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Use of Trials of Improved Practices (TIPs) to Improve Complementary Feeding, Including the Consumption of Preserved Foods, in Isiolo and Marsabit Counties, Kenya

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List of Abbreviations and Acronyms

ASALs	Arid and Semi-Arid Lands
BHA	Bureau of Humanitarian Assistance
CIDP	County Integrated Development Plan
CRS	Catholic Relief Services
DFSA	Development Food Security Activity
FGDs	Focus Group Discussions
GAM	Global Acute Malnutrition
IBTCI	International Business & Technical Consultants, Inc.
IDIs	In-Depth Interviews
IYCF	Infant and Young Child Feeding
KABP	Knowledge, Attitudes, Beliefs and Practices
KHIS	Kenya Health Information Systems
KIIs	Key Informant Interviews
LRA	Long Rains Assessment
MIYCN	Maternal Infant and Young Child Nutrition
MOH	Ministry of Health
NDMA	National Drought Management Authority
SMART	Standardized Monitoring and Assessment of Relief and Transitions
TIPs	Trials of Improved Practices
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development

Table 1: Local Terms and Definitions

Almathau	**Traditional prayer ceremony during which fermented milk is blessed and served**
Anjera	Pancake made from fermented wheat flour
Bute/Dhibbe/Dhool/Thol/	Traditional container for storing preserved meat
Dujum/Duyum	Traditional wooden straws/pipes with holes in both ends
Fontuma	Grounded fried meat
Galeni	Metallic container for storing mandazi and preserved meat
Gorf/Soror	Traditional container for storing milk
Ititu	Fermented milk
Jajia	Thread-like strips of meat cut for drying
Koche/Qimiti/Nyirnyiri/Galangal	Small pieces of fried meat
Kurkude/Thub/Guguble	Fried fatty meat
Liter	Plastic storage container
Moye	Wooden equipment used for pounding food
Qalqalch/Dhakar/Mader/Quorasum /Urur/Bisik	Special plant used for smoking storage containers which imparts a pleasant scent or flavor
Qodha	Traditional storage container made through weaving
Ree	General term for sheep and goats
Sorio	Passover ceremony among the Rendille, Samburu, Gabra and Borana where animals are slaughtered for meat and preserved.
Suusa	Fermented camel milk

Local names according to Rendille, Samburu, Borana, Gabra and Sakuye tribes

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Executive Summary

The Nawiri program is a 5-year Resilience Food Security Activity (RFSA) program funded by the U. S. Agency for International Development-Bureau of Humanitarian Assistance (USAID-BHA). The program's goal is to sustainably reduce persistent levels of acute malnutrition among vulnerable populations utilizing a phased approach that involves: 1) learning to inform programming in the first phase (2019–2021); and 2) filling knowledge gaps through implementation in the second phase (2021–2024). This implementation research study explored strategies for improving complementary feeding practices for children 6 to 23 months of age, including practices around feeding of preserved foods, using trials of improved practices (TIPs) methodology in northern Kenya. This study was undertaken in Isiolo and Marsabit counties in the Arid and Semi-Arid Lands (ASALs) of Kenya. Both counties experience high levels of global acute malnutrition (18% in Marsabit and 9.2% in Isiolo in 2019[a]) due to the seasonal variation in food availability in Kenya's ASALs as households often do not have access to year-round nutritious and safe foods. The seasonality in food availability presents a major challenge, especially during the dry season, as recurrent drought and lack of rains affect infant and young child nutrition and contribute to the intergenerational cycle of malnutrition and disease burden.

To mitigate the challenges associated with seasonal barriers to accessing food, pastoralists and agropastoralists in Isiolo and Marsabit counties have relied on indigenous knowledge and food preservation techniques such as drying and salting meat, fermenting milk to increase shelf life and prevent spoilage, and smoking storage containers to impart flavor. While local preserved foods, such as meat and fermented milk, are routinely fed to older children, these foods are generally not part of the carbohydrate-focused diets of young children ages 6 to 23 months. Thus, preserved foods present an opportunity to provide a low-cost, shelf-stable, and nutritious solution to young children, who are vulnerable to acute and chronic malnutrition and micronutrient deficiencies. Unfortunately, traditional food preservation practices are steadily disappearing thanks to lifestyle changes associated with globalization and modernization. Furthermore, among populations who continue to retain indigenous knowledge of food preservation, household practices may be weakened by poor hygiene, leading to low nutrient bioavailability and food safety concerns. Together, these challenges lead to gaps in food preservation practices that further increase food insecurity for populations most vulnerable to its effects.

Methods

Using TIPs, a participatory formative research approach developed by the Manoff Group, the study was conducted in two rounds—round one (February 15–March 11, 2021), during the dry season, and round two (May 18 – 27, 2021), during the rainy season—to explore the possibility of improving complementary feeding through the use of traditionally preserved food, year-round. Subsequently, the research team coded all data from interview transcripts using Dedoose software to identify themes, subthemes, and illustrative quotes. Food frequency was calculated according to foods consumed by young children on a daily and weekly basis. In total, the study had the following participants: 60 mothers (17 to 52 year of age) of children ages 6 to 23 months in TIPs; 26 fathers (21 to 61 years of age) of children ages 6 to 23 months in focus group discussions (FGDs); 12 elder women (60 to 86 years of age) in in-depth interviews (IDIs); and 8 government officials in key informant interviews (KIIs). All TIPs, IDI and FGD participants were from

[a] Integrated Smart Survey 2019

pastoralist and agropastoral communities, which herd animals (goats, camels, cattle and sheep) and have frequent access to animal source foods (milk, fermented milk, meat, animal organs).

Key Findings

The study communities were animal herders who rely on raising and/ or selling livestock. Most participants mentioned that during the dry season livestock are often emaciated and sold for lower prices. During the dry season, some participants sold their livestock or slaughtered and sold the meat to butcheries. During the rainy season mothers, fathers and elder women described animals as being healthier with higher quality meat, animals which are kept for reproduction.

Food Access – At Home: Despite proximity to animal-source foods, large animals (i.e., cattle and camels) are rarely slaughtered except in cases of sickness, emaciation, or injury (which often occur during dry seasons). On the other hand, small animals such as goats and sheep are often slaughtered and immediately consumed, in quantities deemed insufficient for food preservation. While more animals like goats and sheep are slaughtered during religious ceremonies and consumed communally, these occasions did not ensure increased an availability of meat to preserve. Study participants mentioned that while milk and meat are preserved during the rainy season, the preserved food is not of sufficient quantities to last through the dry season. Animals' migration to areas with greater access to pasture and water during the dry seasons means less milk and meat available for preservation, as experienced during the study period when rainfall was inadequate.

Food Access – Markets: Some families purchased meat and milk from local butcheries and shops. In addition, some mothers and fathers relayed not having enough money to purchase food, resulting either in borrowing money to buy food, and/or getting food on credit from local shops. Most study participants found access and availability of fresh fruits and vegetables to be inadequate (i.e., only sold 1 day per week), even amongst agro-pastoral communities and especially during the dry season. In both counties poor road infrastructure, long distances to markets and limited market days have led to increased food prices and poor-quality fruits and vegetables. Key informant stakeholders noted that prices further increased since the onset of the COVID-19 pandemic.

Food Preservation Methods – Meat, milk and other foods: Study communities practice various food and milk preservation techniques, including fermentation of milk and drying and frying of meat. After slaughtering these animals, specific parts of the animal (primarily boneless animal meat) are preserved through processes including air-drying for several hours/ days or frying meat in animal fat or oil. Goat or cow milk is commonly preserved through fermentation, but camel milk consistency perceived as *"too watery"* for fermentation. To preserve cow and/ or goat milk, fresh unboiled milk is put inside traditional gourds or plastic containers that are smoked using tree branches or bark, which impart flavor and extend their shelf life. Most study participants believed that using unboiled fresh milk for fermentation is important to retain the sweetness, nutrient-rich qualities and/ or taste of the milk. Besides preserving milk and meat, many study participants also mentioned preserving mandazi, maize and animal fat/ ghee for their families. The preservation of fruits and vegetables was not mentioned and does not nor occur in these households, although most key informants say they have encouraged the preservation of fruits and vegetables among community women's groups.

Food Safety and hygiene: Most participants relayed the importance of properly preparing and storing foods to ensure the safety of preserved foods. They also agreed that if meat is not "*fried well*" for preservation, mold will grow when it is stored. The majority clean storage containers with soap and water

and regularly smoked containers to increase the foods' shelf life, kill bacteria and prevent a foul smell. Some emphasized the importance of using cutlery instead of hands to serve food. Challenges to storing preserved foods mentioned included inadequate fresh milk to add to the fermented milk daily, especially during dry seasons, and humidity during the rainy season, which cause rapid food spoilage thereby undermining preservation. Food safety and hygiene challenges mentioned include the use of uninspected meat, especially during ceremonies, due to "a shortage of meat inspectors" across local slaughterhouses and communities; slaughtering of sick animals for food; not cleaning animal udders prior to milking, shortage of clean water and siphoning whey using the mouth.

Food Preservation Roles and Norms: In both counties it was unanimous that the preservation of meat, milk, mandazi and ghee are a *"woman's domain"*, while fathers slaughter animals in preparation for preservation. Preserved meat is usually kept for consumption by male household members. Some participants explained that a woman risks "*losing her respect"* in the community if she eats food preserved specifically for men. Furthermore, women and children are forbidden to consume particular foods and animal parts like the tongue, given beliefs that children "*will talk excessively*", sheep meat which "*will delay the children's speech"* and goat milk, which will "*cause children to be restless"*. Mothers typically eat last, after other family members.

Transfer of food preservation knowledge and advice through elders: Most study participants said related knowledge is passed down through generations. Yet certain communities relayed being "*modernized"*, meaning that traditional methods of preservation are no longer practiced due to the availability of other foods in local shops and lack of time to preserve foods. Families often turn to readily available packaged food in shops such as boxed milk, meat, rice, beans, pasta, and flour. Moreover, traditional storage containers are no longer being made so generally unavailable, with mothers using plastic and metallic containers for meat and milk preservation. The common use of plastic containers (known as '*liters*'), is more conducive to food spoilage according to some mothers, fathers and elder women.

Breastfeeding Practices & the introduction of foods prior to 6 months of age: Most mothers stated that they exclusively breastfeed their children for 6 months, with all mothers continuing to breastfeed through 2 years of age. Based on health worker advice, many mothers practice exclusive breastfeeding, although, some mothers introduced animal milk for infants, only two months old. Notably, the early introduction of fresh goat, camel or cow milk fed alongside breastmilk is a common practice which disrupts exclusive breastfeeding.

Complementary Feeding (including preserved foods): Most mothers had limited knowledge on complementary feeding, with continued reliance on animal milk which featured prominently in children's diets, alongside soft carbohydrate-rich foods, and milky tea. Children had inadequate intake of both quantity and quality food, including meats, vitamin A-rich fruits and vegetables, pulses, and legumes and eggs. Nutrient-dense preserved foods like meat and milk were not always fed to young children 6-23 months old, with religious beliefs prohibiting feeding young children chicken or eggs. Participants also expressed beliefs around feeding young children preserved foods, e.g., that meat causes constipation or stomach aches, fermented milk causes diarrhea, and that preserved animal meat should be reserved for adults and older children, but not given to young children who "*cannot chew*" or "*have no teeth*". Fermented milk, a common preserved food in these communities, was considered "too sour" for young children, leading to adding sugar to sweeten fermented milk, or diluting it with fresh milk or water to make it "lighter" for digestion. Sometimes, small pieces of preserved meat and sheep tail fat are given to young children to suck (but generally not swallow) as a treat.

Weak institutional food preservation capacity*:* In both counties, no policies or legislation currently exists to guide food preservation and related multi-stakeholder collaboration remains limited as does county-level funding for food preservation activities, which rely largely on development partner/ donor funding. Furthermore, neither county has the laboratory facilities or the capacity to conduct milk and meat food safety tests, apart from testing dried cereals for aflatoxin and moisture. Consequently, no preserved food samples were collected for testing.

Daily & Weekly Food Frequencies: According to the daily food frequency data, animal milk (i.e., cow/goat/camel) was a prominent feature of young children's diets, alongside cereals and carbohydrate-rich foods like potatoes, *anjera* and porridge. In Isiolo County, legumes, and pulses (i.e., beans and green grams) were the foods most frequently consumed weekly, making up nearly one-third (TIPS 1 visit) and one-fifth (TIPS 3 visit) of the foods consumed by children 12-23 months old. The weekly consumption of Vitamin A-rich fruits and vegetables (carrots, mangoes, and kale) showed a large increase from 17% amongst children 6 - 11 months old, between the TIPS 1st and 3rd visits. In Marsabit County, legumes and pulses made up 17% of foods consumed by older children (12 -23 months old) and only 6% of younger children (6-11 months old) during TIPS #1.

Applying the Findings and Lessons Learned

Overall, mothers had greater success implementing TIPs recommendations during the dry season than the rainy season, as livestock stayed in the fora (i.e., migrated for pasture) due to lack of rainfall. Most mothers relayed challenges with unavailability of the foods for preservation and in both counties, the most successful TIPs recommendations were increasing the frequency and amount of food for young children, increasing fruits and vegetables, and stopping feeding unhealthy snacks like commercial fruit juices, soda, biscuits, and sweets. Not all TIPs recommended practices were carried out (e.g., preserving foods, delaying animal milk during the first six months, stopping giving young children tea, with or without milk), due to factors including the lack of foods to preserve, inadequate money to purchase food, contradictory advice from family members and lack of time to practice some recommendations.

Key Recommendations for CRS-Nawiri Support

- **Build health and nutrition promotion strategies** using the culturally resonant and community-tested TIPS counseling guide, alongside other county IYCF resources, to improve children's nutritional outcomes including dietary diversity.
- **Train community health volunteers (CHVs) to counsel mothers to diversify young children's diets,** including using preserved foods, boiling milk prior to fermentation, feeding children fermented milk without adding sugar, not chewing food for their children, feeding modified preserved meats, more fruits and vegetables, chicken/eggs to children, in line with optimal meal frequency and quantities per age group.
- **Strengthen the food supply chain** to ensure the local availability of safe and fresh nutritious foods, including fruits and vegetables, throughout the week.
- **Strengthen the purchasing power of households** to ensure food affordability, especially vegetables and fruits.
    - Have CHVs work alongside mothers and families to **preserve locally available foods,** including fruits (i.e., wild fruits) and vegetables (i.e., spinach, kale), following market days.
    - **Enhance multi-sectoral collaboration between different line departments** in the counties and sub-counties, to help improve household food and nutrition security, safe and hygienic food preservation practices and community education using the TIPS counseling guide.

- **Conduct multi-sectoral trainings** with Ministries of Health and Agriculture **that target households at community level,** especially on the preservation of local fruits and vegetables available within local markets, like mangoes and kale.
- **Encourage communities with water access (including rainy season and along the riverine)** to **engage in small-scale gardens** (vegetables like spinach and kale and wild/ local fruits), with Ministry of Agriculture collaboration.
- **Advocate for multi-sectoral resource allocation at county level** for activities that enhance food security and safety, including training mothers/ others on complementary feeding, food safety and hygiene and establishing home gardens where feasible.
- **Develop or adapt an integrated food security policy** specific to ASAL counties.

Many of the above recommendations align closely with those stemming from wider Nawiri Phase 1 collaboration, research and learning reports, making for fertile ground to start implementing these recommendations collaboratively moving forward.

1.0 Introduction and Objectives

1.1 Background information

Arid and semi-arid lands of Kenya, including Isiolo and Marsabit counties, continue to experience recurrent acute malnutrition amongst children under 5 years of age, within Laisamis and North Horr, Marsabit County and some wards (Moyale and Saku in Isiolo County).[2] Children under 2 years of age are at a higher risk of acute malnutrition during this period of rapid growth and development, as Kenya Demographic and Health Survey[3] data confirms that wasting levels are highest in children ages 6 to 8 months and ages 9 to 11 months, consistent with the complementary feeding period. Most households in Isiolo and Marsabit counties do not have sufficient access to a year-round supply of nutritious and safe food, due to seasonal availability of foods, recurrent drought and lack of rains. Seasonal migration of animals (i.e., cattle, goats) also has implications for families' access to meat and milk, especially for household members who do not migrate with their livestock—mostly women, children and the elderly. According to Demographic Health Survey (DHS) data, only 15.5% and 39.7% of children ages 6 to 23 months consume four out of the seven recommended food groups in Marsabit and Isiolo counties, respectively.[4,5]

Locally available indigenous foods are often viewed as acceptable, low-cost, shelf stable and nutritious for vulnerable groups, including the Kenyan ASALs. Pastoralists and agropastoralists have relied on indigenous traditional food preservation methods and knowledge to increase shelf life, prevent spoilage and enhance flavor of food items, such as meat and milk, through frying, drying and fermentation processes outlined in Table 3. Yet, limited food preservation knowledge and practices, alongside poor hygienic behaviors, may affect the safety of preserved foods, as well as nutrient retention. In addition, traditional food preservation practices which were passed down from generation to generation have been lost over the years due to modernization,[6] leaving a gap in food preservation knowledge and practices that may exacerbate food insecurity. While traditional foods are preserved and consumed by adults, whether these foods are appropriate or are fed to young children (i.e., complementary feeding) is a key gap in the reviewed literature. In Marsabit and Isiolo counties, complementary foods are usually largely limited to porridge, milk, Irish potatoes, rice, ugali and tea.[7] This study noted that fermented milk and meat stews (i.e., served mainly with ugali and spaghetti) and beans with tomatoes/cow pea leaves were consumed by families, yet not fed to children,[7] though reasons for these practices were neither collected nor published. It is important to ensure nutrient-dense foods are available to young children 6 to 23 months of age, who are vulnerable to acute and chronic malnutrition as well as micronutrient deficiencies. In ASALs, ensuring the extended shelf life of nutrient-dense foods, and their potential to improve food and nutrition security among young children, has not been examined. To date, there is a lack of specific guidance on how families can prepare and store high nutrient value foods, with extended shelf life, for complementary feeding.

Nawiri is a 5-year Resilience Food Security Activity (RFSA) project funded by the U.S. Agency for International Development-Bureau of Humanitarian Assistance (USAID-BHA). CRS, the official international humanitarian agency of the Catholic community in the United States, is leading a consortium of partners, including Concern Worldwide, Village Enterprise, Tufts University, Feinstein International Center, Friedman School of Nutrition Science and Policy, Global Alliance for Improved Nutrition (GAIN), International Business and Technical Consults, Inc. (IBTCI) and the Manoff Group, to implement the Nawiri program in Isiolo and Marsabit counties, Kenya. The program's goal is to sustainably reduce persistent

levels of acute malnutrition among vulnerable populations using a phased approach. The first phase (2019–2021) involves collaborative research and learning to inform programming and address critical evidence gaps. The second phase (2021–2024) focuses on a systems-driven, evidence-based implementation of the program interventions informed by findings from phase

1. Consequently, the CRS-led Nawiri project supported a study on using TIPs to increase consumption of preserved and high nutrient-value foods with extended shelf life for complementary feeding practices of young children, 6 to 23 months of age, in Isiolo and Marsabit counties to provide insights in 1) ensuring year-round availability of such preserved foods

2. Encourage families to feed infants and young children these preserved nutrient-dense foods to sustainably reduce acute malnutrition. Beyond these strategies, the Nawiri program is exploring additional strategies for improving year-round availability and accessibility to nutritious foods that are not explicitly described in this report or examined in this study.

1.2 Research Question and Study Objectives

The main research question was:

"How best can consumption practices of preserved food[b] *among children ages 6 to 23 months be improved using nutrient-dense locally available food items with extended shelf life for year-round optimal complementary feeding in pastoral and agropastoral communities of Isiolo and Marsabit counties?"*

The primary objective of this study was to identify safe food preservation techniques for complementary feeding of young children 6 to 23 months of age.

The specific secondary objectives of this research study were to:

1. Identify ways to **improve complementary feeding, within the context of traditional food preservation practices**, which extend the shelf life and availability of nutritious foods, during dry and rainy seasons in Isiolo and Marsabit counties, Kenya.

2. Explore **barriers and facilitating factors** to complementary feeding and use of preserved foods for feeding children 6 to 23 months of age in Isiolo and Marsabit counties, Kenya.

3. Formulate **recommendations for program implementation** based on objectives 1 and 2, above. Study households where IDIs with mothers of children ages 6 to 23 months were conducted were selected on the basis of previous experiences with food preservation. It was determined that seven to 10 days was long enough to practice and observe food preservation based on the methods that the communities were currently using.

[b] Preserved food is defined in this report as any substance (meat, milk, vegetables, animal fat, fruits, maize) whose shelf life has been extended through fermentation, drying, frying and adding other chemicals to prevent spoilage and maintain nutritive value.

2.0 Methodology

2.1 Desk Review

The research team conducted a desk review of peer reviewed and gray literature to identify traditional food preservation practices in Kenya and similar ASAL contexts. In addition, reports and policies developed by the Ministry of Agriculture and Ministry of Health, as well as other publications related to food preservation practices, were examined. A review of these documents deepened the research team's understanding of traditional food preservation practices, and the role of these food items in the diets of young children in ASALs contexts and guided the team in refining the data collection tools.

The online databases used in the literature search were Pro Quest and PubMed. The search was restricted to studies from January 2010–December 2020 and was carried out December 2, 2020, to December 16, 2020. A combination of relevant terms and key words for conducting these literature review searches included the following, shown in Box 1:

Box 1. Literature search terms, traditional food preservation practices

"food preservation and Kenya," "food processing and Kenya," "food preservation and pastoral communities," "food drying techniques and Kenya," "fruit processing and Kenya," "vegetable preservation and Kenya," "meat preservation and Kenya," "milk preservation and processing and Kenya," "post-harvest handling and Kenya," "fermentation and Kenya," "indigenous food preservation and Africa," "post-harvest storage methods and Kenya," "indigenous food processing" and "Africa," "indigenous knowledge" and "food preservation" and "Africa," "indigenous knowledge" and "food security" and "Africa," "fermented dairy products" and "Africa," "food storage and Kenya," "fruit and vegetable fermentation" and "Africa," "fruit and vegetable preservation" and "Kenya," "meat preservation" and "pastoral communities," "milk fermentation" and "Kenya," "milk preservation" and "Kenya," "postharvest storage" and "Kenya," "postharvest management" and "Kenya," "traditional butter production" and "Africa."

2.2 Summary of literature review

Details of the literature review are in Annex 1.

