineapple	0.00	34.38	18.75	46.88
Tamarind	n.a.		Tamarind	0.00	0.00	0.00	100.00
Watermelon	4.96		Watermelon	0.00	37.50	21.88	40.63
Palm fruit: hyphaene compressa)	n.a.	Doum/Eng'ol	Palm fruit	0.00	3.13	3.13	93.75
Tomato	9.79	Inyaya	Tomato	46.88	50.00	0.00	3.13
Papaya	5.61	Lpaipai	Papaya	0.00	9.38	15.63	75.00
Banana, large, unripe	4.54	ndizi Najon	Banana, large, unripe	3.13	18.75	12.50	65.63
Banana, large, ripe	5.52	ndizi Nowo	Banana, large, ripe	18.75	68.75	9.38	3.13
Mango	n.a.		Mango, orange flesh	6.25	50.00	28.13	15.63
Oils and fats			Oils and fats				
Margarine, fortified	43.40		Margarine, Kenya fortified	3.13	18.75	18.75	59.38
Fat, vegetable, cowboy, kapra or kimbo	21.33	lata	Fat, vegetable, cowboy, kapra or kimbo	34.38	34.38	6.25	25.00
Oil, vegetable	23.49	lata naruko	Oil, vegetable	53.13	31.25	9.38	6.25
Sugars and confectionary			Sugars and confectionary				
donut; sconge (Wheat snack)	27.37	donut; sconge	Wheat snack	15.63	31.25	18.75	34.38
mandazi; chapati; ngumu (Wheat, fried)	19.08	mandazi; chapati; ngumu	Wheat, dough, deep fried	15.63	53.13	25.00	6.25
Sugarcane	n.a.	miwa	Sugarcane	0.00	28.13	43.75	28.13
Honey	86.00	naisho	Honey	3.13	9.38	65.63	21.88
Jaggery	n.a.	sukari Kuru	Jaggery, solid	0.00	6.25	18.75	75.00
Sugar, white	11.89	sukari nairobor	Sugar, white	28.13	15.63	9.38	46.88
Sugar, brown	12.12	sukari wuerikoi	Sugar, brown	75.00	15.63	9.38	0.00
Herbs, spices and condiments			Herbs, spices and condiments				
Salt, iodized	4.80	chumbi	Salt, iodized	96.88	3.13	0.00	0.00
Lemon	17.56	ndimu	Lemon	0.00	9.38	15.63	75.00
Tomato paste, concentrated	42.19	nyanya mkebe	Tomato paste, concentrated	3.13	21.88	15.63	59.38



ANNEX E: RESULTS OF MARKET SURVEY AND DIETARY HABIT INTERVIEWS WITH CENTRAL AGROPASTORAL LZ

Market Survey Analysis Summary: Nawiri Samburu County		DIETARY HABITS INTERVIEW ANALYSIS SUMMARY					
Samburu Central Agropastoral LZ	Average Price Per 100g	FOOD NAME		Percentage of interview respondents			
	Season 1	Local Name	English Name	Usually (5 days + per week)	Often (1-4 days per week)	Rarely (Once a year, once a month etc.)	Never
Grains and grain-based products		Grains and grain-based products					
Maize, grain, dried	4.24		Maize, dried, grain	0.00	90.63	0.00	9.38
Maize flour	4.85		Maize, flour, dry	87.50	12.50	0.00	0.00
Maize, on the cob, white	7.01		Maize, on the cob, white	0.00	6.25	68.75	25.00
Millet, finger, grain or flour	10.22		Millet, finger, grain or flour	3.13	0.00	25.00	71.88
Oats	28.89		Oats	0.00	0.00	0.00	100.00
Pasta	14.04		Pasta	0.00	53.13	40.63	6.25
Sorghum, grain or flour	15		Sorghum, grain or flour	0.00	3.13	21.88	75.00
Ujimix	12.31		Ujimix	21.88	46.88	18.75	12.50
Rice	10.06	mchele	Rice	25.00	75.00	0.00	0.00
Bread	13.75	mkate	Bread	0.00	59.38	31.25	9.38
Wheat, grain or flour	7.28	ngano/lng'anoyio	Wheat, grain or flour	0.00	53.13	46.88	0.00
Weetabix (Cereal, high protein)	77.97	Weetabix	Cereal, high protein	0.00	6.25	6.25	87.50
Roots and tubers		Roots and tubers					
Beet root	34.54		Beet root, red	0.00	0.00	6.25	93.75
Potato	5.19		Potato	34.38	62.50	3.13	0.00
Arrowroot	15.66	Ndume	Arrowroot	0.00	0.00	9.38	90.63
Sweet potato	6.57	Nkuashe	Sweet potato	0.00	3.13	18.75	78.13
Legumes, nuts and seeds		Legumes, nuts and seeds					
Bean, red, dried	10.49		Bean, red, dried	0.00	68.75	3.13	28.13
Soybean, top of milk, dried		"soya"	Soybean, top of milk, dried	0.00	6.25	15.63	78.13
Cowpea, dried	11.95	'ng'imare'	Cowpea, dried	0.00	9.38	25.00	65.63
Lentil, dried	19.44	kamande	Lentil, dried	3.13	12.50	21.88	62.50
Varied color beans	10.78	naragwe	Bean, pinto, mature	12.50	40.63	31.25	15.63