Methods of food preservation: A variety of food preservation methods and techniques that pastoralists have traditionally used are continually in use, even today. These techniques include salting, smoking, drying, blanching, roasting, fermentation and hanging in baskets.[6,8–10] In Marsabit County, Kenya, Borana pastoralist women were responsible for preserving food and passing down preservation techniques to younger generations.[9]

Preservation of milk: Milk is one of the most commonly preserved foods among pastoralists in Africa due to its widespread availability.[11–14] Camel milk accounts for 60% of total nutrient intake among communities in ASAL and is an important source of Vitamin C, which is needed due to a scarcity of fruits and vegetables.[13] In Isiolo County, camel milk is most frequently consumed raw, but traditional strategies to extend the shelf life of milk are often observed, such as fermentation and smoking of storage containers.[13,14] Fermentation of milk has been observed as a strategy to improve the functionality and

digestibility of milk in Kenya.[15] *Ititu* (fermented milk) is a common product of milk fermentation among Borana pastoralists,[11] made by churning milk and adding fresh milk over several days in traditional bottle gourds. To clean equipment used for milk preservation, smoking (i.e., fumigation) is frequently used among pastoralist communities in Isiolo County and throughout Kenya[13,14,16] to reduce bacterial growth, extend shelf life and improve flavor.[12–14,16]

Preservation of meat: In addition to milk, meat is also preserved among pastoralists in Kenya.[8,9,17] Red meat (derived from cattle, sheep, goats and camels) accounts for 80% of all available meat in pastoralist regions in Kenya.[18] Meat is commonly smoked, roasted or deep fried by women in the household.[9] Meat preservation occurs most often around special occasions, and a cross-sectional study in Marsabit County found only 16% of Borana households had traditional meat products at the time the study was conducted.[19]

Preservation of maize, vegetables and fruits: Maize can also be harvested and preserved for home consumption in Kenya.[8,20,21] Maize is commonly sprayed with chemical insecticides for preservation or is often sundried.[20] Common challenges to maize preservation have been reported in the literature and include aflatoxin contamination and exposure to rodents, insects, birds or rain.[21] Aside from maize, fruits and vegetables are not regular features in pastoralists' diets.[22] Traditional drying techniques for fruits and vegetables in African countries include sun drying, solar drying, solar energy drying, blanching and drying fermentation.[23] Scaling up both traditional and modern methods of fruit and vegetable preservation as a means of increasing year-round availability of nutritious foods represents a growing area of interest among country stakeholders that would require multisectoral collaboration to improve access to technologies to mitigate post-harvest losses.[24,25] Successful examples of fruit and vegetable preservation in Africa include sweet potato chips in Zambia, banana leaves in Uganda and guava in Kenya.[24, 25]

Challenges in food preservation: Animals are a sign of wealth and prestige within pastoral communities; therefore, they aren't slaughtered routinely, which leads to inadequate consumption of meat and meat byproducts—leading to challenges with food access.[26] This is further hampered by drought, insecurity and inadequate infrastructure.[27] Challenges with food safety and animal milk hygiene include lack of proper cleaning of storage containers, lack of hand-washing and cleaning of animal udders before and during milking,[11,14] sharing of cups used to drink fermented milk and serving fermented milk by hand, due to its thickness.[11] in addition, spoilage of milk was attributed to poor hygienic practices.[13] Furthermore, technologies and hygienic practices promoted by stakeholders may run contrary to the culture of pastoralists. For example, boiling milk during fermentation has been recommended but has not been widely adopted because, among some, it may be seen as uncommon or unacceptable.[22] Post-harvest loss of not only vegetables and fruits but also meat is a common challenge in food preservation in pastoralist communities in Kenya.[18] In addition, gaps in infrastructure to transport and sell preserved food represent a barrier to scaling up and sustaining food preservation.[6] For this reason, traditional food preservation practices represent a potential solution to improving food availability throughout all seasons that aligns with local cultures and customs.

Traditional food preservation methods have been passed down from generation to generation by pastoralists, but methods may have been lost over the years.[6,9,18] In Marsabit County, a qualitative study found that women over 50 years old play a pivotal role in the generational transfer of knowledge on traditional meat preservation, as they frequently pass down knowledge to their daughters about traditional skills and practices.[9] Yet, village elders reported meat being preserved less frequently and relayed that fewer methods were employed today compared with past generations.[9] Gaps in transfer of

skills and knowledge among pastoralist communities may be related to scarcity of traditional food preservation equipment, such as traditional wooden vessels used for fermenting milk.[18]

Infant and young child nutrition: In addition to being recognized as bearers of knowledge on traditional food preservation methods,[9] elder women (grandmothers, mothers-in-law) often provide advice regarding infant and young child nutrition in pastoralist communities in Northern Kenya.[4,5] Data from Marsabit and Isiolo counties found elder women alongside health care providers (e.g., health facility workers, community health volunteers) were the main sources of information on infant and young child nutrition.[4,28] The support of these influencers, as well as fathers, was a facilitating factor to appropriate complementary feeding in Marsabit County, while positive community attitudes toward breastfeeding—and complementary feeding and mothers' knowledge of complementary feeding—contributed to sustained and appropriate infant and young child feeding in Isiolo County.[4,5]

Nonetheless, gaps in child feeding practices were found to exist, as consumption of iron-rich and iron-fortified foods was poor (20.2%) in Marsabit County and low (43.3 %) in Isiolo County.[4,5] Furthermore, although 75.7% of mothers breastfed exclusively until at least six months in Marsabit County, some mothers introduced complementary foods like porridge, anjera or animal milk as early as three months.[4] In Marsabit County, the main barriers to appropriate complementary feeding included food and nutrition insecurity, poverty, prolonged drought and gaps in infant and young child feeding knowledge among mothers.[4] Similarly, in Isiolo County, barriers to appropriate complementary feeding included food insecurity, gaps in infant and young child feeding knowledge, maternal workload and family conflict.[5]

2.3 Study site and sampling

The study took place in two counties in northern Kenya, Marsabit and Isiolo counties. A short summary of the geographic location and related characteristics of these areas (acute malnutrition rates, ethnic groups, livelihoods zones) of the counties are as follows:

Marsabit county is located in the upper northeastern region of Kenya bordering Ethiopia, with four subcounties: Laisamis, North Horr, Saku and Moyale. The major livelihood zones in the county are comprised of pastoralists (81%), agropastoralists (16%) and those (3%) engaged in other employment (formal employment, casual wage labor, petty trade and fisheries). Pastoralists are dominant in almost all subcounties, with agropastoralists most notable in Saku and some parts of Moyale subcounty. The county is primarily composed of different ethnic groups including the Gabra, Rendille, Borana, Turkana, Samburu, Burji, El Molo, Dassanach and Waata (Marsabit County SMART Survey, 2019). The 2019 SMART survey reported Global Acute Malnutrition (GAM) rates of 18%, indicating a decline in child nutrition status compared to 12.4% reported in 2018 attributed to prolonged drought. Subcounties with the highest prevalence of GAM were defined as "*hot spots*" for acute malnutrition and include Laisamis (30.7% GAM rates) and North Horr subcounties (25.1% GAM rates).

Isiolo County borders Marsabit County to the north and is comprised of three subcounties: Isiolo Central, Garbatulla and Merti. The livelihood zones include pastoral (67%), agropastoral (26%) and firewood traders/formal employment (7%). While several languages are spoken in the county, Isiolo largely consists of Oromo-speaking Borana and Sakuye and other languages including Turkana, Samburu, Meru and

Somali[c]. In January 2019, survey data revealed a GAM rate of 9.2%, an improvement from the 2018 GAM rate of 13.8%. The subcounty with the highest malnutrition rate[d] is Merti subcounty.

Study sites were purposively chosen based on the following criteria: areas of high malnutrition according to data from the Nawiri hot spot mapping study, areas where the main livelihood includes pastoralists and agropastoralists, areas that are secure with minimal conflict and areas that are accessible during the rainy season. An additional criterion included the selection of predominant ethnic groups: Borana in Isiolo and Rendille, Samburu and Gabra in Marsabit. In addition, Sakuye and Gabra tribes in Isiolo County were also among those sampled as they had settled and intermarried with the Borana. The TIPs study was conducted in two rounds: round one was conducted during the dry season (from February 15, 2021–March 11, 2021), and round two was conducted during the rainy season (between May 18, 2021–May 27, 2021). The aim of including two rounds of data collection was to develop recommendations to ensure year-round availability of preserved foods for optimal complementary feeding.

County	Subcounty	Ward	Health Facility	Village
Marsabit	Laisamis	Logologo Ward	Logologo Health Center	Lbaarok 2 Village (hotspot)
				Odhola Village (hotspot)
			Kamboe Dispensary	Ldonyo Village (non-hotpot)
	North Horr	Maikona Ward	Maikona Health Center	Boji Village (hotspot)
				Gamura Village (hotspot)
			Hurri Hills Dispensary	Gubba Village (non-hotpot)
Isiolo	Merti	Charri Ward	Bulesa Health Center	Godha B Village (hotspot)
				Manyatta Box 1 Village (hotspot)
			Bilingo Marara Dispensary	Marara A Village (non-hotspot)

Table 2: Study site (wards and villages), Isiolo and Marsabit Counties

Mothers with children ages 6 to 23 months (*n*=60) were purposively selected from the three study sites (Logologo, Maikona and Charri wards); 30 mothers were reached in the dry season and an additional 30 were reached in the rainy season. The children were stratified into the following age groups: 6 to 8 months, 9 to 11 months and 12 to 23 months to capture any differences in cultural beliefs, practices and consumption of preserved foods in light of complementary feeding practices. Data from the Nawiri hotspot mapping study was used to identify subcounties and wards with the highest prevalence of GAM (hotspots) while those with the lowest rates within the hotspots were identified as non-hotspots.[e] A total of 24 women in Marsabit and 16 women in Isiolo were purposively sampled in hotspot areas, while 12 women in Marsabit and 8 women in Isiolo were purposively sampled in non-hotspot areas (see Table 2). In addition, a total of 60 TIPs visits were conducted for TIPs #1, which was merged with TIPs #2. Fifty-eight visits for TIPs #3 were conducted between seven and 10 days after TIPs #1 and TIPs #2.

c CIDP 2018-2022

d Note: There are certain wards in Isiolo central subcounty (Ngaremara and Oldonyiro) which have higher GAM rates than Merti subcounty.

[e] Sophie Ocholla, Judith Munga, and Elijah Odundo, E. (2021) Malnutrition Hotspot Analysis and Mapping for the Nawiri Project in Isiolo County

In-depth interviews (IDIs) with elderly women (n=12), focus group discussions (FGDs) with fathers (n=6) and key informant interviews (KIIs) with stakeholders (n=8) were conducted in both counties before commencement of TIPs, which was triangulated with information from mothers' interviews. Fathers and elderly women were randomly selected from the same sites as TIPs #1, while key informants were purposively sampled from the county, subcounty and ward levels of the study counties and included officers from the following departments: agricultural extension, home economics, nutrition, agribusiness, agri-nutrition and livestock. The study team contacted the participants and obtained informed oral consent before conducting the interviews. All interviews were conducted in adherence to COVID 19 regulations.

Table 3: Study site, sample size, type of data collected during dry and rainy seasons,

Isiolo and Marsabit Counties

Data collection methodology	County	Subcounty*	Hotspot	Non-hotspot	Total
TIPs** Round 1	Isiolo	Merti	8	4	12 (24 visits)
TIPs** Round 2	Isiolo	Merti	8	4	12 (24 visits)
TIPs** Round 1	Marsabit	Laisamis	6	3	9 (18 visits)
TIPs** Round 2	Marsabit	Laisamis	6	3	9 (18 visits)
TIPs** Round 1	Marsabit	North Horr	6	3	9 (18 visits)
TIPs** Round 2	Marsabit	North Horr	6	3	9 (18 visits)
FGDs - fathers (n=6)-Round 1	Isiolo	Merti	1	1	2
	Marsabit	Laisamis	1	1	2
		North Horr	1	1	2
IDIs - elder women *** (n= 12)-Round 1	Isiolo	Merti	4		4
	Marsabit	Laisamis	4		4
		North Horr	4		4
KIIs- stakeholders (n=8) -Round 1	Isiolo	N/A	4		4
	Marsabit	N/A	4		4
Total					(86)

Wards noted in Table 2 ** TIPs 1 and 2 were combined, so two visits to each mother were conducted – TIPs #1-2 and TIPs #3 * IDIs with elder women not specific to hotspot/non-hotspot*

2.4 County engagement

The research team held county engagement meetings at the commencement of fieldwork, with key county and subcounty leaders from the Departments of Health and Agriculture. These meetings were held to ensure full commitment by the key county and subcounty government departments in supporting the TIPs study. During these meetings, the research team presented the proposed methodology for conducting the study and, with the county leadership, identified stakeholders from the county government for key informant interviews. The research team worked with the county and subcounty health officers and the Nawiri team to select and prioritize study sites and select households (mothers with children 6 to 23 months of age), fathers and elder women for the TIPs study.

2.5 Preparation for data collection

The research team worked with the Nawiri team to identify research interviewers, transcribers and supervisors from the local county database who had experience conducting qualitative surveys and

research, were residents of the communities and were conversant with the local language and culture. The research team developed the data collection tools in English, which were then translated into four local languages spoken by the predominant tribes in selected study sites. In Marsabit County, data collection tools were translated into the Gabra, Rendille and Samburu local languages, while the tools for Isiolo County were translated into the Borana language.

During round one of data collection, the research team carried out an in-person, five-day training for the study teams in each county to ensure that all questions were culturally appropriate and understood. In Marsabit, the pretest was conducted in Odhola and Lbarook villages in Logologo ward, Laisamis subcounty; for the Rendille and Samburu community in Segel village, Mountain ward, Saku subcounty; for the Gabra community in Bubisa Village, Turbi ward, North Horr subcounty. In Isiolo County, the pretest was conducted in Gotu village in Ngare Mara ward, Isiolo central subcounty. During the training, the participants validated the translated questionnaires, which were then refined based on the suggested changes to ensure the translation retained the original meaning of the question and were subsequently used for data collection. Additionally, a one-day refresher training was held before Round 2 of data collection.

2.6 Data collection methods

2.6.1 Trials of Improved Practices (TIPs)

Trials of improved practices (TIPs) is a participatory formative research approach that was developed by the Manoff Group. TIPs usually consist of a series of three visits.

- Visit # 1: During the first visit, mothers were interviewed about infant and young child feeding practices, cultural beliefs and perceptions, food preservation methods and food safety. A food frequency questionnaire was administered to determine the foods and liquids that are fed to children on a daily and weekly basis. Gaps in feeding practices, including preserved foods, were identified during visit #1, and counseling was conducted on the same day. Counseling was based on gaps in feeding practices, cultural beliefs and motivations identified in TIPs #1, which were described in the TIPs counseling guide.[f]

- Visit # 2: Due to long distances between households visited, the second visit was conducted on the same day as the first visit. The interviewers analyzed current practices, based on what mothers discussed during the interview, and counseled mothers based on identified gaps—negotiating feasible solutions they could try within a seven to 10-day period.

- Visit # 3: After seven to 10 days, the interviewers visited the mothers to determine if they had succeeded in carrying out the recommendations; if any modifications were made, and why; and if they would continue with the practice. In addition, the same food frequency questionnaire used in TIPs #1 was administered to learn about changes in food consumption, based on the recommendations given to the mothers, and was administered during TIPs #3.

[f] The draft counseling guide was developed using findings from the literature review. This was then updated before Round 2 using the findings from Round 1.

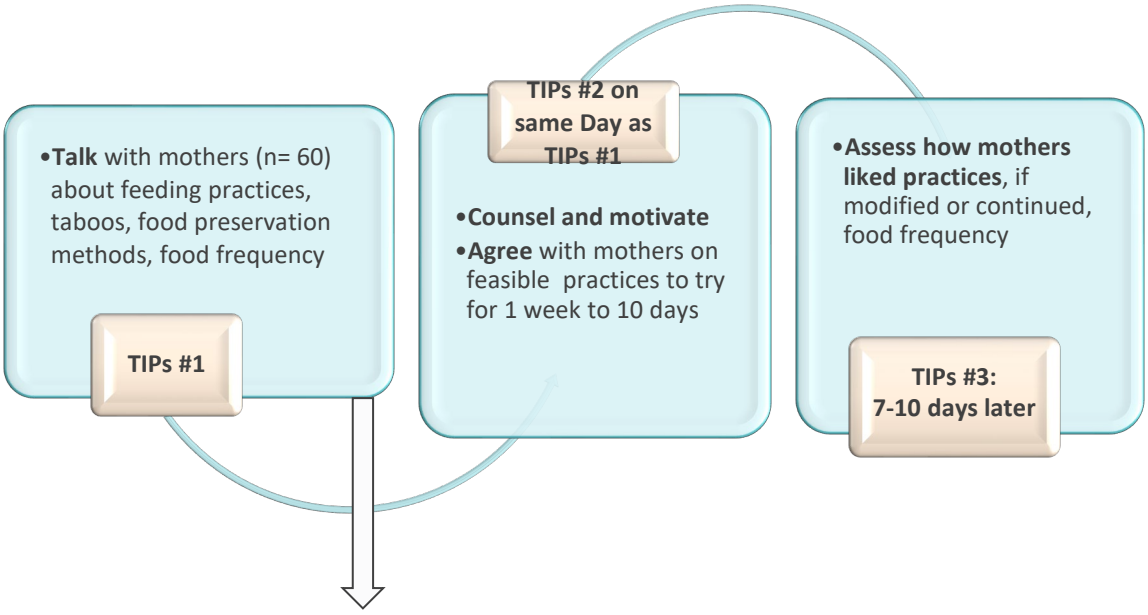


Figure 1: Trials of Improved Practices

Three study teams in Merti, two teams in Laisamis and two teams in North Horr Subcounties conducted the two consecutive TIPs visits (given TIPs #1 and #2 visits were combined on the same day), IDIs and FGDs. During TIPs #1, the study team discussed mothers' feeding practices, food preservation methods, food availability, taboos and cultural practices around complementary feeding in relation to preserved foods. Dietary intake was collected using food frequency questionnaires for all children ages 6 to 23 months during TIPs #1 and #3.

During TIPs #1 visit, initial IDIs in targeted households, food frequency (daily, weekly, monthly) and household observations provided information on perceptions, cultural beliefs, facilitating factors and barriers to complementary feeding, as well as how families currently do or do not preserve food including the use or non-use of the preserved food by families. TIPs #2 visit was carried out on the same day as TIPs #1 to reduce travel time, given the large distances the team had to cover. After TIPs #1, the team reviewed the information provided from the in-depth interview within 30 minutes to an hour of the interview, identifying gaps and challenges with food preservation and complementary feeding, which formed the basis of the prioritized key counseling messages and motivators for the mothers used during TIPs #2. During TIPs #2, which was conducted the same day as TIPs #1, the team approached the mothers with one to three small, feasible practices that they could try within a period of seven to 10 days. These actions were contextualized by cultural beliefs and perceptions, which emanated from discussions with mothers, and which were documented in the TIPs counseling guide. The TIPS guide was refined iteratively, as various gaps in feeding practices were noted throughout the study. These practices were negotiated with the mother, who then agreed to try the practices that were new to them, affordable and culturally appropriate. The agreed-upon practices between the mother and the data collector(s) were recorded. While mothers are the primary caregivers, fathers and grandmothers/mothers-in-law also influence child feeding practices, as observed in this study. Consideration was given to these and other community influencers by administering separate questionnaires for fathers and elder women, most of whom were grandmothers.

TIPs #3 was conducted between seven and 10 days after the first visit (i.e., combined TIPs #1 and TIPs #2) to allow for time to practice the recommendation on one to three small, feasible actions/practices, including the recommendation about preserving foods or use of preserved food. During the visit, the team held discussions with the mother, inquiring about her experience trying any TIPs practices that were "new" to her. In this discussion, the team asked what worked well, what challenges she experienced with the practices and whether she would continue with these practices. The modifications made to the TIPs recommendations, or the continuation of these practices and challenges, were documented. In addition, a second food frequency questionnaire was administered to determine changes in daily and weekly intake based on the counseling messages given during TIPs #2.

IDIs with elder women over 60 years of age and FGDs with fathers with children ages 6 to 23 months were conducted in the study villages before TIPs #1, and their findings were used to inform TIPs visits and recommendations for mothers. The elder women provided additional insight on traditional food preservation practices to inform actions recommended during TIPs #2. Food preservation practices and storage equipment were also ascertained by household observations and documented through photographs (when available). KIIs were conducted with the identified county and subcounty stakeholders to provide information on strategies, challenges, and opportunities on food preservation practices within the study counties. During Round 1, IDIs with elder women, FGDs with fathers, KIIs with stakeholders and TIPs with mothers of children ages 6 to 23 months were conducted. During Round 2, only TIPs data was collected. All interviews were recorded by tape recorders. Audio recordings in the local languages were directly transcribed into English for IDIs, FGDs and TIPs #1. KIIs were audio recorded in English. Transcriptions were supported by one transcriber per field team, for a total of up to four transcribers in Marsabit and three in Isiolo, each conversant in the local languages.

2.7 Communication and quality assurance

The research team and field supervisors checked the completeness of the questionnaires before leaving the study site, and periodic debriefing sessions were held with the field teams to ensure quality data collection, processes, and findings, including addressing any challenges. The supervisors (who were native speakers of the local languages of Gabra, Samburu/Rendille and Borana) checked the quality of the transcription from audio to English for accuracy and completeness. In addition, the research team conducted data quality verification for the background information for TIPs #1 and #2, FGDs, IDI respondents, TIPs #3 and food frequency.

2.8 Data analysis

An initial qualitative data coding framework was developed using the data collection tools and was refined based on the field transcripts. For quality assurance, a subset of all transcripts was read and coded by team members to ensure agreement on code organization and definition. After the team established consensus on code use, definition, and structure—developed from the initial framework—the codebook was finalized. Subsequently, coding was carried out using Dedoose software, in which themes, subthemes and illustrative quotes were identified. Food frequency was calculated according to foods consumed by young children daily and weekly. The analysis was related to complementary feeding in terms of types of foods consumed, food groups, the number of meals per day and an understanding of the type of foods fed to young children. The proportions of mothers who were given TIPs recommendations and accepted, tried, succeeded, and modified them was calculated and presented in graphs.

3.0 Results

The key findings presented below are for both Isiolo and Marsabit counties, Kenya. Dominant themes that emerged from analysis of IDI, FGD and TIPs data are presented in Table 3, below. The sections that follow describe and highlight the most salient information on common food preservation practices, barriers to safe food preservation practices and ensuring year-round nutrient-rich complementary feeding of young children ages 6 to 23 months old. Any key differences between tribe or between Marsabit and Isiolo counties are noted below.

Table 3: Key themes

Theme	Sub-Themes	Definition
Food preservation methods/practices	*Methods/practices – Meat* *Methods/practices – Milk* *Methods/practices – Other* *Food safety/spoilage*	Discussion of methods and practices to preserve meat, milk and other foods, and challenges associated with food safety or spoilage.
Food access	*Seasonal variation in food* *Ceremonies/traditions* *Geographic variability – Market* *Geographic variability – Home* *Financial concerns* *Means of earning a living* *Tribal conflict*	Discussion of availability of certain foods, including challenges to accessing meat, milk, and other animal products to food preservation.
Roles	*Roles – Mothers* *Roles – Fathers* *Roles – Grandmothers/elder women* *Roles – Other children* *Roles – Community* *Roles – Stakeholder*	Norms around roles family members, community members and stakeholders play in food preservation.
Transfer of knowledge/advice	*Transfer of knowledge – Food preservation* *Advice – Infant and young child feeding practices*	Discussion of ways in which knowledge and advice on food preservation methods, or infant and young children feeding practices, is learned and passed down.
Norms/beliefs	*Norms/beliefs – Foods eaten by household members* *Beliefs – Feeding practices*	Norms and beliefs about infant and young child feeding practices and types of foods eaten by household members.
Complementary feeding and breastfeeding	*Breastfeeding* *Feeding – First foods* *Feeding – Preserved foods fed to infants/young children* *Feeding – Other*	Discussion of breastfeeding and complementary feeding practices for infants and young children.
Child health and growth	*Signs of health* *Signs of ill health*	Descriptions of signs of health and ill health, including malnutrition.

Policy/legislation	*Policy/legislation – Food preservation* *Multistakeholder collaboration* *Funding*	Discussion of policy/ legislation, multistakeholder collaboration, and funding concerns related to food preservation.

3.1 Characteristics of study participants

The study participants were pastoralists and agropastoralists. Mothers of children 6 to 23 months of age participating in TIPs (n=60) were 17 to 52 years of age (See Table 4). Most mothers were not formally employed and were housewives, pastoralists, casual workers (e.g., fetching firewood or water), small business owners (e.g., selling milk or operating shops) or often a combination of these roles. Half (12 out of 24) of the mothers in Isiolo County had completed at least some primary education, whereas only a small proportion (six out of 36) of mothers from Marsabit County had completed some primary education. Most mothers were married, and a few were widowed or divorced. Mothers had between one to eight children, whose ages ranged from 6 months to 24 years. Fathers (n = 26) ranged in age from 20 to 61 years of age. Most fathers worked as pastoralists, and a few worked white collar jobs (e.g., post office worker, agricultural officer), casual work or owned a small business. None of the elder women (n=12) who participated in IDIs had completed formal education. KIIs (n=8) consisted of government officials at county, subcounty and ward levels in Marsabit and Isiolo counties. Both counties consisted of malnutrition hotspots, and more than half of all study participants lived in malnutrition hotspots.

Table 4: Demographic characteristics of all study participants

	Mothers		Fathers		Elder women	
	Marsabit County (n = 36)	Isiolo County (n=24)	Marsabit County (n=17)	Isiolo County (n=9)	Marsabit County (n=8)	Isiolo County (n=4)
Sex of youngest child						
Male	17	14	-	-	-	-
Female	19	10	-	-	-	-
Age of child (months)						
6–8.99	12	7	3	1	-	-
9–11.99	11	9	2	1	-	-
12–17.99	7	3	5	2	-	-
18–24.99	6	5	7	5	-	-
Age of participant (years)						
18 or below	-	1	-	-	-	-
19–24	13	5	-	3	-	-
25–29	8	4	2	1	-	-
30–34	5	6	3	1	-	-
35–39	5	6	2	2	-	-
40–44	3	1	2	2	-	-
45–49	2	-	4	-	-	-
50–54	-	1	-	-	-	-

55–59	-		2	-	-	-
60–64	-	-	2	-	2	-
65+	-	-	-	-	6	4
Tribe						
Borana		10	-	3	-	3
Gabra	18	6	9	2	4	-
Rendille	8	-	4	-	3	-
Sakuye	-	8	-	4	-	1
Samburu	10	-	4	-	1	-
Education						
None	30	12	-	-	8	4
Some primary	2	6	-	-	-	-
Completed primary	4	6	-	-	-	-
Completed secondary	-	-	-	-	-	-
Occupation						
Unemployed	27	12	-	-	-	-
Pastoralist	6	5	14	5	-	-
Unskilled labor	2	2	1	3	-	-
Small business	1	5	-	1	-	-
Professional	-	-	2	-	-	-

3.2 Food access

3.2.1. Food access: At home

All study participants were from pastoral and agropastoral communities, which herd and keep animals and have frequent access to animal source foods, due to the nature of their livelihoods. However, according to their traditions, the community does not believe in slaughtering animals (goats, sheep, cattle, camel) for home consumption (defined as the process of cutting, skinning and separating meat from bones). This was affirmed by mothers, stakeholders, fathers, and elder women. This belief is elaborated by the key informant who stated, *"[Communities] have to change their culture of not wanting to slaughter their animals because I believe they have enough that they can preserve, but they rarely slaughter their animals."* Key informant, Isiolo County.

Furthermore, the community rarely slaughters large animals like cattle or camels, regardless of season. However, "*in case one of their animals is sick, like it cannot walk far"* (Key informant, Isiolo County) or when their animal might die due to disease or injury, communities may slaughter them regardless of season. Therefore, most animals that are slaughtered are goats and sheep, which are consumed within a few days and are therefore believed to be inadequate for preservation as illustrated by the following quotation.

"Nowadays who slaughters cattle like before {previous years}. (laughs)...unless it's slaughtered in the butchery, nowadays people don't slaughter cattle, we usually slaughter sheep or goats when there is prolonged drought and store the fats and meat especially the steak meat. Yes, before {previous years}, you had livestock that you could slaughter, but now we don't have those animals. People slaughter in butchery; you buy meat from the butchery and cook it with vegetables…we have nothing to preserve." Elder woman, Isiolo County, Borana

Rather than slaughter during the rainy season, most study participants reported slaughtering small animals like goats and sheep during the dry season. However, mothers and fathers reported that during the dry season, the animals are often in poor health, emaciated or do not have enough meat. This is illustrated by a mother from Marsabit County who stated, "*We never slaughtered a camel, now goat meat is too little to last longer*." Mother, child 8 months old, Marsabit County, Gabra.

Moreover, during the dry season, most animals (cattle, goats, camel and sheep) have moved away in search of pasture. These factors leave no meat for preservation, as reported by nearly all study participants. For those respondents who slaughter, meat is not typically preserved as small animals (goats and sheep) are slaughtered, and all the meat is eaten. As a result, most of the households visited did not have preserved meat, as attested to by a mother in the quote below:

"We slaughter animals. We prepare this kurkude (fatty meat) well, store in the jug and preserve and have it in the house. But today all the animals are not here, we don't have anything else in the house." Mother, child 18 months old, Marsabit County, Gabra

In addition to meat, study participants reported that the animals' migration to areas with greater access to pasture and water has led to less milk being available for preservation in these communities. Despite leaving a few animals in the homesteads, study participants described these animals as not producing enough milk. However, during the rainy season, study participants unanimously agreed that milk is readily available due to the availability of pasture and water, which allows animals to stay closer to the villages. This is illustrated by the quotes below.

"Because animals go far in search of food therefore [we] can't get food from animals [during the dry season]. But during rainy season animals are available and have food...as we can produce more food products, such as milk, ghee and meat." Mother, child 18 months old, Isiolo County, Gabra

"Not for now as it is dry season now, but fermented milk is available during rainy season…

There is inadequate milk during dry season. During dry season these foods are not available, animals have less milk so there is no milk to ferment." Elder woman, Isiolo County, Borana

"During rainy season animals get more nutrients and are in good health and have enough food and produce more milk but during dry season there is nothing to eat for animals and they don't produce enough milk. During rainy season animals are fatter and you get good meat compared to dry season when animals are weak and lean and produce poor quality meat." Mother, child 21 months old, Isiolo County, Borana

Nearly all study participants indicated that in the past, food would be preserved during the rainy season, which helped families have adequate food during the dry season when food was scarce**.** Yet several mothers relayed that they cannot preserve enough food during the rainy season to last through the dry

season. In addition, even if food is available and preserved, concerns arose around food spoilage due to preservation methods and techniques. This is illustrated by a mother from Marsabit County who explained, "*The way we do it when we preserve during rainy season, it [the preserved food] will not stay up to dry season…even that fermented milk will stay for one week, so there is nothing which will stay up to dry season.*" Mother, child 9 months old, Marsabit County, Gabra

Although participants reported that more food is usually available in the rainy season, during this current rainy season, there was inadequate food to preserve as the animals were still away in search of pasture and water due to the inadequate rains in the study areas. This is attested to by a mother who reported that *"During rainy season we have it more, but this time you also see that rain was short and there is no grass. And now our livestock are still far from us."* Mother, child 12 months old, Marsabit County, Gabra

Ceremonies and traditions during which study participants mentioned slaughtering animals included the following: *Sorio* (Passover ceremony), *circumcision* (traditional ceremony to celebrate boys' transition to adulthood), *weddings*, *childbirth*, *funerals/burial rituals*, *Eid* and *Christmas*. A few participants also mentioned *Almathau* (traditional prayer ceremony during which fermented milk is blessed and served to children). Most mothers, fathers, elder women and key informants mentioned meat being more readily available after special occasions when animals are slaughtered in celebration or to mark the occasion, following local traditions, regardless of season. An elder woman from Marsabit County describes the availability of meat during ceremonies, stating, *"Yesterday I was given meat from 'lorora' (small home specifically built for circumcision occasion). Family friends gave me the meat which I have preserved now."* Elder woman, Marsabit County, Rendille.

Although several mothers and fathers mentioned slaughtering animals during festivities, they also reported there was "*not always enough meat to be preserved"* to feed the family, especially when smaller animals like goats or sheep were slaughtered, as meat is shared and consumed communally. For example, when a mother from Isiolo County was asked if she preserves and stores meat that remains after festivals like *Sorio*, she stated, *"We usually cut it and fry it and preserve it but usually the meat does not remain as many people come and the meat is finished."* Mother, child 18 months old, Isiolo County, Gabra

In both counties, some study participants, including mothers and fathers, indicated that *"regularly when it rains, we plant foods like maize and beans and kale."* Fathers' FGD, Marsabit County.[g] However, during the dry season, the study participants do not plant crops due to inadequate rains, resources for irrigation or the river changing its course. In addition, several participants in Marsabit County indicated that during the dry season, the government or relief agencies provide communities with relief food such as sorghum and cooking oil.

[g] Among the Gabra in Maikona Ward, North Horr Subcounty

3.2.2. Access to Food - Markets

Meat purchases from butcheries

Study participants who are not herding animals and remain at home, or who do not own animals, bought meat from the butchery and purchased milk from local shops as illustrated by the following quote:

> *"For milk, they are able to access from their animals but not all the time. Sometimes, when the weather is favorable, that is when they can get milk and meat, they can slaughter the animals although not all the time. Mostly they buy from butcheries."* Key informant, Isiolo County

Food access – purchases from shops

During both seasons, study participants reported purchasing other foods, such as cereals, sugar, cooking oil and fruits from the shop. One mother from Isiolo County illustrates the availability of foods from local shops, stating, "*You know we don't have farms; we just rely on shops for food which we buy. That is what we rely on for foods like rice, ugali, wheat flour, cooking oil, sugar, we all get from the shop."* Mother, child 14 months old, Isiolo County, Sakuye

In addition, some mothers purchased pre-packaged milk from local shops due to unavailability of fresh milk as the animals were in search pasture or water during rainy and dry seasons. For example, when one mother was asked which foods, she fed her son between six to eight months of age, she responded*, "I feed him the packed milk from the shop as now we don't have any livestock at home, when the livestock are at home, I will feed him milk from our camels."* Mother, child 8 months, Marsabit County, Gabra

Purchases of fruits and vegetables (open air markets)

Production of foods like vegetables, fruits and maize was described by the majority of the study participants as inadequate, even amongst agropastoral communities, especially during the dry season. Consequently, study communities depended on food crops from other towns—as shown in the following quote:

> *"Mostly they get it from the farms when there is plenty of production especially Marsabit but not on that side of Laisamis and North Horr, those ones depend on the town, that is Saku… especially like greens, it is hard for them to get, only cabbages are available, not kale. But if you have a small piece of cabbage at home you can chop it into small pieces. They [families] depend on markets. They buy [from shops] especially in Marsabit. During the dry season, it come from Meru, so many things come from Meru**."*** Key informant, Marsabit County.

Mothers and fathers reported purchasing more food in the dry season, although perishables like vegetables and milk were described as inexpensive in the rainy season compared to the dry season. This price differential was described by several key informants, including one who stated, *"During the dry season, prices of vegetables hike. So, if your budget is not enough you have to forgo some vegetables, if they are plenty, they can easily afford."* Key informant, Marsabit County.

Borrowing money or taking foods on credit from local shops:

Several mothers and fathers said they borrow money to buy food or take food from the shops on credit (to pay later when they have money) to obtain food for their families often during drought/dry season or other times of financial need. This reliance on borrowing is echoed by the following mothers who stated:

> *"If I have, I will cook for them. I want the best for my children, in lack I won't sit and leave them hungry; I will cook for them anything I have, or I take goods on credit from the shops within my village. When it rains, I sell our animals and pay debts. Sometimes it's hard to pay the debts too. But that's how we survive. Most of our animals die in the prolonged drought due to hunger and*

shortage of water, so we sell the little that remains and pay back the debts, now what else can we do?" Mother, child 8 months old, Marsabit County, Gabra

"*When food is available, I cook for my children, but when food is not available, I borrow food, and if I can't borrow food… we stay without food for the day… you can also borrow a loan of about KSH 500 [to buy food]."* Mother, child 10 months old, Marsabit County, Gabra

In addition, some mothers, fathers and elder women mentioned families having trouble affording food. Some mothers and elder women said they could only afford to purchase meat and vegetables when they had surplus income, as illustrated in an FGD where a father stated, *"We also eat ugali, sometimes we don't have money to buy with vegetables to cook stew."* Father FGD, Isiolo County, Borana

Challenges in food access

In both counties, poor road infrastructure—coupled with long distances to the remote locations where the communities reside—leads to increased food prices and poor quality of vegetables, as their quality deteriorates during transportation. In addition, there are specific market days in the remote towns, hindering accessibility. Another hindrance is that prices are much higher in these rural areas compared to urban areas. Moreover, prices for vegetables like tomatoes, cabbage and kale are cheaper during the rainy season and on market days. However, the prices increase during the dry season and on non-market days. The key informants also noted that prices also increased at the height of the COVID-19 pandemic. This resulted in vegetables not being purchased regularly; thus, vegetable availability and consumption were limited to market days. These issues were described at length by several key informants:

"Now the distance from the source, you find that they source the vegetables from Isiolo, in those areas that they do not grow. So now you can imagine the vegetables coming to this place, and they overstay on the way to Merti. Even for a day there is a lot of a deterioration of that product nutritionally. You find that when they get the vegetables, even the kale and spinach, they are yellow. So, they have a challenge because of the distance but if they grow near, they can access the vegetables while they are fresh and they can be able to get Vitamin C, and you know Vitamin C is very volatile. Mostly, it is lost even through air and exposure to those high temperatures as they transport to those areas. So, there is a problem." Key informant, Isiolo County

"Accessibility is the issue that is why I said, one of the factors that cause food shortage in the area is the poor infrastructure. Though, we have seen improvement of late because of the road network, vehicles drive from Meru, Isiolo to this side, trying to access these remote areas, therefore accessibility is still a factor of cost. By the time he reaches the remote areas, he hikes the price, so the prices of those commodities will increase. If that person living in this remote area had low income, accessibility can be an issue. Which is a common factor making the area food insecure." Key informant, Marsabit County

Another challenge expressed by study participants was that, while sometimes money was available, some commodities required were not always stocked in the shops. A key informant from Marsabit County elaborates on this issue in the following quote:

"Although they have the goats, they have the animals, but the foods are not in the market. Though the father will sell the cattle and get the cash, the shop nearby has not stocked foods like beans, green gram and others. He will eat whatever is in the shop, but the money is there." Key informant, Marsabit County

In addition, according to most participants, the butchery is expensive and therefore most are not able to afford buying meat. Moreover, during the dry season, some participants reported being able to buy milk for making tea, since the quantity was not enough for their children to consume. A key informant elaborates on this, stating:

> *"When animals are slaughtered here, they are not able to buy since meat is too expensive, I think 1 kg is 480 Kenyan shillings. They only buy milk for the tea and the child is given tea. They cannot afford to buy milk for the child."* Key informant, Isiolo County

Further, some participants cited lack of money to purchase food while most expressed, they would only buy food when money was available, pointing to food insecurity. A mother from Marsabit County explained, *"We are not able to get something to eat all the time, sometimes we lack. Sometimes if you have something to buy with, you buy, yeah, we just buy because we do not have any farm."* Mother, child 7 months old, Marsabit County, Gabra

3.2.3 Means of making a living

Selling animals

Most mothers and fathers were animal herders and relied on raising and/or selling livestock to make a living, "*as our salary is animals,*" as relayed by a mother, child 13 months old, Marsabit County, Gabra. During the dry season, several participants said they sold their livestock in times of hardship: during the drought/dry season, during times when no other food was available at home or when an animal was starving/sick. Though some would sell the livestock, others would slaughter and sell the meat in the butcheries. Selling livestock to obtain money for food was also mentioned by the majority of mothers during the rainy season. This is illustrated by the following quote:

> *"We are good during rainy season, because we have plenty of milk, and meat. But during dry season, all the animals are weak, like goat, we can't slaughter them like ours. Now some are suffering from diseases, and we take them to market for sale. Unless I sell livestock, but there is nothing else we have*." Mother, child 8 months old, Marsabit County, Gabra

The need to sell livestock to make a living is echoed by another mother from Marsabit County. Upon being asked what actions she took to ensure adequate food for her children, she responded,

"Maybe I do casual work, I go do some jobs first, I go fetch firewood take to the market and sell and sometimes, I just sell my livestock, cattle or goat or sheep or camel, whichever." Mother, child 8 months old, Marsabit County, Gabra

Most mothers mentioned that their means of making a living from their livestock varied by season. They reported that during the dry season, livestock are often emaciated, causing them to sell at lower prices. In contrast, during the rainy season, animals are often healthier and have better quality meat when slaughtered. Most mothers therefore described a preference for selling their livestock during the rainy season mostly to buy food. This is illustrated by one mother from Isiolo County, who stated the following when asked about differences between making koche in the rainy versus dry season:

> *"During rainy season, animals you slaughter for koche have a lot of meat and are fatty unlike during dry season when they are thin and have less meat. Even milk, animals have more milk during rainy season, and we can preserve ititu (fermented milk) unlike during dry season when they don't have any milk."* Mother, child 8 months old, Isiolo County, Borana

Selling animal products and food crops

Some mothers described selling animal products from their livestock. Most often, mothers relayed selling fresh or fermented milk when there was a surplus as one mother from Isiolo County stated,

"I sell fresh milk and fermented milk...preserved meat is just for use in the household...for my kids and the family." Mother, child 6 months old, Isiolo County, Gabra

Several mothers mentioned distinct challenges in selling preserved foods for additional income during both seasons. A few mothers described losing their customer base for selling animal milk (as all animals have milk; therefore, animal milk is readily available in families' homes) and roads being impassable during the rainy season, while most mothers mentioned having no preserved foods to sell during the dry season. The limited ability to sell foods during the dry season is illustrated by a mother from Isiolo County who recounted, "*The difference is, if you have these preserved foods during rainy season, you can sell and meet other needs with the money you get. But during dry season, there is no preserved food therefore you can't get anything."* Mother, child 18 months old, Isiolo County, Gabra

This is echoed by a mother from Marsabit County who stated the following:

> *"During the drought season you cannot sell the milk because it's not enough, its only during the rainy season that one can sell milk, but during the dry season the milk is not enough…also when you sell the animal it's only during the rainy season that it can fetch good money, since during the dry season it has no water and grass and they are usually weak, so we do not even sell them."* Mother, child 7 months old, Marsabit County, Gabra

Additionally, some mothers mentioned selling farm produce during the dry season when it fetched better prices. This is illustrated by a mother from Isiolo County who, when asked whether she sells or consumes the maize she harvests during the rainy season, responded, "*No, I only sell during dry season, because during rainy season, the price is less but during dry season it has more money."* Mother, child 9 months old, Isiolo County, Gabra

Small businesses and casual jobs

Most mothers mentioned selling in shops, making roofing thatches to sell, making and selling charcoal, or fetching firewood or water as sources of income. The mothers conducted these activities either as casual laborers or operated them as their own small businesses. This is illustrated by one mother who relays her reliance on casual work to ensure her children have enough to eat:

> *"[I look] for temporary jobs. When I get the job, I buy them foods from the shop. We use half of the money and save the other half. If I have taken food on credit, like vegetables or borrowed some things from the shop, I use the money I get to pay them."* Mother, child 6 months old, Isiolo County, Borana

In addition, a few key informants mentioned price fluctuations caused by the COVID-19 pandemic or dry season/drought causing financial hardship for families. Tribal conflict was also an area of concern that could prevent families from accessing food, as stated by a key informant from Marsabit County who elaborated, "…*the main challenges are the war and water*…" Key informant, Marsabit County

3.3 Food Preservation Methods

In these study communities, meat and milk are primary food sources, which are preserved through traditional means in Marsabit and Isiolo counties. This is described by an elder woman below:

> *"Livestock has two main sources of food, meat and milk, and all of them are preserved for a short or long period. Oils/fats are easily preserved, and meat is also easy—but as for the preservation for milk, it always has to be topped up"* Elder woman, Isiolo County

3.3.1 Preservation of Meat

Study communities primarily kept the following animals: camel, cattle, goat and sheep. Specific parts of these animals are slaughtered for food preservation in both study sites. These parts include the forelegs and hind legs of the animal. Preserved meat is mainly comprised of steak (boneless meat). The neck and the ribs of animals are not preserved. The specific parts preserved are illustrated by a key informant who states, "*Because there are certain parts of meat used to prepare Nyirinyiri [small pieces of fried meat] not every part of meat, the steak of back legs is used…of goat or cattle or camel."* Key informant, Marsabit County

The time for drying meat varied from several hours to several days depending on the method of preservation. Meat meant for preservation through frying is dried for several hours, while meat meant for preservation as dried raw meat is dried for several days. Participants relayed drying meat both inside and outside the house, and some mothers explained that drying inside the house prevents birds from eating it. The process of drying meat is described by a key informant who stated the following:

> *"After the animal is slaughtered, the meat is cut into string like pieces and hung in kitchen on a rope ensuring enough air circulation so that it dries under room temperature…it is dried for at least a month inside the house before using. This type of meat can stay for more than a year when stored well."* Key informant, Isiolo County

In addition, when frying the meat for preservation, sheep fat was preferred. Some respondents also mentioned using commercial oil when sheep fat was not available. A mother from Isiolo County describes this practice, stating, *"I use sheep fat to fry the meat. Yeah, but if I slaughter a goat since goats do not have fat, I just use cooking oil bought from shops."* Mother, child 14 months old, Isiolo County, Sakuye

Some mothers and elder women mentioned having multiple responsibilities; therefore, the time required to preserve meat was a challenge as they needed to attend to other tasks such as looking for water or looking after animals. This lack of time resulted in food spoilage, as illustrated by the following quote from an elder woman.

> *"So, the challenge is sometimes when you slaughter a goat in the morning, you also have to look after your animals nearby…sometimes we will not even return for a whole day, now when you have come back from looking after the animals, the meat will have spoiled."* Elder woman, Isiolo County, Borana

3.3.2 Preservation of milk (fermentation)

Fermented milk was the most frequently mentioned preserved milk product, regardless of tribe or county. Fermented milk is typically goat or cow's milk, as camel milk is not preferred due to its consistency which

was described as "too watery." In addition, when mothers ferment camel milk, they mix it with either cow or goat milk.

When milk is preserved, the majority of the mothers and elder women described placing milk in a traditional gourd/plastic container that is smoked with a special herb, and at times cleaned with soap. Fermented milk can be prepared in one week. However, the period for which the fermented milk will last ranges between one week to one month depending on the availability of fresh milk to add to the fermented milk. The process of smoking is believed to "*kill germs*" or "*impart a certain smell/flavor."* As an elder woman described, fermentation of milk is thought to be a continuous process, in comparison to other preservation processes.

All study participants, including key informants, reported not boiling the milk meant for fermentation due to their belief that the milk will not retain its sweetness or nutrient-rich qualities or will taste different, as relayed by a mother who explained, "…*the boiled one differs from the un-boiled one. It [boiled milk] changes to another form, which is not good, and the un-boiled milk is just good. The un-boiled milk is very sweet"* Mother, child 7 months old, Marsabit County, Samburu

This belief is echoed by a key informant who stated the following:

> *"If you boil milk, you have killed all the nutrients in the milk. When the milk boils, the milk cream floats at the top of the milk together with all the nutrients in the milk, However, the whole un-boiled milk is mixed with the fat and all the nutrients are intact as they are "live" and viable."* Key informant, Isiolo County

3.3.3 Other preserved foods

Mandazi

Besides milk and meat, mandazi was the most frequently mentioned preserved food by mothers, elder women and fathers from all the tribes. Most mothers described making mandazi by frying dough. One elder woman described the popularity of mandazi, stating, "*Only elder people preserve foods nowadays…women nowadays don't preserve meat even if they slaughter; instead, they concentrate on cooking mandazis."* Elder woman, Isiolo County, Borana. In addition to the common fried dough recipe, some respondents mentioned mixing mandazi together with fried meat for preservation.