Green gram	14.63	Ndengu, mbaazi	Green gram, whole, dried	0.00	21.88	40.63	37.50
Groundnut/peanut, roasted, shelled	62.16	njugu	Peanut, roasted, shelled	0.00	6.25	15.63	78.13
Sesame seed		Simsim	Sesame, seed	0.00	0.00	3.13	96.88
Meat and offal		Meat and offal					
Beef, bone marrow			Beef, bone marrow	0.00	3.13	81.25	15.63
Beef, heart			Beef heart	0.00	3.13	81.25	15.63
Beef, intestines			Beef intestines	0.00	37.50	56.25	6.25
Beef, meat	47.25		Beef meat	0.00	18.75	71.88	9.38
Camel meat			Camel meat	0.00	0.00	31.25	68.75
Chicken, ready to cook	51.43		Chicken, ready to cook	0.00	12.50	53.13	34.38
Chicken meat			Chicken meat	0.00	9.38	65.63	25.00
Goat intestines/stomach	38.67		Goat intestines/stomach	3.13	71.88	25.00	0.00
Goat meat	50.35		Goat meat	0.00	68.75	28.13	3.13
Mutton meat	51.36		Mutton meat	0.00	37.50	43.75	18.75
Pork meat			Pork meat	0.00	0.00	3.13	96.88
Goat liver	41.96		Goat liver	0.00	31.25	59.38	9.38
Donkey meat			Donkey meat	0.00	0.00	0.00	100.00

Market Survey Analysis Summary: Nawiri Samburu County		DIETARY HABITS INTERVIEW ANALYSIS SUMMARY					
Samburu Central Agro-pastoral LZ	Average Price Per 100g	FOOD NAME		Percentage of interview respondents			
	Season 1	Local Name	English Name	Usually (5 days + per week)	Often (1-4 days per week)	Rarely (Once a year, once a month etc.)	Never
Fish, seafood, amphibians and invertebrates		Fish, seafood, amphibians and invertebrates					
Fish, tuna, packed			Fish, tuna, packed	0.00	0.00	3.13	96.88
Fish, any type, raw		Any type	Fish, raw	0.00	0.00	0.00	100.00
Fish, any type, salted		Any type	Fish, salted	0.00	3.13	0.00	96.88
Fish, small, dried, freshwater	44.22		Fish, small, dried, freshwater	0.00	6.25	3.13	90.63
Eggs and egg products		Eggs and egg products					
Egg, chicken	31.54		Egg, chicken	12.50	71.88	9.38	6.25
Milk and milk products		Milk and milk products					

Milk, camel, fresh			Milk, camel, fresh	3.13	12.50	21.88	62.50
Milk, cow, fresh	6.14		Milk, cow, fresh	40.63	31.25	12.50	15.63
Milk, cow, powdered, whole	120		Milk, cow, powdered, whole	6.25	12.50	9.38	71.88
Milk, cow, UHT	12.72		Milk, cow, UHT	12.50	53.13	25.00	9.38
Milk, goat, fresh	7.94		Milk, goat, fresh	40.63	31.25	15.63	12.50
Milk, powdered, fortified	200		Milk, powdered, fortified	0.00	0.00	21.88	78.13
Milk, sheep, fresh		Kule ee Nkera	Milk, sheep, fresh, whole	31.25	31.25	21.88	15.63

Vegetables and vegetable products			Vegetables and vegetable products				
Cabbage	2.5		Cabbage, green or white	46.88	53.13	0.00	0.00
Carrot	7.7		Carrot	3.13	37.50	21.88	37.50
Onion	11.56		Onion	78.13	21.88	0.00	0.00
Onion, spring or scallion			Onion, scallion	3.13	21.88	40.63	34.38
Squash, butternut	11.15		Squash, butternut	0.00	3.13	59.38	37.50
Swiss chard	7.4		Chard, swiss	0.00	78.13	12.50	9.38
Cowpea leaves		Kunde	Leaf, cowpea	0.00	0.00	25.00	75.00
Pumpkin leaves		Mbene elmuronge	Leaf, pumpkin	0.00	9.38	62.50	28.13
Peas, green	29.59	minji	Pea, green	0.00	21.88	31.25	46.88
Solanum		suja / managu	Solanum	0.00	40.63	59.38	0.00
Kale	5.72	sukuma	Kale	18.75	71.88	6.25	3.13

Market Survey Analysis Summary: Nawiri Samburu County		DIETARY HABITS INTERVIEW ANALYSIS SUMMARY					
Samburu Central Agro-Pastoral LZ	Average Price Per 100g	FOOD NAME		Percentage of interview respondents			
	Season 1	Local Name	English Name	Usually (5 days + per week)	Often (1-4 days per week)	Rarely (Once a year, once a month etc.)	Never
Fruit and fruit products		Fruit and fruit products					
Apple	31.65		Apple, with skin	0.00	6.25	15.63	78.13
Avocado	8.73		Avocado	0.00	78.13	12.50	9.38
Coconut, milk			Coconut,milk	0.00	21.88	3.13	75.00
Grapes	70		Grapes	0.00	3.13	0.00	96.88
Melon	17.82		Melon,average	0.00	0.00	9.38	90.63
Orange	7.18		Orange	6.25	81.25	6.25	6.25
Passion fruit	22.59		Passion fruit	3.13	18.75	15.63	62.50
Pear			Pear	0.00	0.00	6.25	93.75
Pineapple	10.81		Pineapple	0.00	21.88	34.38	43.75
Tamarind	12.2		Tamarind	0.00	0.00	15.63	84.38
Watermelon	5.94		Watermelon	0.00	15.63	21.88	62.50
Palm fruit: hyphaene compressa		Doum / Eng'ol	Palm fruit	0.00	0.00	0.00	100.00
Tomato	8.13	Inyaya	Tomato	62.50	37.50	0.00	0.00
Papaya	8.04	lpaipai	Papaya	0.00	6.25	9.38	84.38
Banana, large, unripe	4.67	ndizi Najon	Banana, large, unripe	0.00	25.00	18.75	56.25
Banana, large, ripe	5.62	ndizi Nowo	Banana, large, ripe	6.25	68.75	6.25	18.75
Mango	4.96		Mango, orange flesh	3.13	59.38	34.38	3.13
Oils and fats		Oils and fats					
Margarine, fortified	45		Margarine, Kenya fortified	6.25	21.88	28.13	43.75
Fat, vegetable, cowboy, kapra or kimbo	21.24	lata	Fat, vegetable, cowboy, kapra or kimbo	62.50	25.00	6.25	6.25
Oil, vegetable	27.84	lata naruko	Oil, vegetable	56.25	40.63	0.00	3.13

Sugars and confectionary		Sugars and confectionary					
donut; sconde (Wheat snack)	14.86	donut; sconde	Wheat snack	15.63	46.88	15.63	21.88
mandazi; chapati; ngumu (Wheat, fried)	14.71	mandazi; chapati; ngumu	Wheat, dough, deep fried	12.50	75.00	9.38	3.13
Sugarcane	3.34	miwa	Sugarcane	0.00	25.00	56.25	18.75
Honey	125	naisho	Honey	3.13	9.38	56.25	31.25
Jaggery	25.76	sukari Kuru	Jaggery, solid	0.00	15.63	34.38	50.00
Sugar, white	11.59	sukari nairobor	Sugar, white	25.00	43.75	12.50	18.75
Sugar, brown	11.44	sukari wuerikoi	Sugar, brown	71.88	25.00	3.13	0.00
Herbs, spices and condiments		Herbs, spices and condiments					
Salt, iodized	5.83	chumbi	Salt, iodized	93.75	6.25	0.00	0.00
Lemon	17.83	ndimu	Lemon	0.00	3.13	28.13	68.75
Tomato paste, concentrated	47.73	nyanya mkebe	Tomato paste, concentrated	0.00	0.00	9.38	90.63