Maize

Maize was mentioned by a few elder women, mothers and fathers from the Borana, Sakuye and Samburu tribes. A few elder women, mothers and fathers said maize should be stored in a well-stitched sack elevated off the floor to prevent rats, termites and weevils, while some mothers mentioned using chemicals to keep off pests. Issues with storage were illustrated by a father who said, *"You have to store well and stitch the sack well for good storage so that nothing will enter into it like weevils."* Father FGD, Marsabit County, Borana. Furthermore, one mother expressed challenges with acquiring the chemicals, stating:

> *"There is no problem in this food that you cook but in maize preservation sometimes you may lack chemicals to apply to maize and it may go bad, that's one of the problems; sometimes, you can even lack storage materials like sack and if you don't have it that's a problem."* Mother, child 21 months old, Isiolo County, Borana

Animal fat/Ghee

Several mothers, elder women and fathers mentioned the preservation of animal fat. To preserve animal fat, sheep tail fat is melted and stored in clean smoked containers. In addition to animal fat, ghee (clarified

butter) was mentioned by some study participants from all the tribes as a food they preserved from animal milk. For example, one mother from Marsabit elaborated on the process of making ghee, stating, *"[To make ghee,] I boil [cream from milk] until it turns color and give the child and the rest I use to add into the food."* Mother, child 18 months, Marsabit County, Samburu

Fruits/vegetables

Preservation of fruits and vegetables was not mentioned by mothers, fathers or elder women in both Marsabit and Isiolo counties. However, nearly all key informants spoke about encouraging the preservation of fruits and vegetables with community women groups, but this did not occur at the household level. Government stakeholders relayed teaching specific community groups about preserving the following foods: mango; sweet potato/cassava/taro flour/chips; tomato jams/sauces/pastes/purees; and other vegetables (e.g., kale, spinach, onions, Amaranthus, managu, cow peas, carrots) as explained in the quotes below.

> *"Mostly [meat and milk] are the products that they preserve but we are also training them to start preserving vegetables. Mostly, you find that they will dry vegetables because during the rainy season vegetables are in abundance. The indigenous vegetable, they are so abundant here. Now we are training them to preserve, there are those who are doing, they preserve, and they keep the dried vegetables and use at a later date…Just teaching them, you know our people here, our pastoralists mostly are not appreciative about vegetables, they value milk and meat and now even adopting other protein like crop-based protein. It has been slow, but they are doing it now."* Key informant, Isiolo County.ss

Table 5: Key food items and food preservation processes [by tribe(s)]

Food item	Method/process	Tribe(s)
Meat		
Jaji- Gabra and Borana/ Sarsar- Rendille **Dried strips of goat/ sheep/ camel/ cattle meat**	• Slaughter the animal • Remove the bones and the fatty parts from the meat • Cut the meat into thin strips • The strips are then hung on a tree/string to dry • The dried meat is then put inside a storage container	Gabra/ Rendille/ Samburu/ Borana
Koche (small pieces of fried meat) goat/ sheep or cattle or camel meat—also called *Nyirinyiri or Kalanga/ Qimiti* (Borana)	• Slaughter the animal • Identify parts of the animal with steak such as the upper part of the legs • Separate the red meat from the bones and the fatty meat • Cut the meat into thin strips • The strips are hung to dry for a few hours or overnight • After drying, the strips are cut into small pieces • The small pieces of meat are then fried until they turn brown/red and become hard • The meat is removed from the fire and left to cool	Gabra/ Borana

Small pieces of fried meat (Nyirinyiri), similar to koche	• Slaughter the animal • Identify parts of the animal with steak, such as the upper part of the legs • Separate the meat (steak) from the bones and the fatty meat • Cut the meat into small pieces • The small pieces of meat are then fried until they turn brown/red and become hard • The meat is removed from the fire and left to cool	Rendille and Samburu
Koche (pounded fried meat)	• Slaughter the animal • Separate the bones from the red meat and remove the fatty meat • Cut the meat into thin strips • Using Qadabe (piece of stick), hold the meat on a fire (roasting) • Once the meat is brown, pound it and remove the hard pieces • The pounded meat is then fried • When it's ready, the meat is cooled • Garbu (oatmeal seeds) are added to the fried meat • The product is then poured into a smoked storage container (Dibe) • The meat can stay for three to four months if the fatty parts are removed	Gabra
Koche (Gabra) / Fontuma (Borana) – Pounded fried meat	• Separate the meat from the bones • Pound the meat in a moye (wooden equipment used for pounding food) • Fry the pounded meat • Once ready, set aside and leave to cool • Smoke the storage container • Add the fried meat into the storage container together with the oil	Gabra/ Borana
Kurkude Thub/ Guguble – Fatty meat. Extracting fat from fatty meat or from sheep's tail.	• Separate the fatty meat from the red meat • Clean the fatty meat • Cut the meat into small pieces (bigger than the pieces of red meat) • Place on fire and add water to boil • Once the water dries up, cook some more until fat melts from the meat and is extracted • Remove the meat from the fat and leave to cool • Smoke two storage containers • Put the fried fatty meat (kurkude) into the smoked storage container (thibe) or metallic jug with locks, which is then hanged inside the hose for safe keeping • Drain the oil into another smoked storage (thibe) container • The oil will last for three weeks/months without spoiling • The fatty meat (kurkude) will last for two weeks/three months without spoiling	Gabra

Animal intestines (Cattle/Camel)	• The intestines are dried first by hanging as strips on a rope inside the house • The dried strips are then fried • Then they are fried in oil and preserved in oil • The fried intestines last for one week	Rendille
Milk and milk products		
Thick, fermented goat or cow milk (Ititu) or mixed with camel milk	Milk is put in smoked containers, a plastic jerry can or traditional gourd—water is removed underneath the fermented milk using a traditional straw (dujum), and the container is refilled with fresh goat or cow's milk each day • Smoking the container occurs with herbs or with special trees; in some cases, the jerry can is cleaned with washing powder and then smoked (Kasuyu/Rendille tribe), and white charcoal dust from acacia trees may be left at the bottom (*qunche)* (Sakuye) • Mentioned milk is boiled, sieved and then smoked with qorqore tree specific for smoking milk, and can last up to 10 months; if you don't keep adding milk, it can go bad in seven days (Gabra) • Mixed milk goat/cow and camel (Gabra); sometimes add sugar to it (Gabra, Rendille) • Takes up to one week to ferment, and keeps for up to one to three months (Gabra); nearly all participants said they consume it within the week or two weeks	Gabra, Rendille, Borana, Sakuye, Samburu (all tribes)
Sour milk (*Qaman*)	• Type of sour milk where the cream of the milk is removed after shaking	Borana
Fresh animal milk (i.e., cow, goat) can be preserved through smoking process for a short period of time; milk may be boiled	• Gourd "chicho" (Gabra) is often smoked to preserve fresh milk for a few hours (i.e., eight hours) to a few days	Gabra, Rendille, Borana, Sakuye, Samburu (all tribes)
Dried camel milk (*Susa/suche*)	• Remove whey as refill milk, and remove until it dries; you use a "scoop" to eat • Sakuye tribe – mentioned doesn't remove the whey • Takes two days to ferment and lasts one to two months	Borana (Merti), Sakuye, Gabra
Other preserved foods		
Mandazi (fried dough)	• Make the dough using flour, yeast/baking powder, salt, sugar, eggs, animal fat/oil and warm water • Roll out the dough and cut into small pieces • Fry the dough in oil in a *sufuria* (frying pan) • Store in a smoke container • Consume within two weeks	Borana, Gabra, Sakuye

Maize	• Once harvested, remove maize from husk and place on a *kodo* (traditional granary) to dry in the sun • Apply white chemical powder (commercial pesticide) to prevent spoilage • Store maize in a well-stitched sack indoors on an elevated surface • Serve within three months; either cook maize with beans, milling maize into flour to make ugali, or crushing maize with mortar and pestle to make porridge	Borana/ Sakuye/ Samburu
Ghee (Clarified butter)	• Boil cow's milk or shake the milk while in a closed container • Extract the creamy layer that comes to the surface of the milk • Boil the cream until it changes color • Extract the top layer • Store up to one year in a clean container	Gabra/ Samburu

3.4 Food safety

Process of preservation as an aspect of safety

Nearly all participants mentioned drying as a method of keeping foods from spoiling. Additionally, most participants described cutting thin strips of meat to prevent spoilage, as thick strips develop worms when dried. This is illustrated by an elder woman from Isiolo County as follows:

> *"Dry it well for 3-4 days, because the moment it has moisture content, it tends to have dudu (meat worms). So, after adequate drying, you cut into small pieces, cook and you store. It can stay for 2 months, what you need to do is smoking and warming after some time. Smoking is done repeatedly."* Elder woman, Isiolo County Borana

Most study participants, including mothers, fathers, elder women and key informants, also indicated that during preservation, the removal of fatty parts and all other parts that spoil easily will ensure that the meat is preserved for longer. A mother from Marsabit County illustrates this by stating:

> *"Let us say if you slaughter goat and you want to prepare Galangal, you make sure you have removed all the parts that can easily get spoilt. Then you cut the rest of red meat into small pieces, put all in a sufuria to make Galangal (small pieces of fried meat)."* Mother, child 7 months old, Marsabit County, Rendille

Over half of the participants, including elder women, mothers, fathers and key informants, said that properly preparing and cooking foods ensures the safety of preserved foods. By contrast, most mothers and elder women mentioned that if food is not well fried for preservation, mold will grow when stored. This is illustrated by an elder woman from Isiolo County, who stated, *"If you get camel, cattle or even goat and sheep meat, if you preserve it when it is not well cooked and store in a container, it starts to form molds."* Elder woman, Isiolo County, Sakuye

It was unanimous among the mothers that the process of adding fresh milk daily while removing the whey extends the shelf life of fermented milk. A few fathers also echoed this belief, including one from Marsabit County who stated:

"If you smoke this qotha [traditional storage container] and pour in this milk. You add this fresh milk every morning and evening, like every day, no break in between, if you pour the day before yesterday, and fail to add fresh milk yesterday and today, it will go bad." Fathers' FGD, Marsabit County.

Additionally, mothers mentioned that adding leftover milk will lead to spoilage of fermented milk. One mother describes the resulting fermented milk as "sour," stating, *"You need to make this fermented milk well, that you do not sip milk and add to it. If you add leftover milk, it will spoil it, it can be too sour, that milk might spoil and smell bad."* Mother, child 19 months old, Marsabit County, Gabra

Most mothers spoke of not boiling milk for fermenting as it will form solids and will not be smooth. While the majority of the mothers gave their children unboiled milk, some mothers indicated that they give boiled milk to their children. A mother from Isiolo County illustrates this practice in the following quotation.

"We wash the liter (plastic container) with hot water, after it's clean we smoke and put [goat] milk, after 2-3 days of fermenting, after it has produced water, I remove the water and sieve fresh milk to add. This milk is unboiled." Mother, child 7 months old, Isiolo County, Borana

Cleaning of storage containers

Most of the respondents cleaned the plastic and metallic storage containers with soap and water. However, two participants reported using hot water only, with one mother rinsing and applying oil as a method of cleaning the container. Furthermore, a few mothers preferred not to use detergent as after using it, there was a residual smell in the container. This is illustrated by the following quotes:

After it's crafted, you clean with water and apply oil to it. Either hot or cold water—there might be dust and small particles that is left behind after being crafted; that [is] why it's washed to get rid of such particles and dust, then oil is applied. I do not use detergent; it leaves smell and foods put in it will have that smell of detergent and it is not good." Elder woman, Isiolo County, Borana

"Then you smoke the gourd, for us we don't know soaps. We put some water in a gourd, pour then smoke it. And for the gellen (metallic container used to store fried meat) we also smoke and make sure it's clean. Then you wait for the fried meat to cool down after which you remove all the oil and then put the dry fried meat in that container." Mother, child 7 months old, Marsabit County, Rendille

Smoking of storage containers

Most participants mentioned smoking storage containers regularly, and a few women discussed smoking utensils and bowls. Most of the participants said that smoking enhances food safety by increasing the storage duration, killing bacteria and preventing foul smells. This is illustrated by a father from Marsabit County who explained, *"When the gourd is properly smoked, the preserved meat stays fresh. When the gourd is not smoked, the preserved meat starts producing some bad smells."* Fathers' FGD, Marsabit County

The various communities used different trees for smoking depending on availability. A mother from Isiolo County describes the process of smoking containers as follows:

"I wash and dry with..so that it's not wet inside…I wash using warm water; now when water has dried up, I smoke it for some time…you leave that smoke inside it for some time, yes…then you

preserve the meat before the smoke diminishes inside the galeni [storage container]…then you close and leave it…you wait a bit until the meat cools down, when it cools down then you transfer the meat and oil inside the galeni before the smoke diminishes." Mother, child 9 months old, Isiolo County, Sakuye

Storage

Proper storage emerged as a key theme to enhance food safety. Some participants recommended storing food in a safe place with free air circulation, avoiding storage in dusty places, covering with lids, using clean storage containers and storing fried meat in fat. Mothers also allowed the food to cool before storing to prevent moisture that would lead to spoilage. Several mothers and elder women mentioned that the meat storage container should be dry, and some mothers had locks on their metallic containers "*because children steal the food by using their dirty hands."* Elder woman, Rendille

Serving preserved food with utensils

Some mothers also emphasized that hands should not be used to serve or that one should not dip hands into the preserved food, but separate dry spoons be used for scooping the food or pouring out the food into a bowl. They reiterated that the preserved foods should be warmed before serving and served with clean utensils, with the remaining food being kept in a covered container.

"Yeah, I preserve it in a clean container then keep out of children's reach so that they will not dip their hand in it. Another thing is when I want to eat meat, I first warm it. Yeah, even every time when serving, I serve it using clean spoon not with hands. I also tell people not to dip their hands in it." Mother, child 6 months old, Isiolo County, Borana

"You take clean bowl. Your galangal does not stick to the gourd. So, you tilt and pour in the bowl. You don't put your hand inside, not even spoon. You tilt towards your bowl and put the lid back and return it to safety. If you are using the spoon, you ensure it's only used to remove galangal." Mother, child 15 months old, Marsabit County, Rendille

Regular warming of food

In addition to warming food before it is served, mothers from all tribes in both counties spoke of monitoring the state of the preserved foods. Some mother described regular warming of the preserved meat to ensure that it keeps for longer, as illustrated below.

"After storage, you let it stay for like 20 days and open the lid to monitor its state, when it seems like getting spoilt, you put it in sufuria, add oil and warm it up, then wait for it to cool to put it in dhibe (a traditional container used to preserve meat) again." Elder woman, Isiolo County, Borana

"When we talk of nyirinyiri, the mother of the house does regular smoking and warming these foods slightly, after every week. When you want to eat you use dry spoon and not inserting bare hand since it will contaminate the meat and it will go bad." Fathers' FGD, Marsabit County

3.4.1 Challenges of food safety

A few mothers noted additional challenges in keeping fermented milk and other preserved foods fresh during the rainy season. Most mothers mentioned fresh milk being more readily available during the rainy season compared to the dry season, with several mothers describing not having enough fresh milk to add to fermented milk. A mother from Isiolo County described this concern stating, *"The challenge is like when*

the animals that I am milking stop producing milk and I don't have the milk to top up on the fermented milk and it will get spoilt due to that." Mother, child 6 months old, Isiolo County, Gabra. In addition, a few mothers noted that the humidity during the rainy season caused food to spoil quicker than in the dry season. This is illustrated by the following quotes:

> *"During rainy season you can get milk to preserve, for the meat if you preserve during dry season it takes long time without getting spoiled but during rainy season, whatever you preserve, it won't stay long."* Mother, child 18 months old, Isiolo County, Gabra

> "*Maize, you have to harvest and store it well and avoid it coming into contact with rainwater as it will get bad…and if the maize is stored in traditional granary, you have to remove it during rainy season to prevent it from coming into contact with water to avoid spoilage."* Mother, child 21 months old, Isiolo County, Borana

The participants noted that traditional equipment for storage kept food safer for longer. These containers were made naturally from wood or animal skin. Since these containers are not available currently, people use plastic containers called "liter" which they associated with a lot of diseases and increased food spoilage. The liter melts when exposed to high temperatures through the sun or during smoking. This is illustrated by a father from Isiolo County who describes the ubiquity of liter.

> *"Even mine is the same, previously "dhibe" was used in storing meat, this dhibe (traditional storage container for meat) was smoked well and when meat was stored, it didn't get spoilt and for gorf, it didn't spoil. Now there is nothing like that, "liter" is used on everything, we are afraid of this liter because it melts when put in sun, this is why we are afraid of it. Diseases like cancers are said to be brought by it, people are afraid of even smoking liters."* Fathers' FGD, Isiolo County

A few key informants reported that most people use meat that has not been inspected. This is attributed to "*a shortage of meat inspectors*" across the slaughterhouses and communities (*Key informant, Isiolo County)*, leading to consumption of uninspected meat. According to one key informant, this situation is further exacerbated during ceremonies where there is mass slaughtering of animals. This is illustrated by the following quote:

> *"County personnel to conduct meat inspection are very few. In Sololo subcounty, we have one meat inspector. That meat inspector has to move across the slaughterhouse and slaughterhouses operate up to 8 a.m. That person will not manage to visit all of the slaughterhouses. When we have ceremonies, according to me, it's hard to control issues to do with meat quality. If a man decides to slaughter cattle, whether it has an issue or not, it will be slaughtered and it will be eaten."* Key informant, Marsabit County

Furthermore, fathers, mothers, elder women and key informants reported the slaughtering of sick animals for food. In addition, the mothers and elder women may also cook spoiled meat as illustrated by an elder woman who stated, *"Now remember in the morning I may go to look after livestock, even if the meat spoils, we will wash and then cook. No problem with that."* Elder woman, Isiolo County, Borana

3.5 Food preservation roles of women, men, elder women and community members

3.5.1 Women's roles

In Marsabit and Isiolo counties, all study participants described food preservation and ensuring the safety of the preserved food as a women's domain. All fathers in the FGDs described food preservation as women's work, as they related it to their role as caregivers; whereas some women described gender norms that prohibited men from participating in food preservation. This sentiment is illustrated by a key informant from Isiolo county who stated, "*those things men cannot do, it is the mothers who do it."* Key informant, Isiolo County

This concept was also illustrated by a father from Marsabit County who was asked who completes tasks needed to preserve food, and responded, *"The work is done by women. Because the slaughtering is done by men, then the cutting, cooking and preservation is done by women."* Fathers' FGD, Marsabit County, Samburu

Although slaughtering of animals is designated for men, it is socially acceptable for women to slaughter animals under certain conditions. In Marsabit County, women are allowed to slaughter when men are away in the field with animals. In Isiolo, a married woman can slaughter when carrying a boy child on her back. A father from Marsabit County and an elder woman from Isiolo County describe social norms around slaughtering animals as follows:

> *"Women can slaughter, sometimes husbands are there in the field looking after the animals, once they come in the evening, it is easy to give them than to slaughter another, since they are already hungry and cannot wait for a goat to be slaughtered."* Fathers' FGD, Marsabit County, Gabra

> *"It's Muslim men who slaughter the animal…yes…but the place where men are not available...married women that have a child will carry the child on her back and slaughter the animal. It's said they carry a boy child on their backs and slaughter an animal."* Elder woman, Isiolo County, Borana

3.5.2 Fathers of children under 2 years of age – roles

Slaughtering meat is the main role fathers play in food preservation. This is illustrated by an elder woman who stated, "*In the case of animals that are herding, men fully manage them, and the milk fermentation is done by men.*" Elder Women, Isiolo County, Borana.

In addition to slaughtering animals, fathers bring food home (either by milking animals, preserving milk/meat outside the home), purchase food, or work other jobs outside of herding animals/farming to provide for their families. In general, fathers were expected to provide for the family. These gendered expectations are relayed by a father from Marsabit County who stated, "*The men's work is to make sure food is available all the time, whether he cultivates or looks after the animal, but when he reaches home, the mother takes the role of preparation, serving and feeding.*" Fathers' FGD, Marsabit County, Gabra. From the FGDs, it emerged that fathers also helped mothers when they were ill and following childbirth, by carrying out various chores like cooking.

3.5.3. Elder women's roles

Elder women from all tribes described their role in preserving meat and milk and mentioned smoking containers, storing and/or locking containers to keep food away from children. In addition,
elder women also mentioned fetching firewood, herding animals and, in some cases, purchasing food for the family. In terms of infant feeding practices, most elder women relayed that they cared for, cooked for and fed their grandchildren who were under 2 years of age, especially if mothers were not at home, as illustrated by an elder woman from Isiolo County who stated,

> *"As a grandmother, I buy sheep tail fat and after melting it, I feed "guguble" (solid remains of that melted fat) and save it up for the child to feed it to him/her. Another thing, I make sure the child does not lack milk in their feeding bottle."* Elder woman, Isiolo County, Borana

Not all elder women provide advice to mothers on feeding children, though most mentioned that this was an important role.

3.5.4 Older children's roles

Older daughters: Several fathers and some elder women and mothers described older daughters helping their mothers with tasks for food preservation (e.g., cooking/chopping meat, chopping vegetables, smoking/cleaning storage containers, removing maize from husks, hanging meat) and with other household chores (e.g., fetching firewood/water, washing clothes, sweeping, buying food from shops, caring for livestock). A key informant illustrated the central role of daughters in aiding mothers in food preservation, stating, *"[Food preservation] is the duty of the mother and daughter."* Key informant, Marsabit County. This was further reiterated in an FGD where a father elaborated on roles typically performed by older daughters by stating the following:

> *"The girl can help in fetching firewood and also she can help in holding meat to be cut and also she can help in frying meat, then she can clean the kettle and smoke it, then she will get small oil to put away the smoke scent before pouring fried meat."* Fathers' FGD, Samburu, Marsabit County

Older sons: Some fathers described older sons (above 10 years of age) sometimes helping with tasks for food preservation, such as aiding their fathers in slaughtering. In one FGD, a father outlined the responsibilities of older sons, stating*, "The adult boys can help their father in slaughtering the goat then later they can go and look after the livestock."* Fathers' FGD, Samburu, Marsabit County

3.5.5 Community members' roles

Sharing foods: Several fathers, mothers and elder women mentioned community members (e.g., neighbors, visitors) coming together to eat after animals are slaughtered, such as during ceremonies/traditions. Some mentioned meat from slaughtered animals and other foods being provided to other community members during times of hardship (e.g., running out of food, being robbed, having a house fire). In an FGD, a father illustrates the role of community members in providing food for those in need of support:

> *"It is the role of community to identify the poor among them and support them, those who do not have anything to slaughter. Related people are forcefully deprived of a camel, and it is slaughtered for those who do not have. Meat is communally prepared by neighbors and given to them to preserve. Oil is removed and given to them to preserve."* Fathers' FGD, Marsabit County, Gabra

3.6 Norms of foods eaten by other family members/community

Few participants from the fathers' FGDs indicated that gender norms prevent women from consuming preserved foods, particularly among the Borana tribe. Some participants explained they believe that a woman will lose her respect within the community if she eats food preserved specifically for a man. These norms are expressed by a father from Isiolo County:

> *"Culture is something which people say by word of mouth, that is it. Culturally women do not have to eat before the men, they have to adhere to it since the food is preserved for specific purpose. If she didn't care and goes ahead to take this food her respect should not be honored, and you also need your daughter to be honored. That is the culture, the Borana praise and follow it."* Fathers' FGD, Isiolo County, Borana

Some mothers from Gabra and Sakuye communities in both counties revealed that gender norms prevent them from eating before men. Therefore, mothers usually eat leftovers after everyone else in the family has eaten, as illustrated in the quotes from a mother from Marsabit County, below:

> *"When you finish cooking food, you serve the father of the house, you serve the children. When my children and father of the house have eaten, the mother of house eats the remainder of the food. I cook food for my whole family, but when the food is not available or it is a small quantity, and the children have not eaten, the father and mother cannot eat."* Mother, child 12 months old, Marsabit County, Gabra

Norms around prioritizing feeding children expressed by this mother were echoed by a few other mothers, such as one from Isiolo County who expressed the following when asked if mothers typically set aside anything to eat after other family members have finished: *"None at all, she only eats 'oqattu' (remains in the cooking pot after others have eaten)."* Mother, child 9 months old, Isiolo County, Sakuye

In addition, some participants—including fathers, elder women and mothers—explained that some animal parts are not eaten by some members of the households. For example, some mothers and fathers expressed taboos against women eating the tongue and specific parts of the animal, such as the goats head, the back legs and meat around the chest and ribs, as they are reserved for men. A few participants mentioned superstitions surrounding feeding the tongue to women and children, as illustrated by a father from Isiolo County who stated, *"You know, in an animal body even head is food, parts like the tongue, women do not eat. They will talk a lot. Even children don't eat tongue and eyes also because they will glare at someone*." Fathers' FGD, Isiolo County, Sakuye[h]

Furthermore, a few participants mentioned intestines being reserved for women and the neck being reserved for elder women. The differences in foods reserved for men and women are expressed by the following mother from Marsabit County*, "Fathers are given goat head, ribs and back legs, the women are given intestine, goat neck, goat back. Children are given kidney and pancreases."* Mother, child 11 months old, Marsabit County, Samburu[i]

[h] From Charri Ward, Merti Subcounty

[i] Among the Samburu in Logologo Ward, Laisamis Subcounty

When meat is preserved, it is normally kept for the men and fed to them when they return home. In case a mother slaughters an animal and the father is not around to eat the parts eaten by fathers, the mothers will call other men in the village to come and eat those meat parts. Meat is normally served with mandazi and tea. Most mothers said they also fed mandazi to children over 6 months old but more commonly, mothers mentioned feeding it as a snack to older children.