ANNEX F: LIST OF WILD GATHERED FOOD IN SAMBURU

Food Item	English or scientific name	When gathered	Who Eats
Terere	Amaranth	Rainy season	Everyone except young children
Managu	Solanum	Rainy season	Everyone except young children
Honey		Rainy season	Everyone
Morija		Both rainy season and dry season	Everyone
Lamai		Dry season	Everyone
Lamuriak	(A wild fruit)	Both rainy season and dry season	Everyone
Lekungik		Rainy season	Everyone
Lgishimi		Rainy season	Everyone
Likormasio		Dry season	Everyone
Lkino / Ikarau		End of rainy season into dry season	Everyone
Lkisayiam /lkupsiim		Rainy season	Everyone
Lmangua		Rainy season	Everyone
Lmariumo		Rainy season	Everyone
Lmisigiya		Both rainy season and dry season	Everyone
Loluko		Rainy season	Women and children
Loka		Dry season	Everyone
Loropig / raragi		Rainy season	Children
Lpuusan		End of rainy season into dry season	Everyone
Mpashash		Rainy season	Everyone
Nanoonker		Rainy season	Everyone
Nderikon		Rainy season	Everyone
Ndoruko		Rainy season or calm season	Everyone
Njasin	(A tuber)	Rainy season	Everyone
Rarang		Dry season	Everyone
Sakoten / lpupa		End of rainy season into dry season	Everyone
Sanankur		Both rainy season and dry season	Everyone
Sapai		Rainy season	Everyone
Sekeet		Rainy season	Everyone

ANNEX G: FHAB, EAST PASTORAL LZ

The edible weight and cost of foods selected for the family for a nutritious Food Habits Diet with the percentage contributed by each food to macronutrients and eight vitamins and four minerals in the Samburu East Pastoral livelihood zone

Food List	Quantity (Kg)	% quantity	Cost (KES)	% cost	% energy	% protein	% fat	% vit A	% vit C	% vit B1	% vit B2	% niacin	% vit B6	% folic acid	% vit B12	% calcium	% iron	% zinc
Chard, Swiss	347	11.3	21748	5.5	1.1	2.4	0.4	23	13	2.1	5.7	1.6	4.9	1.8	0	6.2	6.9	3.2
Avocado	206	6.7	21050	5.3	5.4	1.6	18.7	0.3	2.6	2.1	4.9	4.1	7.5	6	0	0.9	1.3	3.4
Bean, kidney	201	6.5	21902	5.5	10.7	17.1	1.6	0	0.8	12.6	5.5	13.8	8.9	24.2	0	5	16.7	14.6
Breast milk	194	6.3	0	0	2	0.8	4.7	2.1	1	0.6	1.2	1	0.3	0.6	3	1.9	0	0.6
Cabbage	81	2.6	2789	0.7	0.3	0.3	0.2	0.1	2	0.7	0.9	0.4	1.3	0.6	0	0.9	0.2	0.2
Chicken, meat	34	1.1	20931	5.3	1.6	3.5	4	0.3	0	0.5	1.5	4.3	1.2	0.1	1.3	0.2	2.7	1.6
Egg, chicken	92	3	35277	8.9	2.2	4.3	5.8	3.7	0	0.9	8.3	2.7	1.5	1.4	15.9	1.6	6	2.5
Goat liver	4	0.1	2275	0.6	0.1	0.3	0.1	14.4	0.1	0.1	2.2	0.6	0.2	0.3	57.8	0	1.2	0.5
Goat intestines and stomach	57	1.9	17931	4.5	1.1	2.4	2.9	0	0	0.3	0.7	2.3	1.2	0.1	7.8	0	2.5	2.7
Goat meat	39	1.3	21511	5.4	1.1	2.6	2.6	0	0	1.1	2.1	2.8	2.2	0.1	7.2	0.1	5.2	3.5
Tomato	75	2.4	7681	1.9	0.3	0.3	0.1	0.7	1.8	0.7	0.7	0.6	0.8	0.4	0	0.1	0.4	0.2
Lentil	34	1.1	8106	2	1.8	3.6	0.2	0	0	4	0.8	2.5	1.6	0.4	0	0.3	1.9	3.4
Fat, vegetable, hydrogenated	47	1.5	10011	2.5	6.7	0	29	0	0	0	0	0	0	0	0	0	0	0
Maize grain	284	9.2	14468	3.6	16.7	8.7	6.3	0	0	16.9	10.4	14.9	12.1	2.6	0	0.6	11	13.2
Maize flour	96	3.1	5259	1.3	5.7	3	2.1	0	0	5.7	3.5	5.1	4.1	0.9	0	0.2	3.7	4.5
Milk, cow, powdered, whole	67	2.2	31964	8	5.4	6.5	11.8	2.9	0.7	1.9	14.7	5.2	1.8	0.7	6.4	22.7	1.4	5.2
Milk, goat, fresh	53	1.7	3660	0.9	0.6	0.7	1.3	0.6	0.1	0.4	1.4	0.6	0.4	0	0.6	2.5	0.1	0.4
Millet, finger	202	6.5	24233	6.1	10.7	5	1.6	0.1	0	8.3	5.2	5.5	6.6	0.7	0	19.3	6	6.2
Green peas	97	3.1	56258	14.2	0.7	1	0.1	1.1	7.2	2.2	1.4	0.7	2.2	1.5	0	1.4	2.2	0.7
Variegated color beans	147	4.8	15419	3.9	8.3	11.9	1.1	0	1.2	16	5.7	2	9.9	27.8	0	5.8	8.3	8.7
Green grams	87	2.8	13419	3.4	4.5	7.8	0.7	0.1	0	6.2	6.2	6.6	6.2	4.4	0	4.1	7.5	6
Wheat flour	171	5.5	13898	3.5	9.4	8.7	1.9	0	0	8.8	5.6	17.2	7	1.8	0	1.9	7	12
Tomato paste, concentrated, canned	2	0.1	970	0.2	0	0	0	0	0.1	0	0.1	0.1	0.1	0	0	0.1	0.1	0
Kale	466	15.1	26816	6.7	3.7	7.5	2.7	50.4	69.7	7.8	11.1	5.4	17.9	23.6	0	24.3	7.6	6.7
Total	3085	100	397575	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
% target met					100	275	100	275	666	221	179	222	211	277	104	102	100	203

ANNEX H: FHAB CENTRAL AGROPASTORAL LZ

The edible weight and cost of foods selected for the family for a nutritious Food Habits Diet with the percentage contributed by each food to macronutrients and eight vitamins and four minerals in the Samburu Central Agropastoral livelihood zone

Food List	Quantity (Kg)	% quantity	Cost (KE S)	% cost	% energy	% protein	% fat	% vit A	% vit C	% vit B1	% vit B2	% niacin	% vit B6	% foliacid	% vit B12	% calcium	% iron	% zinc
Swiss chard	218	6.3	16,798	4.5	0.7	1.4	0.3	14.2	7.8	1.4	3.3	0.9	3.1	1.3	0.0	4.0	4.3	1.9
Avocado	21	0.6	2,508	0.7	0.6	0.2	1.9	0.0	0.3	0.2	0.5	0.4	0.8	0.7	0.0	0.1	0.1	0.3
Bean, kidney/red	105	3.0	10,970	2.9	5.5	8.6	0.8	0.0	0.4	6.6	2.7	6.5	4.6	14.8	0.0	2.7	8.7	7.0
Beef meat	34	1.0	23,570	6.3	1.3	2.3	3.6	0.0	0.0	0.5	0.9	1.2	1.9	0.1	11.0	0.1	3.6	3.1
Breast milk	194	5.6	0	0.0	2.0	0.7	4.7	2.1	0.9	0.6	1.2	0.9	0.3	0.7	2.0	1.9	0.0	0.6
Chicken, whole, ready to cook	19	0.5	14,317	3.8	0.4	0.9	1.1	0.1	0.0	0.1	0.4	1.1	0.3	0.0	0.2	0.0	0.7	0.4
Egg, chicken	142	4.1	49,631	13.2	3.5	6.3	9.0	5.6	0.0	1.5	11.9	3.8	2.4	2.6	16.6	2.5	9.2	3.6
Goat liver	2	0.1	865	0.2	0.0	0.1	0.0	6.6	0.0	0.0	0.9	0.3	0.1	0.2	18.2	0.0	0.6	0.2
Goat intestines and stomach	47	1.4	18,261	4.9	0.9	1.9	2.4	0.0	0.0	0.3	0.6	1.7	1.0	0.1	4.3	0.0	2.1	2.0
Goat meat	41	1.2	27,641	7.4	1.1	2.6	2.7	0.0	0.0	1.1	2.0	2.6	2.3	0.1	5.0	0.2	5.3	3.3
Lentils	34	1.0	6,691	1.8	1.8	3.5	0.2	0.0	0.0	4.1	0.8	2.3	1.7	0.5	0.0	0.3	1.9	3.2
Hydrogenated vegetable oil	59	1.7	12,612	3.4	8.5	0.0	36.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CONTACT



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This report is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents of this report are the responsibility of Mercy Corps and do not necessarily reflect the views of USAID or the United States Government.

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