Furthermore, some participants revealed that some communities do not consume eggs or camel meat due to religious beliefs. These beliefs were expressed by one key informant from Marsabit County, who stated:

> *"There are certain clans which do not consume certain meat. Now, for those children who come from those clans, they are not allowed to consume especially chicken and camel. The reason they allege is that there are certain powers in them which are very vital to them, so those powers are feted only to those clan members."* Key informant, Marsabit County

3.7 Transfer of knowledge/advice through elders on food preservation

Learning from past generations: Most respondents (mothers, fathers, elder women, and key informants) said knowledge on food preservation was passed down through generations. Mothers were most frequently mentioned as teaching preservation techniques, fathers and grandmothers were sometimes mentioned and other family/community members (i.e., neighbors, great-grandparents, grandfathers, mothers-in-law and aunts) were mentioned by a few respondents. Several elder women and a few mothers and fathers described teaching food preservation techniques to younger family members or community members. The types of knowledge about food preservation that is passed down by mothers is relayed by a mother from Isiolo County who was asked whether she obtains any advice on food preservation from her mother and responded, "*Yeah, I get from her. [She teaches me that] for meat, I have to cook well so that even if I store it can't get bad, for fermented milk I have to preserve well when it is ready and keep it well if dried."* Mother, child 18 months old, Isiolo County, Gabra.

Changing traditional preservation practices: While women learned about traditional methods of food preservation from their mothers, grandmothers or mothers-in-law, these data point to changing practices. For example, traditional storage containers are no longer available, so mothers are using plastic and metallic containers for preservation of meat and milk. Smaller animals (goats and sheep) are often slaughtered, resulting in inadequate quantities of meat for preservation. In addition, there are changes in lifestyle (e.g., food being available for purchase in shops, children attending school instead of working with livestock) and perceptions of younger generations who favor modern methods of preserving and consuming food. Some participants discussed never receiving any advice on how to preserve foods, such as meat or milk. This loss of knowledge is attested to in the following quotes by two elder women.

> *"People don't follow the right procedure in food preservation, like smoking gourd, people nowadays don't have the wooden gourd as we had before. Nowadays they use plastic containers in milking their cows and they use the same in preserving milk. For me, I still have my wooden gourd which my mum gave me. I do not know why they are not observing, but for me, I still follow the same tradition."* Elder woman, Marsabit County, Rendille

"Among the current generation, no one is preserving well. If they slaughter animals, they will just cook and serve it in bowl then put there to be eaten, there is nobody storing preserved meat in wooden traditional meat storage container (Dhibbe). They also have metallic jug to preserve meat, but they don't do so." Elder woman, Marsabit County, Sakuye

3.8 Beliefs around child growth and health

Health is equated with child weight gain, "growing taller" and increasing strength: Most mothers described the health of their child based on appearance or behavior in both counties. Signs of health included *growing taller, becoming stronger, gaining weight, being "fat", not being too slim, being clean—while signs of poor health included losing weight, being weak and displaying symptoms of illness.* These signs of health are illustrated by a mother from Isiolo County in the quote below:

"After I gave birth to him, first I breastfed exclusively for six months and he grew well without even getting any infection apart from the normal…every time I take him to hospital, I always found his weight is increasing regularly he is not decreasing in weight." Mother, child 14 months old, Isiolo County, Sakuye

Feeding well as a sign of child health: Most mothers described being able to understand how healthy their child was based on the way they ate—specifically, if the child is exclusively breastfed or eats foods well during complementary feeding. These were seen as signs of health by most mothers. A few mothers mentioned feeding the wrong foods, such as feeding animal milk before six months, being a cause of illness or stomachache, as illustrated in the quote below.

"They said if you give milk and water, it causes diarrhea…even us we see that they diarrhea…so now, we stopped until those six months. But if they reach those months and beyond, they said we give them good food...that is it, that is why we followed that." Mother, child 8 months old, Marsabit County, Gabra

Signs of poor health could include symptoms of illness: The majority of mothers mentioned symptoms of illness that would indicate their child was in poor health (e.g., fever, flu-like symptoms, cough, fainting, dizziness, diarrhea, sneezing, vomiting, swelling), which would require taking the child to the hospital/nearby clinic for treatment.

Breastfeeding practices: Most mothers discussed exclusively breastfeeding their child until six months, with all mothers continuing to breastfeed through 2 years of age. Some mothers mentioned exclusively breastfeeding their child until 6 months old as a "healthy" practice, and largely expressed that this information came from health care workers at hospitals/health clinics, to not feed the child any other food (including milk or water) until 6 months of age. A mother from Isiolo County describes receiving advice on breastfeeding from a doctor, stating, "*…I did not give him animal milk till seven months as I was advised not to by the doctor as breast milk has all the nutrients needed at that time."* Mother, child 9 months old, Isiolo County.

Early introduction of foods: A few mothers and fathers said they began to introduce certain foods, particularly animal milk prior to 6 months of age, which is the recommended age for introduction of complementary foods. The reason for early introduction of animal milk was a crying child, competing tasks and a child left with other caregivers. This is illustrated by a mother from Marsabit County, who responded as follows when asked why she feeds cow's milk to a child of 2 to 4 months of age:

"This is our tradition since, and even sometimes her mother can't satisfy the child, you will see while the child is breastfeeding, he or she starts crying and sometimes the mother can go to look after the animal or go to fetch water, you are left with the child at home, so you have no option but to give the child animal milk." Fathers' FGD, Marsabit County, Samburu

3.9 Complementary feeding

First food

Regardless of tribe, county or season, our findings reveal a reliance on animal milk as a first food for feeding of children less than 2 years of age. While the age of introduction varies, animal milk is fed as early as 2 months old. However, the majority of mothers relayed introducing "first" foods at 6 months of age. All mothers mentioned feeding either boiled or unboiled fresh animal milk to their children alone or with other "soft" foods, such as potatoes, rice, ugali, porridge or even fruits. The common practice of feeding animal milk as a first food is illustrated by a mother from Marsabit County, who states, *"The first thing I gave her is, I boiled cow milk and gave her, I pour it in a clean feeding cup when she feels thirsty…also I give her something soft…potatoes, rice and stew, macaroni, small anjera.*" Mother, child 19 months old, Marsabit County, Gabra

Feeding preserved food to young children

Most mothers, fathers and elder women reported that preserved foods are often reserved for adults and older children and usually not fed to young "small" children. An elder woman from Isiolo County illustrates this sentiment, stating, "*Food are not much preserved for children; you cook freshly slaughtered and feed them."* Elder woman, Isiolo County, Borana. An elder woman from Marsabit County echoed this belief that small children should not consume preserved foods, stating, "*Older people are the ones to consume not the small children, they are not given Galangal (fried meat)."* Elder woman, Marsabit County, Rendille. In addition, some mothers indicated that they had never given preserved meat. Some elder women indicated that children are not given preserved meat. This belief is illustrated by an elder woman from Isiolo County who was asked whether children below age 2 can be fed fermented milk and replied, "*No. Once in a while this for elder children and mature people as well."* Elder woman, Isiolo County, Sakuye

Feeding preserved meat

Some mothers mentioned different ways of knowing when their child(ren) was ready for consumption of preserved foods. These included the following "markers of readiness": a child reaching a specific age, when a child reaches for food, cries for food, giving small pieces to see if the child will want it, when the child has teeth and when the child starts talking or walking. Furthermore, when one mother from Isiolo County was asked about signs of her child being ready to eat preserved foods, she described "*testing*" her child to know if she is ready to eat certain foods, stating, *"Yeah, if she saw me am drinking or eating food she cries to the food. Yeah, and I will test her whether she can be able to eat."* Mother, child 11 months old, Isiolo County, Gabra

Although most participants agreed that preserved meat (primarily goat) may be fed to children at some point, the age of introducing preserved foods varied from 7 months old to above 2 years old. Some mothers described starting this process by feeding the child small pieces of preserved meat. Preserved meat is usually given in small pieces only when the child has grown teeth and/or can chew and swallow or reached a certain age. As one mother from Marsabit County states, *"This koche [tiny pieces of fried*

meat] when they turned 1 year [old], they can eat what the teeth is able to eat." Mother, child 7 months old, Marsabit County, Gabra

Some participants said that when a child is below 1 year old, they are given pieces of meat to suck as sweets and then they would not swallow but would throw it on the ground after sucking. This practice is illustrated by an elder woman from Isiolo County who explained, *"…but children who are above 1 year to 2 year they can be fed. The children from 1 year and above are the ones given preserved meat and 'mandazi' to suck on it."* Elder woman, Isiolo County, Sakuye

In both counties, the practice of softening meat was explained by one father who said, "…babies do not have teeth, mothers chew these foods on their behalf. After it is softened, babies are given these foods to suck." Fathers' FGD, Marsabit County. Others softened it by dipping it in other hot foods or oil to make it soft as illustrated by a mother who stated, "*Some meat is soft, and others are dry. You will dip in hot food, and when it gets soft you will feed him."* Mother, child 13 months old, Marsabit County, Gabra

Feeding fermented milk

Mothers typically gave their children either fermented goat or cow milk, as camel milk was considered by most mothers to be too light to ferment. The age at which fermented milk is given varied from ages 8 months to 9 months, with most mothers starting to give fermented milk when their child is between 1 to 2 years of age. Additionally, one FGD indicated that milk fat from fermented milk is rubbed on the children's tongues when they reach 6 months of age. This range in ages for beginning to feed children fermented milk is illustrated by a mother from Isiolo County who stated, *"When he turns 1 year old, I give him though children can't drink that much fermented milk since it has sour taste*." Mother, child 14 months old, Isiolo County, Sakuye. However, some children are not given fermented milk because it is "sour." Almost all participants who fed their children fermented milk would add sugar to make it less sour, and fresh milk or water (when fresh milk was unavailable) to make it "light" for digestion. This practice is illustrated by an elder woman from Isiolo County who explained, "*Fermented milk, yes, it's stirred. A little bit of sugar is added and is given to them; they do drink it.*" Elder woman, Isiolo County, Borana. A father from Marsabit County echoed the practice of adding sugar to sweeten fermented milk, explaining, *"Mothers give this fermented milk to children, if the milk is sour, they add sugar and sweeten it, if it is thick and the baby can't drink, they add fresh milk."* Fathers' FGD, Marsabit County

Mandazi

The majority of the mothers fed mandazi to their children from 6 months of age, while others waited until children were above 1 year of age. However, a few mothers reported that their children are unable to eat mandazi because they "*cannot chew"* or "*had no teeth."* For example, one mother from Marsabit County stated, "*This mandazi, she cannot eat before turning one year."* Mother, child 19 months old, Marsabit County, Gabra

For children to eat mandazi, mothers modify it by softening using tea, dipping it in other hot foods, putting the food in oil to soften or chewing for the child. One mother from Isiolo Country describes this practice, stating, *"I put the mandazi inside the tea to make it soft."* Mother, child 6 months old, Isiolo County, Borana. An elder woman from Isiolo County echoes the common practice of softening mandazi for young children, responding as follows when asked whether there are other ways to soften foods for children, *"No. Not unless you put in oil to soften it and feed the children".* Elder woman, Isiolo County, Sakuye

Ghee and preserved tail fat

A few mothers reported giving ghee to children by either feeding them directly or mixing it with other foods. In addition, most mothers started to give their children preserved fatty meat to suck on from 8 months old, and one mother started giving preserved fatty meat at 9 months old. Some mothers believed this meat is good for their children's health, such as a mother from Marsabit County who stated, "*The fatty meat is soft and has animal oil, and if he sucks the fatty meat the animal oil is good for his health."* Mother, child 12 months old, Marsabit County

The practice of feeding preserved fatty meat to children is demonstrated by an elder woman from Isiolo County who stated, "*But those who are below 2 years [old] their preferred meat is dried fried tail fat, which you feed them in the morning."* Elder woman, Isiolo County, Sakuye

Other foods consumed by young children less than 2 years of age

During complementary feeding, foods that children are commonly fed include rice, pasta, small amounts of ugali, beans, anjera (pancake), potatoes and porridge. These foods may be prepared with cabbage, carrots and tomatoes or ugali, or they may be mixed with animal milk. Some mothers mentioned buying local fruits such as oranges, bananas and mangoes for their children and feed them when money is available. This is illustrated by a mother from Marsabit County who relayed, "*Even now, I give her cow's milk, something like yogurt also, sometimes I cook potatoes for her, even rice, anjera (pancakes). Foods like bananas and mangoes I also buy for her."* Mother, child 19 months old, Marsabit County, Gabra

Some respondents indicated that they feed their children vegetables such as cabbage and kale. Other mothers discussed waiting until their children were older before giving them vegetables such as kale or cabbage, with most starting to give it to them when they reach their first birthday, as mothers believe children can eat these vegetables at this age. For meat, some mothers indicated that they knew the child was ready when he/she started showing interest in meat as other people were eating. For example, one mother explained, *"When I have meat and I have observed the child needs meat, I will give. The child will see it while I am holding and will cry for it."* Mother, child 10 months old, Marsabit County, Samburu

Several mothers from all tribes indicated that they feed their child one or two small pieces of meat (i.e., goat, chicken, or cattle) made as a stew accompanied by chapati, ugali or rice**.** Some respondents indicated that they start to give their children meat at around 10 months old, when they start walking, or when they reach one year of age or older. Most mothers described giving their babies pieces of meat to suck on as they do not have teeth to chew. A mother from Isiolo County described this practice, stating, *"I feed her meat if it is available. I add with other food like goat meat stew and feed her. I can feed her together with ugali or rice."* Mother, child 9 months old, Isiolo County, Sakuye. Furthermore, some mothers indicated that refusal of some foods is a reason not to give foods such as vegetables and milk from certain animals. One mother from Isiolo County illustrates this refusal, stating the following:

> *"He doesn't like Sukuma wiki (kale); he usually looks like he wants to vomit every time I give him Sukuma wiki. He has never taken any other milk apart from camel milk; when I give him cow milk he refuses to drink, I usually give him when camel milk is not available…when I give him camel milk, he takes it without refusing."* Mother, child 9 months old, Isiolo County, Sakuye

Several mothers indicated that they give their children unhealthy snacks such as commercial fruit juices, soda, biscuits, and sweets*. "He drinks juices like afya (commercial juice) and soda."* Mother, child 13 months old, Isiolo County, Sakuye. Children are also given tea as a meal and in-between meals as snacks*.*

"Like now when there is no milk, we buy commercial milk, use it to make tea and feed her." Mother, child 10 months old, Marsabit County, Gabra

Norms and Beliefs – Infant and Young Child Feeding

All participants in both counties, including mothers, fathers and elder women, described beliefs that the dried tail fat is soft, has oil, and is good for the health of the child. One elder woman from Isiolo County illustrates this belief, stating*, "Those who are below 2 years their preferred food is dried fried tail fat which you feed them in the morning."* Elder woman, Isiolo County, Sakuye

Most participants including fathers, elder women, mothers and county stakeholders in both counties held the perception that there were no cultural beliefs hindering young children's consumption of certain foods. This was reiterated in an FGD in the quote below:

> *"There are no beliefs that these foods are for specific people. Some mothers due to their misunderstanding sometimes fail to eat preserved meat thinking that she is inferior, and the meat is meant for superior persons…. of which there are no documented beliefs concerning that. But nowadays they do eat them. The only time she eats fermented milk and preserved meat is when the husband is satisfied and has left some of it in the plate. That is when she feeds the baby too…It's the culture that women believe otherwise the husband cannot stop her from eating."* Fathers' FGD, Marsabit County

Despite this perception in the communities, a few cultural beliefs were discussed by fathers, mothers, and elder women regarding introducing certain animal-source foods, including organ meats and certain milk (i.e., goat milk). For example, some participants expressed a belief that children who have not learned to speak yet are not allowed to eat the tongue, as it is believed they will talk excessively. Others mentioned children not being allowed to eat eyes because of the belief that it will cause children to glare at others. In addition, some participants mentioned organ meats such as kidneys, pancreas and liver being reserved for younger children, but not for firstborn children. In Marsabit County, goat milk is not fed to children because some mothers believe *"it makes the children become still and have tosses"* or "*it will make them restless*."[j] In addition, in Isiolo County, some mothers do not feed sheep meat to their children as they believe that it will delay their speech. This is illustrated by a father from Isiolo County who explained his perspective in the following quote:

> *"Sheep meat is not easily given to children. When the baby reached the age of eating other food and she is given sheep, she can't talk fast (speech will be delayed) but when they eat goat meat it is believed they talk fast (speech develops sooner) since goat has got a lot of noise thereby if child eat goat meat they will talk fast.*" Fathers' FGD, Isiolo County.

Norms and beliefs about preserved foods

Some mothers mentioned that they do not feed preserved foods to their children because they believe that it is not good for the child. Some of them mentioned that preserved meat causes constipation or stomachache, while fermented milk was also presumed to cause diarrhea. This belief is expressed by a mother from Isiolo County in the following quote: "*Yeah, he eats mandazi but meat—he doesn't eat it—causes him stomachache. I fear for him having stomachache."* Mother, child 9 months old, Isiolo County

[j] Among the Gabra in Maikona Ward, North Horr

A few participants in Isiolo County mentioned that dried sheep fat is fed to children as a cure for whooping cough, pneumonia, cold/flu or to reduce fever, as expressed by a mother from Isiolo County who stated, "*Yes, there is such food which is preserved for young children like dried sheep fat (guguble). It can be treated as cure for whooping cough."* Mother, child 14 months old, Isiolo County, Sakuye

Furthermore, one mother from Isiolo County reported that she used ghee to alleviate stomach problems:

> *"You will put the fat in a big container/bowl. And heat the fat to melt it...to separate milk and the fat...when you separate, clear clean fat will come at the top...when the milk evaporates, you will remain with clean melted fat…you then cool it. When it cools, you preserve it in a clean container like galeni...and preserve somewhere...now when the kid has flu, he is given these fats like medicine in a spoon in the morning, evening. I do also give him the other times...I give him morning and the evening like hospital medicine prescription.*" Mother, child 21 months old, Isiolo County, Borana

3.10 TIPs findings

Figures 2, 3, 4, and 5 illustrate the recommendations given to mothers in Isiolo and Marsabit counties respectively, during TIPs #2 on complementary feeding and food preservation based on findings from TIPs #1 (motivations and key messages based on TIPs #1 findings are described in the accompanying TIPs Counseling Guide which emanated from this study). The columns describe recommendations given to the mother based on the gaps identified, the percentage of mothers who accepted the recommendation, the percentage of mothers who tried the recommendation, the percentage of mothers who succeeded in trying the recommendation and the percentage of mothers who modified the recommendation.

In the below figures, "*tried"* is defined as the percentage of accepted recommendations that were carried out by mothers. "*Succeeded"* is defined as the percentage of tried recommendations which mothers liked and decided to continue after TIPs. "*Modified"* is defined as the percentage of tried recommendations that were modified to fit the specific needs of the mother. The recommendations given to the mothers are further described in detail **below.**

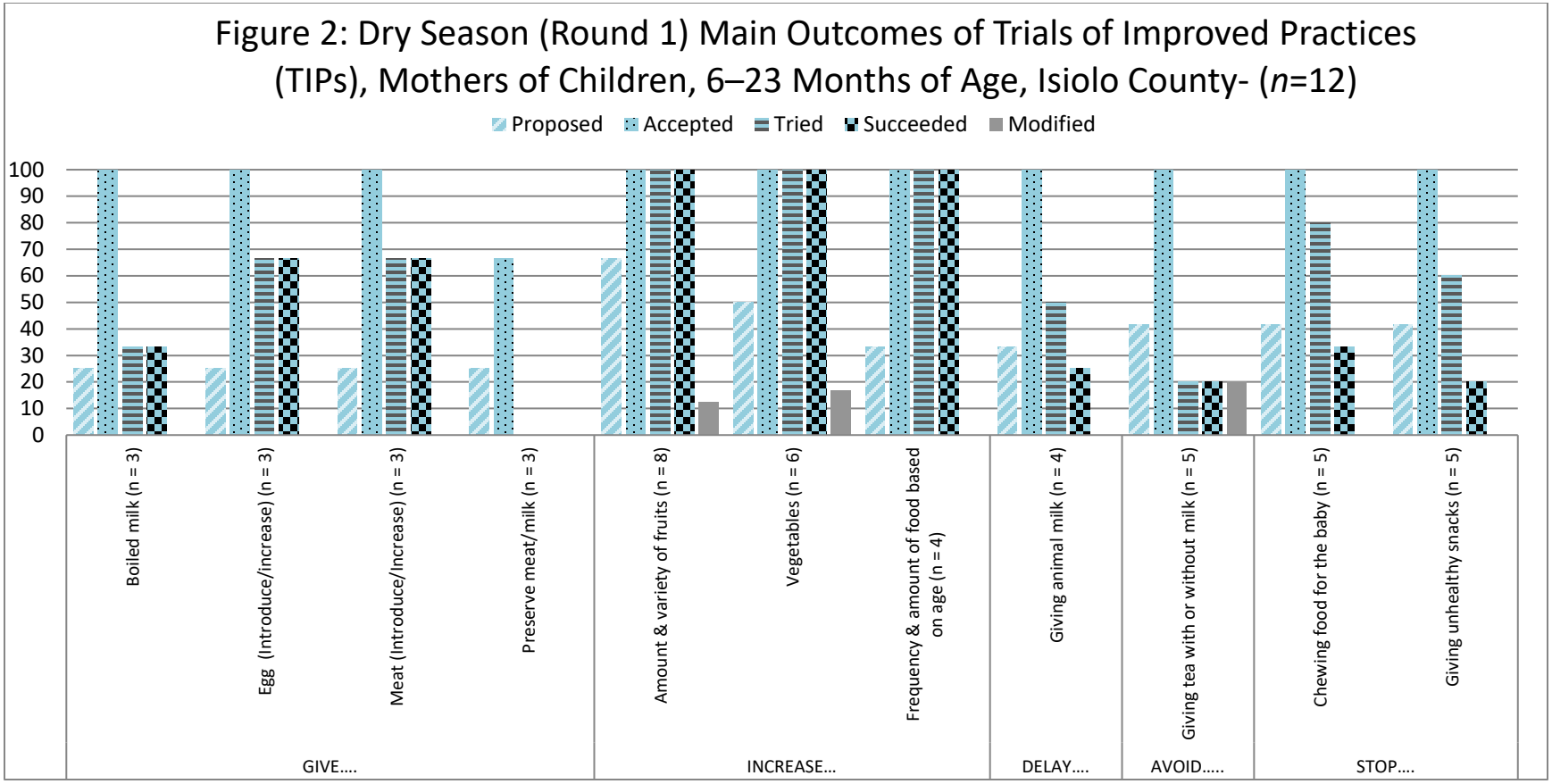


Figure 2: Dry Season (Round 1) Main Outcomes of Trials of Improved Practices (TIPs), Mothers of Children, 6–23 Months of Age, Isiolo County- (n=12)
Proposed
Accepted
Tried
Succeeded
Modified
100
90
80
70
60
50
40
30
20
10
0
Boiled milk (n = 3)
Egg (Introduce/increase) (n = 3)
Meat (Introduce/Increase) (n = 3)
Preserve meat/milk (n = 3)
Amount & variety of fruits (n = 8)
Vegetables (n = 6)
Frequency & amount of food based on age (n = 4)
Giving animal milk (n = 4)
Giving tea with or without milk (n = 5)
Chewing food for the baby (n = 5)
Giving unhealthy snacks (n = 5)
GIVE….
INCREASE…
DELAY….
AVOID…..
STOP….

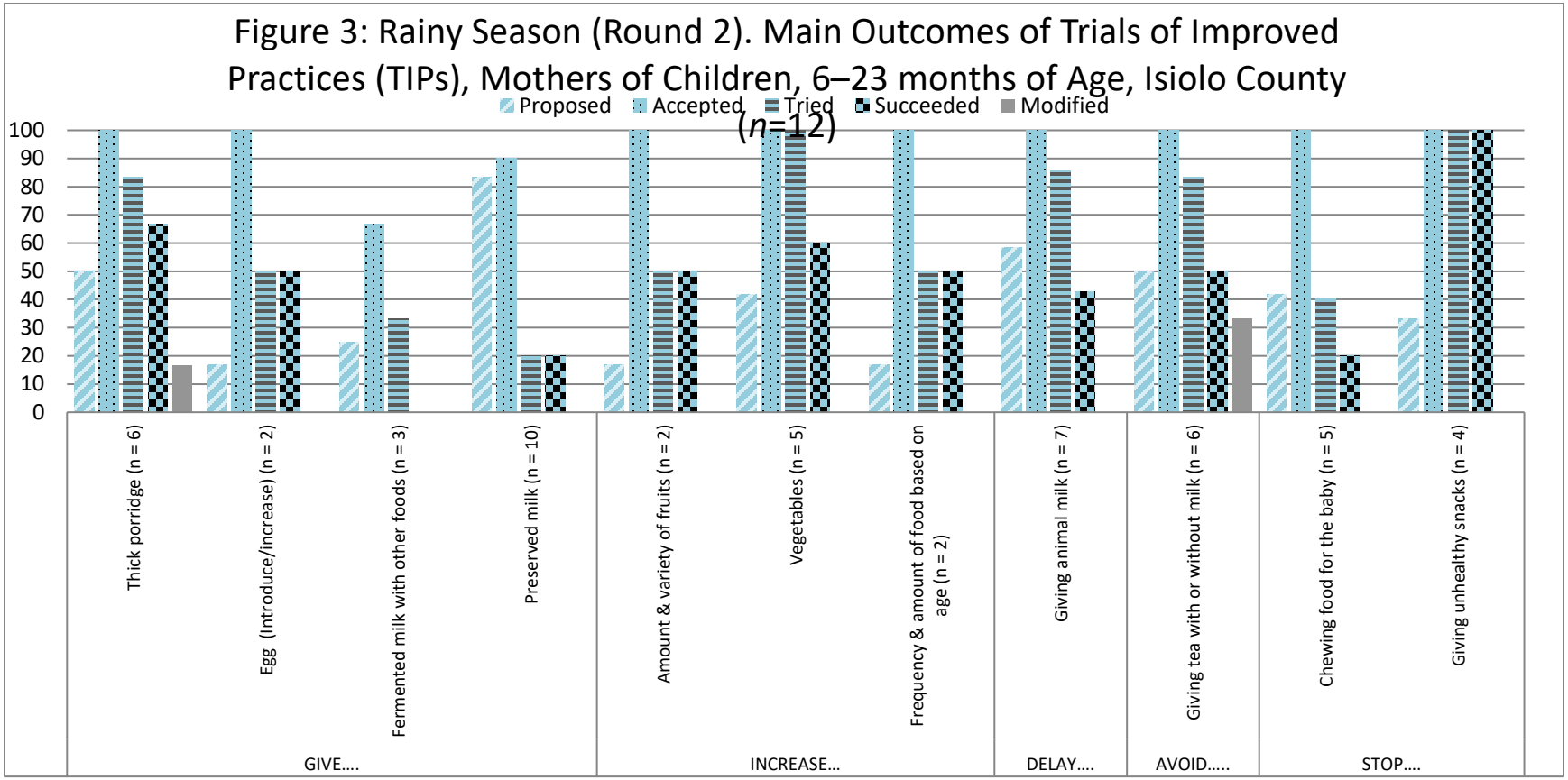


Figure 3: Rainy Season (Round 2). Main Outcomes of Trials of Improved Practices (TIPs), Mothers of Children, 6–23 months of Age, Isiolo County (n=12)
Proposed
Accepted
Tried
Succeeded
Modified
100
90
80
70
60
50
40
30
20
10
0
Thick porridge (n = 6)
Egg (Introduce/increase) (n = 2)
Fermented milk with other foods (n = 3)
Preserved milk (n = 10)
Amount & variety of fruits (n = 2)
Vegetables (n = 5)
Frequency & amount of food based on age (n = 2)
Giving animal milk (n = 7)
Giving tea with or without milk (n = 6)
Chewing food for the baby (n = 5)
Giving unhealthy snacks (n = 4)
GIVE….
INCREASE…
DELAY….
AVOID…..
STOP….

3.11 Isiolo County TIPs recommendations

Feed boiled animal milk to children: Most mothers were giving animal milk to children without boiling it before fermenting it. In Isiolo, during the dry season, one-quarter (3) of mothers (n=12) were advised to boil the animal milk before fermenting it because pathogens present in unboiled milk could make the child unwell. All mothers accepted the recommendation, but only one-third tried and succeeded. Those who did not cited reasons such as having inadequate milk to ferment. During the rainy seasons, no recommendations on fermenting milk were given as mothers stated they had inadequate milk because their animals were away in search of pasture due to insufficient rain.

Feed the child thick porridge: In Isiolo County during the dry season, the counseling focused on replacing tea (fed to children under age 1) with porridge, milk, fruits or another nutritious food found in the home. During the rainy season, mothers were using the little available milk to make tea and thus counseling focused on encouraging mothers to feed the child porridge rather than tea. Half (six) of the mothers were counseled to give thick porridge to the child and all accepted the recommendation. Eighty-three percent (five) of the mothers tried this, with 67% (four) succeeding in giving thick porridge to the child. Though the mothers had been counseled to give thick porridge, 17% (one) modified the porridge to make it lighter by adding milk. Mothers who had not implemented the practice cited reasons such as unavailability of flour and rejection of porridge by the child.

Feed the child meat: During the dry season, counseling on meat uptake focused on preserving and feeding preserved meat as opposed to unpreserved/fresh meat. One-quarter of mothers were advised to either introduce or increase the frequency of feeding meat to their children. Furthermore, the mothers were advised to modify the meat by grinding it, cutting it into small pieces, pounding it or cooking it until it was soft enough for the child to chew and swallow. Although all accepted the recommendation, two-thirds of mothers succeeded in carrying out the recommendation without any modification. Those who were unable to give meat cited lack of money to purchase it from the butchery.

Feed the child eggs: In Isiolo County, most mothers do not feed eggs to children, whether or not chickens are available. During the dry season, 25% (three) of the mothers were advised to feed eggs to their children with 67% (two) trying and succeeding in carrying out the recommendation. However, during the rainy season, 17% (two) of the mothers were counseled to introduce eggs to the child's diet, with half of the mothers succeeding in cooking and feeding the eggs (boiled) to the child with no modification. In both seasons, those who did not try the recommendation cited challenges including lacking money to purchase eggs to feed the child within the seven-day trial period.

Feed preserved foods to the child: Although these study participants come from pastoralist communities in Isiolo County that traditionally consume large quantities of meat, during the dry season, a smaller proportion, i.e., 25% (three) of the mothers were given recommendations to preserve food (i.e., meat and milk). Yet none succeeded due to unavailability of meat, lack of money to purchase from butcheries and inadequate milk for preservation as animals had moved away in search of pasture. One mother cited the amount of time involved in preservation as a hindrance. During the rainy season, 83% (10) of the mothers were counseled to preserve food as per the following and feed it to their children: meat (five mothers), mandazi (four mothers) and vegetables (one mother). Ninety percent of the mothers agreed to try the recommendations. All the mothers counseled on preserving and giving meat to their children were unable to do so, citing reasons such as the animals being far away in search of pasture and lack of money to

purchase it from butcheries. One of the four mothers succeeded in preserving and giving vegetables to her child. For vegetables, those who did not preserve attributed it to either not having enough money to purchase vegetables and unavailability in the market. The mother advised to preserve and give mandazi was successful in following this recommendation. In addition, during the rainy season, 25% (three) of the mothers were counseled to **feed their child fermented milk alongside other foods** such as rice, potatoes, mandazi and fruits like bananas to increase the palatability for the child instead of adding sugar. Sixty-seven percent (two) agreed to try the recommendation, with 33% (one) trying and succeeding. The two mothers who never tried the recommendation cited lack of adequate milk for preservation.

Feed the child organ meats: In Isiolo County, feeding children organ meats is associated with some taboos. This recommendation was given during the rainy season only to the mothers who had slaughtered animals and still had organ meat available or were certain of slaughtering within the week. Eight percent (one) of the mothers were counseled on giving organ meats that were available at the time. This mother was able to cook and feed the child tongue. This recommendation was not given during the dry season.

Increase the amount and variety of fruits fed to children: During the dry season, 67% (eight) of mothers were counseled on increasing the amount and variety of fruits fed to their children and all tried and succeeded in giving them bananas, mangoes or oranges. One mother, however, added sugar to the oranges due to a perceived bitter taste. The fruits given were limited to what was available in the market. During the rainy season, 17% (two) of the mothers were given the same recommendation. In addition, mothers were advised to feed fruits that were in season. All of the mothers agreed to try the recommendation, and half succeeded. Mothers unable to practice the recommendation cited the high cost of fruits as a hindrance and their unavailability in the market.

Increase children's vegetable intake: During the dry season, half of the mothers were counseled to introduce and increase the vegetables fed to their children, and all succeeded**.** One mother modified the recommendation by mixing kale with cabbage, which the child liked and ate, as she would vomit when given kale alone. Mothers also appreciated that children would eat the vegetables when they were cooked until soft. During the rainy season, 42% (five) of the mothers were given the same recommendation. All of the mothers accepted and tried the recommendation. However, only 60% (three) succeeded in practicing the recommendation through the week as some were unable to continue purchasing the vegetables due to cost and availability. However, during both seasons, the key challenge faced was inadequate vegetables (both type and quantity) as they were not always available in the market on a daily basis and mothers lacked money to purchase vegetables.

Increase the amount and frequency of foods consumed based on age: In Isiolo County, during the dry season, 33% (four) of the mothers were counseled to increase the frequency and amount of food. All mothers accepted and succeeded in carrying out the recommendation. Mothers reported that the children ate well and cried less and that the increase was good for their health and wellbeing. The mothers reported that they would continue with the practice for the benefit of the child. To achieve increased frequency, some mothers introduced healthy snacks, while others kept aside family foods that were available on that day for the child to eat as a snack. during the rainy season, 17% (2) of the mothers were given the same recommendations. All mothers accepted to try the recommendations. However, half of the mothers succeeded in increasing the amount and frequency of the meals fed to the child with the mothers who did not succeed citing reasons such as inadequate food for the household.

Delay giving animal milk to the child, and predominant continued breastfeeding: In Isiolo county animal milk is predominantly fed to children below one year of age, at the expense of continued breastfeeding. During the dry season, one-third of mothers were counseled on delaying introduction of animal milk to a child less than one year of age and continue predominant breastfeeding. Half of women accepted and tried the recommendation, yet only 1 of 4 succeeded with no modification. Those who did not try the recommendation said they could not stop because the child was already used to animal milk. During the rainy season, 58% (7) of the mothers were given the same recommendation. All accepted and 86% (6) tried. Of these, only 43% (3) succeeded. The reasons mothers provided when they could not carry out this recommendation include refusal by a mother who cited lack of alternative food to feed the child, decrease in child's weight when the mother stopped feeding them animal milk, and lack of family support. Additionally, one mother said that she would implement the recommendation gradually.

Avoid feeding the child tea with or without milk: Most mothers gave their children tea in Isiolo County. During the dry season, 42% of the mothers were counseled to avoid giving tea with or without milk to the child. Though all accepted, only one mother tried, succeeded, and modified the recommendation. During the rainy season, counseling was focused on replacing tea with porridge alongside other available family foods. Half of the mothers (6) were counseled, and all agreed to stop giving their children tea with or without milk. Eighty three percent (5) of the mothers tried the practice with half (3) succeeding and 33% (2) modifying the practice. Those who did not avoid the practice but chose to modify, reduced the quantity of tea given as they replaced it with porridge and other foods, while others planned to gradually wean the child of the tea. Those who did not try the recommendation described the child crying for it, inadequate milk which made it easier to make tea which will be adequate, refusal of milk by the child, or lack of money to purchase.

Stop chewing foods for the baby: During both seasons, one quarter of the mothers were counseled to stop chewing food for the child or softening with tea. The mothers were counseled to modify foods in the following ways: pound meat and cook until soft, soften mandazi in vegetable or meat stew instead of tea, pound and mash foods such as fruits and maize. All the mothers counseled agreed to stop chewing food for the child. However, only 20% succeeded in the recommendation. Half of the mothers succeeded in modifying the foods in the rainy season as opposed to the dry season, during which only one third did. The mothers counseled on fruits were successful in mashing and feeding. The mother counseled on pounding maize before cooking did so one but found it time-consuming and reported that she would not continue with the practice. One mother could not practice softening mandazi in stew as she said she was too busy to make mandazi. The others who did not practice for meat cited lack of money to purchase it to prepare for the child as advised. A mother also reported that the process of modification was tedious.

Stop feeding the child unhealthy snacks: In Isiolo county, mothers fed unhealthy snacks like commercial juices, sodas, biscuits and sweets to children. During the dry season, 42% (five) of mothers were counseled to stop giving their children unhealthy snacks and to replace them with other available healthy options such as fruits, porridge and family foods. All agreed to try the recommendation and only 20% succeeded without any modification. During the rainy season, 33% of the mothers were counseled to do the same. All of the mothers agreed to try the recommendation and succeeded. Despite mothers reporting that they stopped giving their children unhealthy snacks, it was evident that they were still available within the home, as the children would be given them when they cried for them.

Figure 4: Dry Season (Round 1) Main Outcomes of Trials of Improved Practices (TIPs), Mothers of Children, 6–23 months of Age, Marsabit County, (*n*=18)

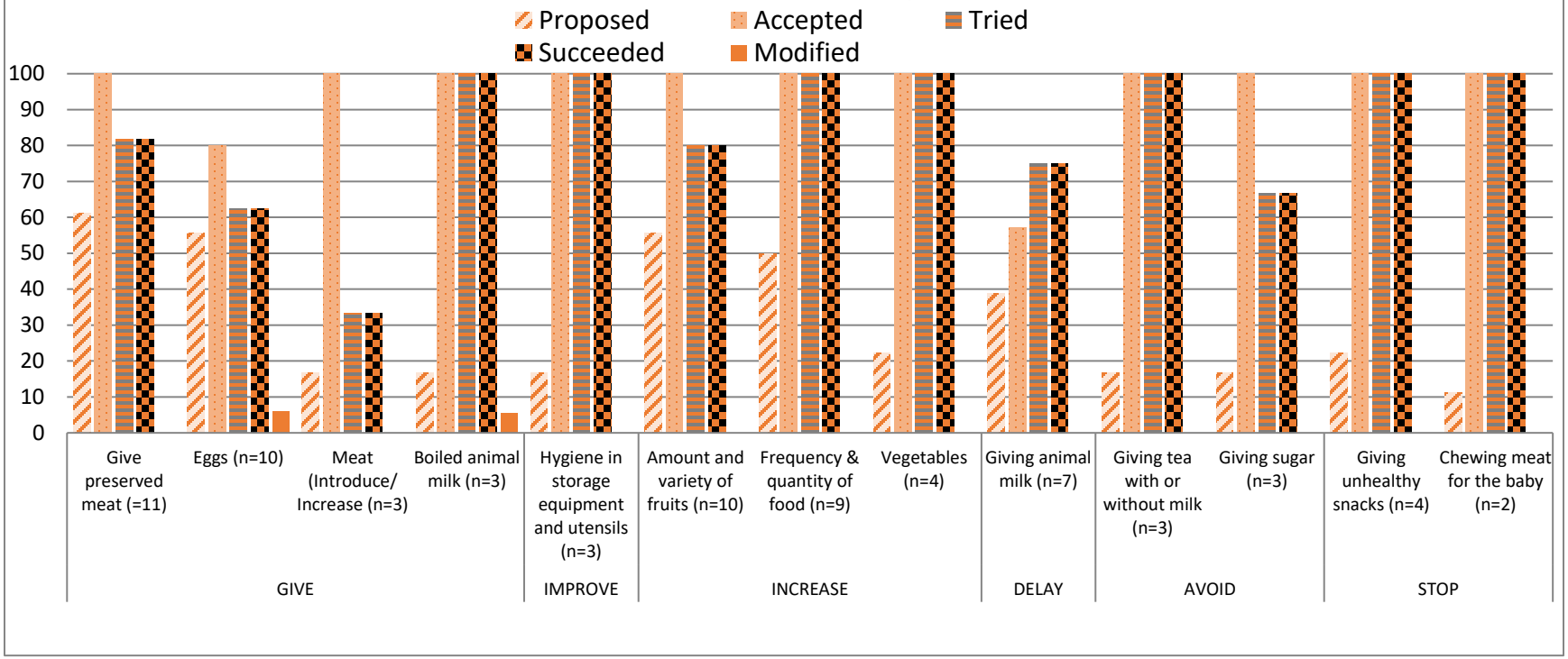
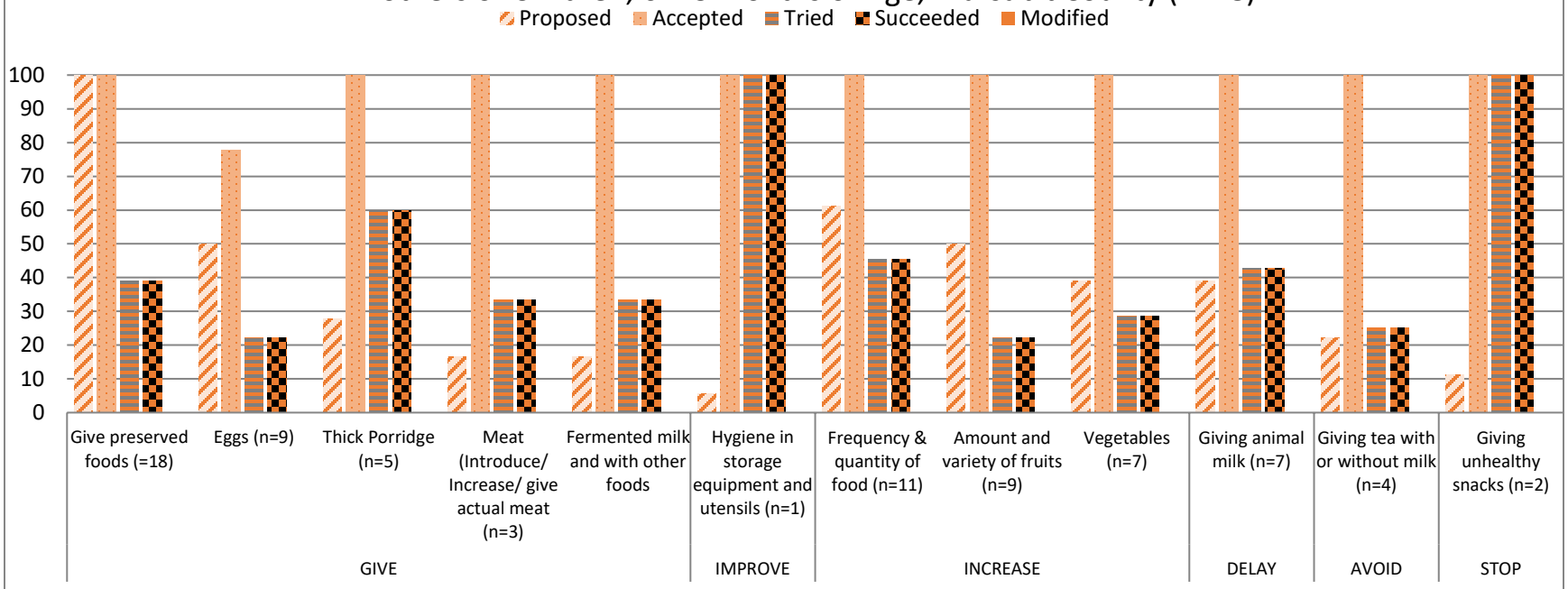


Figure 5: Rainy Season (Round 2) Main Outcomes of Trials for Improved Practices (TIPs), Mothers of Children, 6–23 months of Age, Marsabit County (*n*=18)



3.12 Marsabit County TIPs recommendations

Feed the child preserved foods: During the dry season, 73% (11) of the mothers in Marsabit County were advised to start giving preserved meat to their children. Mothers were specifically taught to modify the preserved meat by cutting it into small pieces, grinding it and boiling it to make it soft enough for their children to swallow. Preserving meat was possible due to a traditional circumcision ceremony among the Samburu and Rendille communities that required households to slaughter goats and that coincided with the TIPs visits. Nearly 82% (nine) of mothers tried and succeeded in giving their children preserved meat without any modification. Those mothers who did not try the recommendation felt that boiling the preserved meat would make it tasteless. One mother who had been given the recommendation was not available for the follow-up TIPs #3 visit.

During the rainy season, all 18 mothers were advised to start giving preserved food to their children, which included meat and vegetables. All mothers accepted the recommendation. Fourteen mothers who were advised to give their children meat were also counseled to stop giving fatty meat for their children to suck on but instead to modify the preserved red meat by cutting it into small pieces, grinding it and boiling it to make it easy for the child to swallow. Only 39% (seven) succeeded with this recommendation, and the mothers who succeeded were all counseled to feed their child preserved meat. Those mothers who did not try the recommendation cited reasons such as animals not being slaughtered in the household during the period and lack of money to purchase meat from the butcheries. One mother indicated that her child was unwell during the week and therefore was not given any other foods apart from milk. Four mothers were counseled on preserving vegetables, but none succeeded in the recommendation. They attributed this to lack of vegetables from the vendors and lack of money.

Feed the child eggs: During the dry season, 10 of 18 mothers in Marsabit County were advised to introduce eggs to their child's diet while ensuring they feed the children the egg white and egg yolk. Sixty three percent (five) of mothers who accepted the recommendation tried and succeeded in feeding eggs to their children without modification. Some of the mothers who refused the recommendation believed eggs smelled bad and they felt that they could not feed them to their children as they also had never consumed them. Those who did not try the recommendation said they were unable to obtain them during the seven to 10-day period, while the one mother who unsuccessfully tried the recommendation ended up giving the baby raw egg yolk after being advised to do so by a neighbor. During the rainy season, half (nine) of the mothers were advised to introduce eggs to their child's diet. About three-quarters (seven) of the mothers accepted the recommendation, while two who refused explained that it's a taboo in their culture to consume eggs. Twenty-nine percent (two) of mothers tried and succeeded in feeding eggs to their children without any modifications. Some mothers who did not try the recommendation said they were unable to obtain the eggs during the one-week period due to lack of money to purchase them, while one mother was unavailable during the TIPs #3 follow-up visit.

Feed the child thick porridge: During the rainy season, 28% (five) of mothers were advised to feed thick porridge to their children. All the mothers accepted the recommendation, and 60% (three) succeeded in implementing it. Of the two mothers who were unable to try the recommendation, one cited reason such

as shortage of maize flour to make the porridge, while the other indicated that she had taken the animals to graze during the week.

Feed the child meat: During the dry season, 17% (three) of mothers were advised to give other meat such as chicken to their children and all agreed to try the practice. Only one-third of mothers were able to successfully implement the practice without modification. During the rainy season, 17% (three) of the mothers were advised to give their children actual meat instead of giving them soup. This advice was given to mothers who felt that their babies were too young to eat meat, in addition to not having teeth. Furthermore, the mothers were advised to modify the meat by cutting it into small pieces, grinding it and boiling it to make it easy for the child to swallow. All the mothers accepted this recommendation, and 33% (one) tried and succeeded in practicing without any modifications. Mothers who did not try the recommendation were unable to access meat during the one-week trial period because they lacked money and animals were not slaughtered in their households.

Feed the child boiled animal milk: In both seasons, 17% (three) of the mothers were advised against feeding their children unboiled fresh or fermented animal milk and were instead encouraged to boil it first. The study team explained to them that the unboiled milk contained pathogens which could affect the health of their child. All mothers accepted the recommendation and succeeded during the dry season. A few mothers reached during the dry season indicated that they modified the recommendation by boiling the raw milk with herbs (locally known as *fito*) and feeding the milk to the child as a cough remedy. In the rainy season, one mother indicated that she believed unboiled milk was healthier and tastier, while another mother indicated that she did not have enough milk during the week and therefore did not practice the recommendation.

Feed the child fermented milk: During the rainy season, 17% (three) of mothers in Marsabit County were advised to give their babies fermented milk. In addition, the mothers were told to give the fermented milk with other foods rather than sweetening it with sugar. All the mothers accepted the recommendation. Thirty-three percent (one) of them tried and succeeded, while those who were unable to follow the recommendation did not have enough milk to ferment during the period.

Increase frequency and amount of food for children: In Marsabit County, 50% (nine) and 61% (11) of mothers were advised to increase the frequency of feeding and the amount of food given to their children according to their children's ages during the dry and rainy seasons, respectively**.** All the mothers accepted the recommendation without modification, with 100% success in the dry season and 45% (five) success in the rainy season. Mothers who were unable to follow the recommendation cited reasons such as inadequate food for the household, as there were other children who needed to be fed, and refusal of the child to eat more food.

Introduce/increase fruits to children: In Marsabit County, 56% (10) and 50% (nine) of mothers were asked to increase the amount and variety of fruits they were feeding their children daily during the dry and rainy seasons, respectively. They were advised that they could also mash or slice the fruit into small pieces. All the mothers accepted the recommendation. Most—80% (eight)—mothers were able to successfully implement the recommendation without modification in the dry season as opposed to the rainy season, during which a smaller proportion of mothers— 22% (two)—were able to try the recommendation without modification. In both seasons, mothers who did not follow the recommendation cited unavailability of fruits, lack of money and lack of time to purchase the fruits as key challenges.

Introduce/Increase vegetables to children: During the dry season, 22% (four) of mothers who were advised to increase the amount and variety of vegetables in their children's diets accepted, tried and successfully followed the recommendation. In the rainy season, 39% (seven) of mothers who were given the same recommendation accepted and 29% (two) successfully followed it. Mothers who were unable to practice the recommendation cited reasons such as vegetables not being available or affordable, and one mother was absent during the TIPs #3 visit.

Delaying animal milk, and continuing to breastfeed: In both seasons, 39% (seven) of mothers in Marsabit County were giving predominant animal milk (fresh and fermented) to their children who were below one year of age, instead of predominant continued breastfeeding. These mothers were advised to delay giving predominant animal milk and instead continue predominant breastfeeding of their children. Fifty seven percent (four) of mothers accepted the recommendation in the dry season, while 100% did so in the rainy season. Seventy-five percent (three) and 43% (three) tried and successfully implemented the practice in the dry and rainy seasons, respectively. Those who were unsuccessful cited reasons such as lack of alternative food to feed their children and mothers being unable to breastfeed especially those who had to look after their livestock during the day.

Avoid giving tea to children: Seventeen percent (three) and 22% (four) of the mothers in Marsabit County were advised to avoid feeding their child tea, with or without milk, as a meal or a snack, during the dry and rainy season, respectively. Mothers were further advised to replace tea with porridge or a healthier snack like fruit or milk. All mothers accepted and carried out the recommendation without modification in the dry season, while 25% (one) were able to follow the recommendation in the rainy season. Mothers reached in the rainy season gave reasons such as "babies cried for the tea" as reasons for not implementing the practice.

For the following recommendations – **Stop chewing food for the baby, improve hygiene and stop feeding the child unhealthy snacks** – small proportions of women agreed to these recommendations in both seasons. All of them agreed to try and were able to successfully implement the recommendation to improve hygiene and stop feeding their children unhealthy snacks during the TIPs visit. However, during the rainy season, mothers who had been advised to stop chewing food for their babies were unable to practice as one mother could not access meat due to lack of finances to purchase it, while the other was absent during the TIPs #3 visit.

Figure 6: Foods consumed daily before TIPs counseling among children 6 to 23 months of age in Isiolo and Marsabit counties

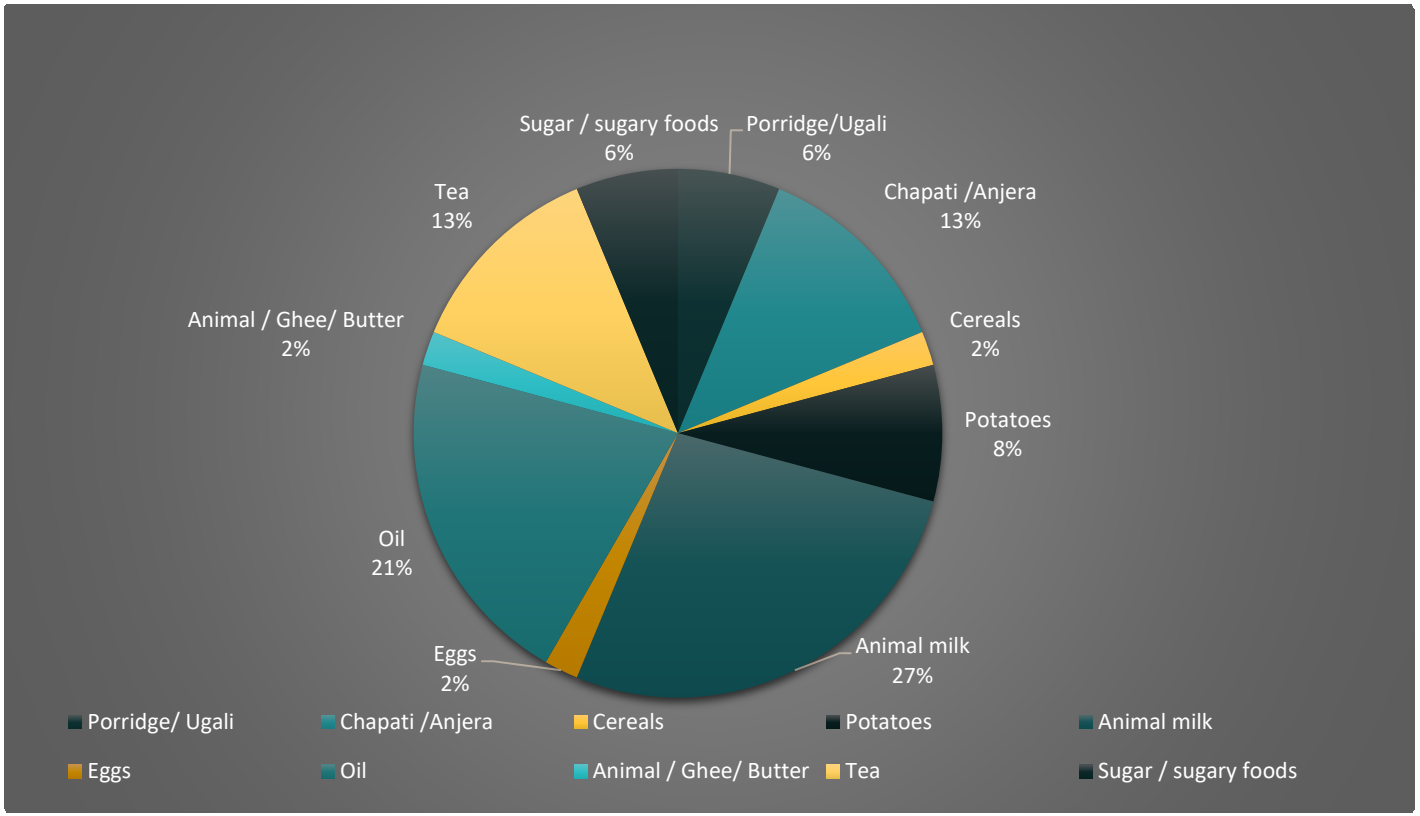


Figure 7. Daily Food Frequency, n= 12, Rainy Season, TIPs #1, Isiolo County

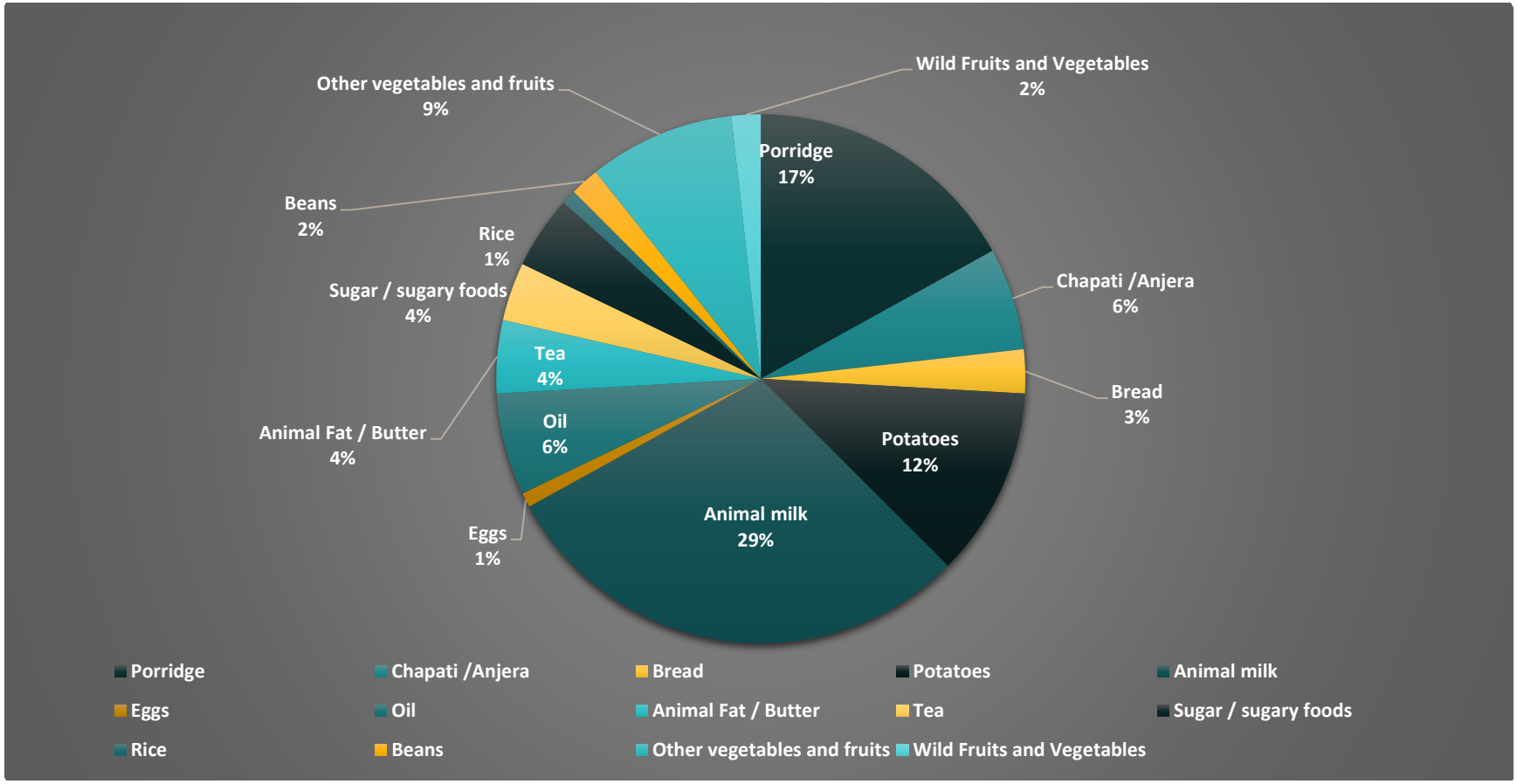


Figure 8. Daily Food Frequency, n= 18, Dry Season, TIPs #1, Marsabit County

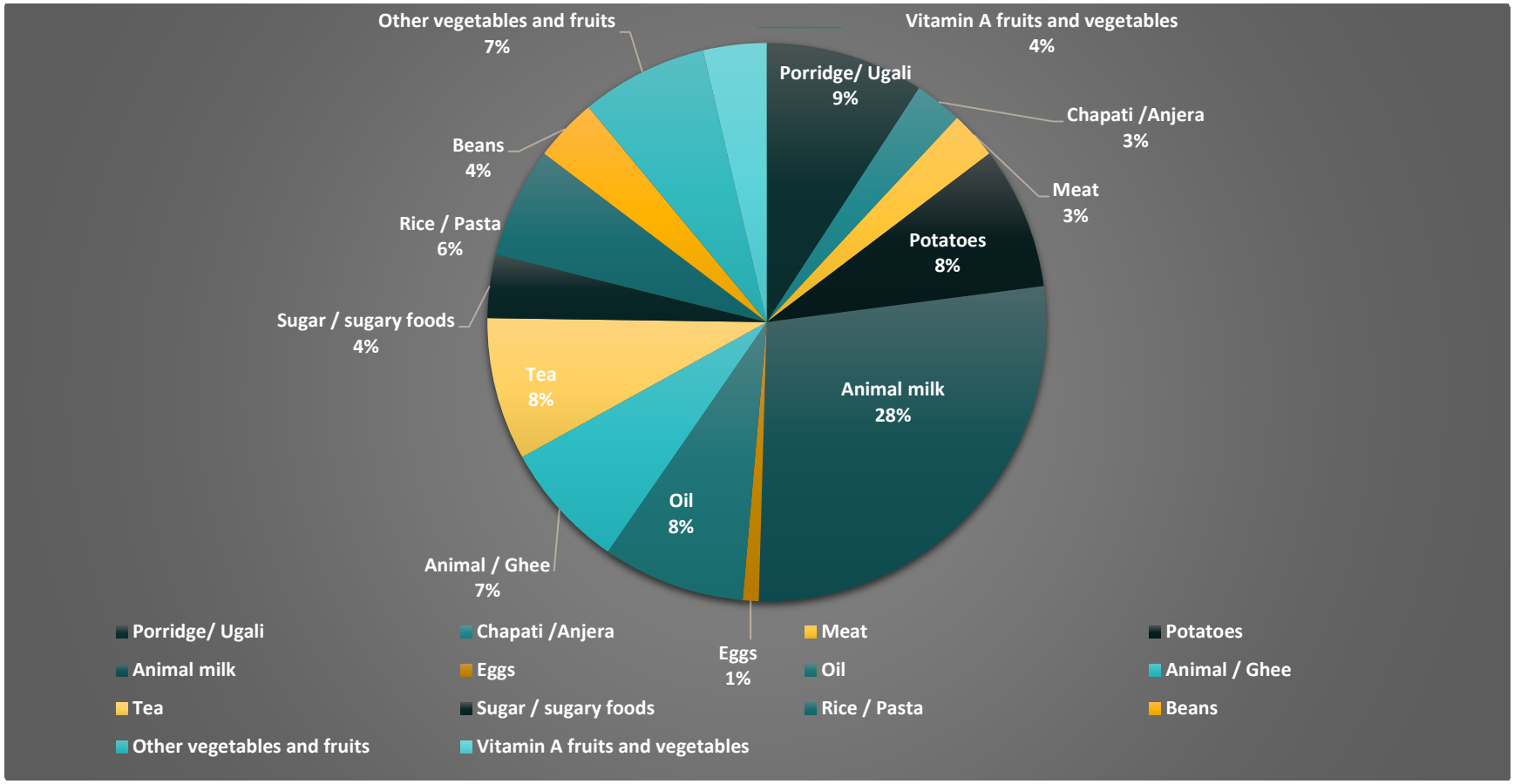
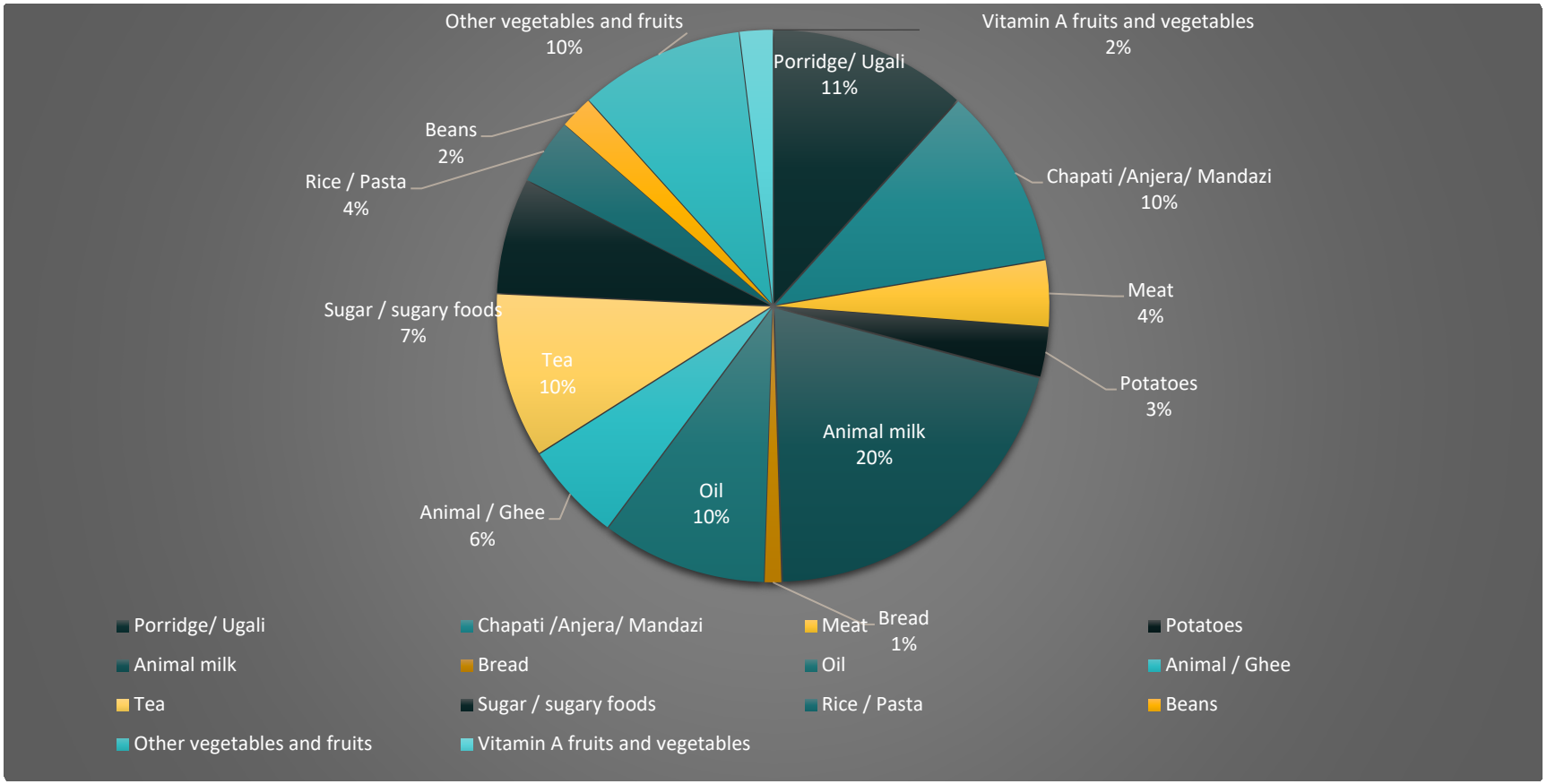


Figure 9. Daily Food Frequency, n= 18, Rainy Season, TIPs #1, Marsabit County



Daily food frequency data from Isiolo County shows that children's daily diets are mainly comprised of animal milk; starches (potatoes, ugali, porridge, chapati, anjera); vegetables; oil; tea (i.e., tea with or without milk); and sugary foods (Figures 6–9). Cereals and starchy foods account for 29% and 39% of all daily foods, respectively, consumed in both dry and rainy seasons. Animal milk, such as camel and goat milk, is a critical feature of young children's diets in Isiolo County and comprises 30% of all foods consumed daily by children, 6 to 23 months of age, regardless of season. Animal fat/butter, wild vegetables, eggs and beans are small proportions of foods consumed daily. These data (Figure 6) show daily consumption of anjera/mandazi or chapati, tea and oil was three times greater in the dry season compared to the rainy season. After counseling, daily consumption of raw, unboiled milk, which was often introduced prior to 1 year of age, decreased by 8% and 15%, while intake of other fruits and vegetables increased by 16% and 12% in the dry and rainy seasons, respectively. During both seasons, none of the children consumed vitamin A-rich fruits and vegetables. However, these data reveal that consumption of vitamin A-rich fruits and vegetables increased by 5% during the rainy season after counseling. There was no daily consumption of pulses and legumes in the dry seasons, though there was a slight increase in the consumption of beans, as part of foods consumed daily, during the rainy season after counseling.

Data on foods consumed daily from Marsabit County mirrors Isiolo County. Young children's diets are mainly composed of animal milk, starches (potatoes, ugali, porridge, chapati, anjera and rice), oil, tea and sugary foods. Cereals and carbohydrate-rich foods account for 26% and 28% of all the foods consumed daily in the dry and rainy seasons, respectively. Animal milk made up 28% of the children's daily diet in the dry season but this percentage declined by 8% in the rainy season. Vitamin A-rich fruits and vegetables, other fruits and vegetables, animal fat/ghee, beans and meat made up a smaller proportion of foods consumed daily. After counseling, there was an 11% increase in the daily uptake of animal milk in the rainy season. The intake of other fruits and vegetables increased across both seasons after counseling. Daily meat intake slightly increased by 2% only during the dry season, due to greater availability of meat during traditional ceremonies, e.g., circumcision among the Samburu and Rendille tribes.

Meal frequency and food quantities fed to children 6 to 23 months of age

Meal frequency

Younger children received an adequate number of meals in comparison to older children, 1 to 2 years of age. Yet, in both counties, most foods fed to children 6 to 23 months of age were liquid-based, i.e., animal milk, tea or porridge. Animal milk often was fed to children and was considered a meal. In Isiolo County, during the dry season, TIPs counseling increased meal frequency. The proportion of children 6 to 8 months of age fed at least two to three meals a day increased by 25%. In addition, among children 9 to 11 months of age, the proportion who met meal frequency requirements doubled (i.e., 50%) following TIPs #3 counseling. Yet, no children 12 to 23 months of age consumed three meals, per IYCF recommendations. During the rainy season, while all children 6 to 8 months of age met meal recommendations according to Kenyan standards, only one-quarter of children 12 to 23 months of age met meal requirements. In Marsabit County, during the dry season, after TIPs #3 counseling, the percentage of children 6 to 8 months of age who met meal requirements increased from 50% to 83% and remained unchanged (17%) for children 12 to 23 months of age. During the rainy season, similar increases were noted amongst children 6 to 8 months of age.

Food quantity

Feeding children recommended quantities of food, according to age, was challenging for most families. In Isiolo County, during both seasons, one-quarter to one-third of children 6 to 23 months of age were fed the required quantities of food on a daily basis (during TIPs #1). Following counseling, there was a substantial improvement in amounts of food fed to children—with three-fourths of children, 6 to 8 months of age, fed recommended quantities of food according to age. Younger children (6 to 8 months of age) were often fed small pieces of food (anjera or two to three pieces of potatoes). An average of 30 milliliters to about two-thirds of a cup of liquid foods (porridge, animal milk, tea) would be fed, depending on the age of the child. In Marsabit County, during both seasons, only one-quarter of the children 6 to 23 months of age were fed the required quantities (TIPs #1 visits). After counseling mothers of children 9 to 11 months of age, quantities of food fed to children did not change significantly. Foods such as rice and ugali were fed to children in amounts ranging from 50 to 200 grams. The quantities of liquid foods (porridge, animal milk, tea) fed ranged from 50 to 158 milliliters (i.e., two-thirds of a cup).

Figure 10: Proportion of Children, 6 to 23 Months of Age, Consuming Foods Three Times or More per Week Across Both Seasons, TIPs #1, Isiolo County.

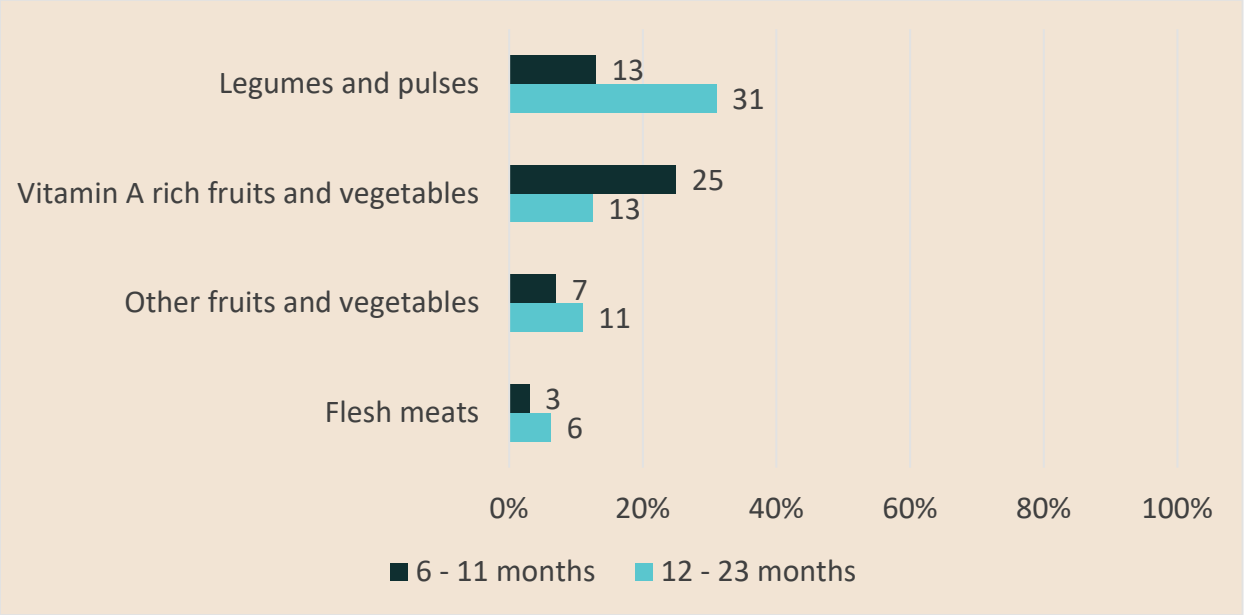


Figure 11: Proportion of Children, 6 to 23 months of Age, Consuming Foods Three Times or More per Week Across Both Seasons, TIPs #3, Isiolo County.

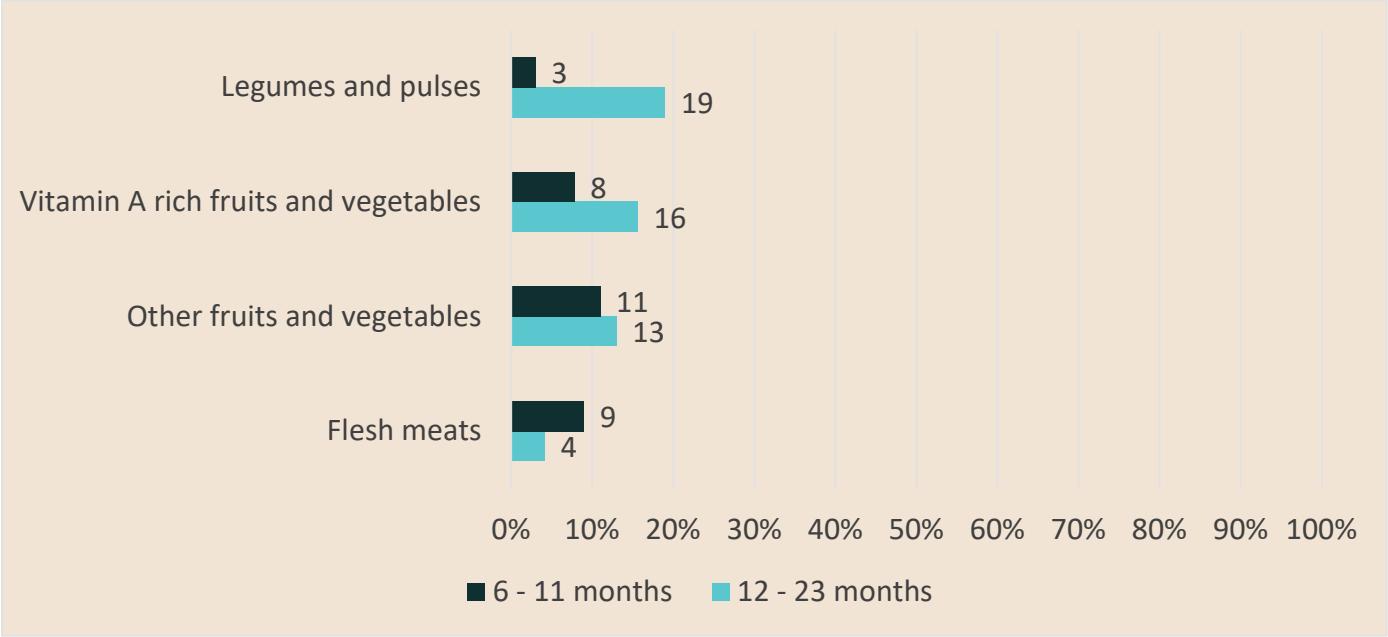


Figure 12: Proportion of Children, 6-23 Months of Age, Consuming Foods Three Times or More per Week Across Both Seasons, TIPs #1, Marsabit County.

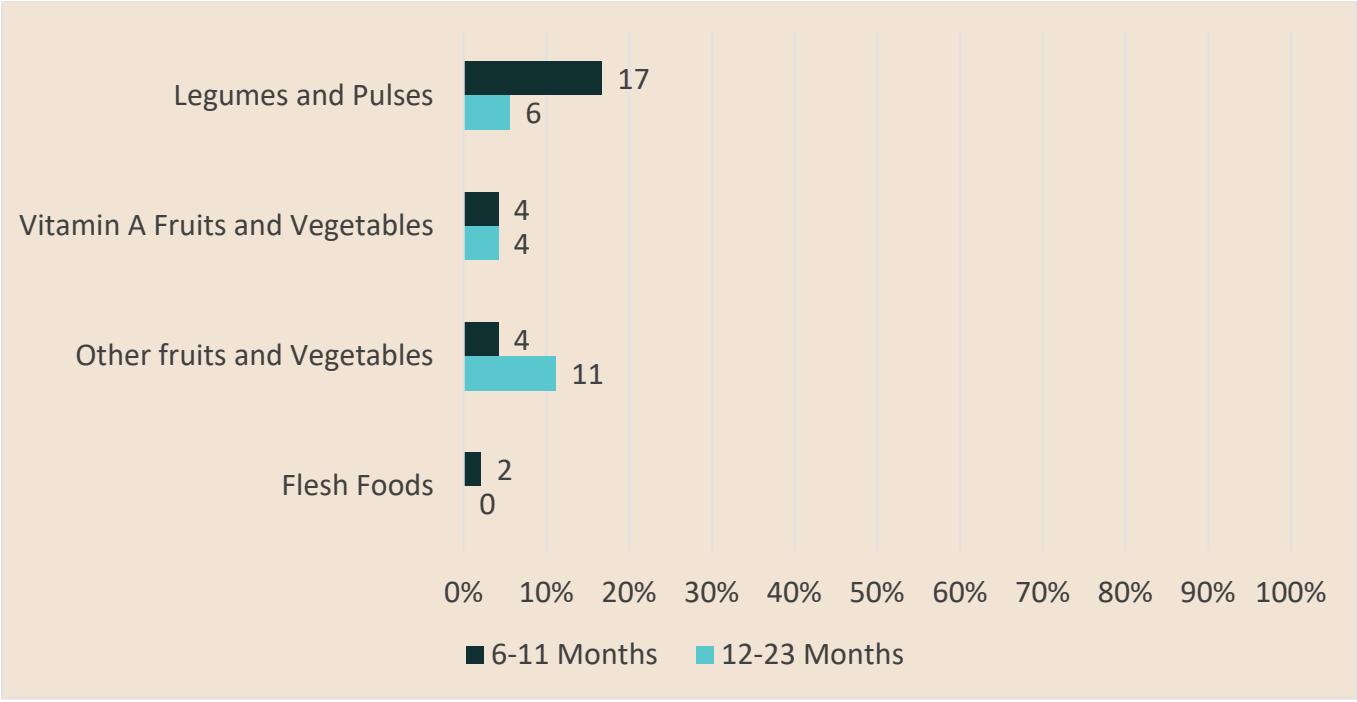
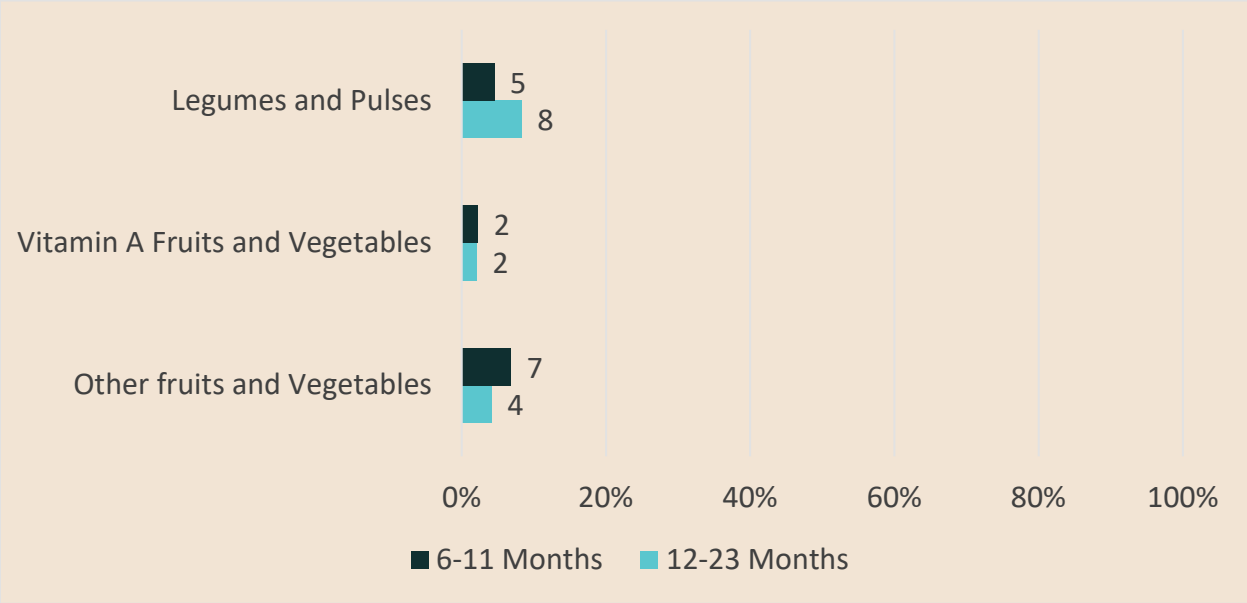


Figure 13: Proportion of Children, 6 to 23 Months of Age, Consuming Foods Three Times or More per Week Across Both Seasons, TIPs #3, Marsabit County.



The proportion of foods consumed a maximum of three times or more in a week was also assessed during TIPs visit #1 and TIPS visit #3 to ascertain the difference prior to and following TIPs counseling in both seasons (Figures 11–13).

- In Isiolo County, legumes and pulses (i.e. beans and green grams) were the foods most frequently consumed, greater than three times per week. Consumption of legumes and pulses, three-plus times a week, was high, with nearly one- third (TIPs #1) and one-fifth (TIPs #3) among older children, 12-23 months of age. The consumption of vitamin A-rich fruits and vegetables (i.e., carrots, mangoes, kale) showed a decrease of 17% amongst younger children, 6 to 11 months old, with a small improvement for older children 12 to 23 months old from TIPs #1 to TIPs #3 visits. The proportion of children consuming other fruits and vegetables at least three times or more in a week showed slight increases for all children.

- In Marsabit county, a similar pattern was observed, as legumes and pulses (i.e., beans and green grams) were consumed by 17% of older children, 12 -23 months of age and only 6% of younger children during TIPs #1. Overall consumption of certain foods (shown above) had a tendency to decrease during TIPs #3. Other fruits and vegetables (i.e., cabbage, bananas, oranges, and tomatoes) were also consumed 3 times or more by 5 and 11% of children 6-11 months and 12-23 months respectively during TIPs #1.

3.13 Advice Around IYCF

Regarding IYCF advice, some mothers relayed non-receipt or insufficient advice on infant and young child feeding. However, the majority of mothers mentioned that health workers advised them to exclusively breastfeed until 6 months of age and then start feeding "*soft*" and "*clean*" foods "*that don't hurt the throat.*" Health workers, community health volunteers and elder women (i.e., grandmothers) were often cited as trusted sources of advice by mothers, as expressed by one mother from Isiolo County, below.

> *"The advice I got is that don't feed babies anything apart from breast milk till they turn 6 months old and when they turn 6 months old start to feed them immediately…clean food*. Also, my mother *taught me how to feed this child. I trust my mother but also trust the health facility…. the advice I trust most is community health worker."* Mother, child 14 months old, Isiolo County, Sakuye

However, even after receiving advice from health workers and elder women, some mothers trusted in other people and their own opinion. This is evident as reported by a mother from Isiolo County who stated the following when asked whose advice is most trustworthy.

> *"I only trust my way of upbringing, because from the day I was advised by medical officers, they don't know if I am feeding the child or not, so I just follow my usual routine of upbringing, even if it's wrong. I am the one who stays with my child."* Mother, child 9 months old, Isiolo County, Gabra

All mothers reported getting advice on exclusive breastfeeding for six months from the health workers and community health volunteers. However, most mothers reported that they had not been given specific guidance on feeding the child after six months. Unclear or missing messaging from health care providers on child feeding after six months was expressed by one mother from Marsabit County who relayed the following when asked about advice given on feeding her children:

> *"We heard of giving the children food and milk at 6 months old most of the time at the hospital they say not to give children water and milk until they reach 6 months old. But we have not been given the training of saying they need to eat this at this age or given this type of food but that one-off saying not to give anything to the child until 6 months old."* Mother, child 16 months old, Marsabit County, Gabra

3.14 Policies

In Marsabit and Isiolo, no county-level policies/guidelines on food preservation exist and any implementation is guided by national policies. While a singular Isiolo stakeholder mentioned an adaptation of national to county policies, there was no clarity which content was adapted for use in Isiolo County. A Marsabit County stakeholder mentioned that coordination/training is based upon "what is assessed" on the ground.

Community education: Nearly all stakeholders said they play a role in community education on food preservation, including teaching about meat, milk, vegetable and fruit preservation techniques and practices, safety/hygiene during preservation, minimization of post-harvest loss and community nutrition. However, these trainings target groups while households in the study sites have no knowledge about the preservation of vegetables and fruits. One key informant illustrates this, describing his role in training mothers to preserve vegetables:

"Some time we train mother to mother support groups or care groups on how to preserve some food. There is a time, for example, when the drought comes, and you preserve some food you can sustain yourself, but our people don't know to preserve it. We train them on how to preserve some food like kale and moringa." Key informant, Marsabit County

Funding

Most of the key informants in both counties indicated that the budgetary allocation to their ministries was insufficient for the optimal implementation of activities. This is illustrated by the following quotes from stakeholders in Isiolo and Marsabit counties.

"They will say that 10% of any national budgets will go to the agricultural sector, and when talking of agriculture sector, it's both livestock and agriculture, but you find in the budget, that what we get is very little." Key informant, Isiolo County

"I will just be at the office, maybe when they request for certain topics, sometimes I just go there and train them because I have to do my work; that is my responsibility otherwise, we don't get support from the county office." Key informant, Marsabit County

Key informants revealed that most of the food preservation activities conducted within the counties are facilitated by implementing partners. The support is, however, limited to project timelines and includes transport, training and provision of food samples for demonstrations on food preservation. This sentiment of limited support was reflected by a key informant from Marsabit County who stated the following:

"We work with organizations, and they send us. They give us allowance and we go on the sides of North Horr, Laisamis and Moyale…there are so many organizations…they buy everything for us, even meat, vegetables, so that we go and teach the people." Key informant, Marsabit County

Additionally, one key informant said that partner support is limited depending on the duration of the project and partner priorities. Once a project closes out, the government ministries have no support to conduct food preservation activities in the field. The vastness of the county means that the officers are unable to visit the communities/villages for training.

"We depend on partners to support us. Since 2018, I think there has been no training conducted on food preservation. So, our major problem is the support, and also the community is vast, that is, distance from one village to another, you don't have any means to reach them." Key informant, Marsabit County

One key informant expressed one of the challenges with regard to food preservation is the issue of staffing. There is a shortage of staff within the ministries, as staff who retire are not replaced. Reaching the community with services is therefore a challenge. A key informant from Isiolo County describes this issue, explaining, "*Others are not here, we were four staff, one died, one retired and the other…So, now I am with support staff. There is no employment of staff. The last time the ministry employed people I can't recall.*" Key informant, Isiolo County

Stakeholder Collaboration

Key informants indicated that at the county level they have a county steering group that coordinates activities of implementing partners and line ministries within the government. The government ministries and implementing partners collaborate in trainings, food preservation activities, policy development and implementation of field activities. This is illustrated by the following quotes from several key informants:

> *"We work with the agriculture department so when they are explaining to the members how to produce food and harvest, I explain the nutritive value of food and do cooking demonstration with the home economics person."* Key informants, Marsabit County

> *"What I appreciate is that we have partners who work in the nutrition docket, so they support us in teaching our farmers. Mostly we have activities that encourage various value chains from production, preparation, preservation and marketing. So those projects support us to conduct training to the farmers and also carry out demonstrations on food preservation."* Key informant, Isiolo County

4.0 Discussion

Traditional food preservation practices

Traditional food preservation practices are of perceived value to African communities, as the transfer and use of traditional preservation practices and knowledge can often be implemented by food-insecure and/or impoverished families. Pastoral communities in Kenya and elsewhere in the region have used traditional methods to meat, milk and ghee as their diets are largely comprised of animal source foods.[22] This study revealed that the preservation of meat, milk and ghee was widely practiced in Isiolo and Marsabit counties. The lower hind legs and forelegs of animals (i.e., goat, cattle, camel or sheep) were often preserved, which was supported by data from pastoral communities in northern Kenya.[19]

Preservation of meat

Study communities preserved meat from either camel, goat, cattle or sheep through drying and frying. Among the Borana tribe in Kenya, beef, goat and camel meat are typically preserved through drying, frying, roasting,[8,9,17–19] while meat is preserved through drying, salting, curing, cooling, cooking, pressing and/or oil application in traditional communities in other African countries.[22] Large animals (cattle and camels) were rarely slaughtered except when sick or injured—which was sold to butcheries.[30,31] While beef is preferred by local butcheries because of size, longer shelf life and choice of cuts,[9] study communities preferred to slaughter smaller animals (i.e., goat and sheep), which often was not sufficient quantities for food preservation to feed families.[9]

Preservation of milk

Fermentation was the most common method of preserving milk, as documented in similar settings.[10,12,15,22] Fermentation was spontaneous (does not rely on well-defined starter cultures) and was carried out at small-scale in households or groups in communities.[12,13,15] Study communities fermented cow and goat milk as camel milk was perceived to be "*too light,*"[13] drying and smoking processes were used for long-term storage, and a variation in the duration of fermentation was noted, which was described in other studies.[11,15 22]

Seasonal variations in food and animal availability

During typical rainy seasons, milk supply is often plentiful.[13,22,26] Yet, during the study period, inadequate rains forced animals to search for pasture for longer periods of time, which was also highlighted amongst the Maasai tribe in Kajiado County.[30] As a result, study participants emphasized that inadequate quantities of preserved milk did not last through the dry season and often spoiled.

Study communities often do not preserve fruits or vegetables, even though sun drying is the most common preservation method,[10,22,23] amongst other processes, including fermentation.[22] Yet, a key challenge is the lack of vegetables and fruits in the pastoralist diets,[22,26,27] which was noted amongst the diets of young children in study sites. In Isiolo County, there was no intake of fruits and vegetables during the dry season with 11% intake of fruits and vegetables in the rainy season (of which 2% was attributed to the consumption of wild fruits and vegetables). In Marsabit County, the intake of fruits and vegetables was 11% across both seasons. This was attributed to lack of availability, poor road infrastructure, long distances, increased food prices and poor quality of vegetables, which is compounded by lack of knowledge about how to preserve fruits and vegetables. A study in Ethiopia also reported market access, cost, availability and quality of foods as challenges affecting availability.[27]

Community and family roles in food preservation

In Isiolo and Marsabit counties, men's roles in food preservation were centered around slaughtering animals and milking.[13,14] Data from other studies[9,13,14] revealed that mothers are primarily involved in food preservation, which corroborates these findings. Elder women provide advice on food preservation processes, as well as feeding children. Similar to this study, elder women had in-depth knowledge about food preservation.[9] While pastoral communities pass down traditional food preservation practices through generations,[6,15,30] some traditional knowledge is lost[6] due to less skills transfer.[9] In addition, most participants used modern containers such as plastic oil jars, metallic jugs and plastic tins for storage in place of the traditional containers due to lack of access to raw materials (i.e., giraffe skin and specific type of trees). In other ASAL counties in Kenya, modern, metallic and/or plastic containers were used due to the high cost and scarcity of traditional containers.[14,18]

Food safety

Communities had different ways of ensuring the food safety of meat and milk, including using clean and dry storage containers and serving spoons, storing food in locked containers with free air circulation, avoiding storage in dusty places, covering leftover food and smoking (fumigation) storage containers. In this study, smoking is thought to *kill bacteria* and *prevent foul smells*, similar to other studies where smoking was reported to disinfect, increase shelf life[11–14,16] and add flavor.[9,11–16] In this study, a critical issue was that animal milk (i.e., camel, goat, cow) was either fed raw to young children or preserved, without boiling, which is similar to other studies which described the consumption of fresh or fermented animal milk.[11,13–15] Some pastoralist communities believe boiling milk destroys nutrients,[11] yet, heat treatment is recommended before milk fermentation.[22] Challenges documented in the study with food safety and hygiene in relation to food preservation included lack of cleaning of the udder prior to milking as documented elsewhere,[14] shortage of clean water, and siphoning the whey using the mouth, as discussed by the key informants and mothers.

Breastfeeding

As described in a recent survey report,[4,5] study mothers reported receipt of "trusted" advice from health care workers and CHVs on exclusive breastfeeding for up to 6 months of age, which was reflected in mothers' knowledge of exclusive breastfeeding.[5] While most women practiced exclusive breastfeeding, some mothers introduced unboiled, raw goat, cow or camel milk as early as 2 months of age due to perceptions of insufficient breastmilk to satiate the child or as a first food fed after birth.[3–5,26]

Complementary feeding – feeding of preserved foods, cultural beliefs and TIPs

In this study, contrary to breastfeeding, mothers received little information on complementary feeding apart from introduction of foods at 6 months of age and feeding "soft foods." This is corroborated by the survey data that revealed that IYCF counseling was "*the least offered*" among all counseling services.[5]

In Marsabit and Isiolo counties, raw animal milk, primarily camel milk, was a predominant feature of young children's diets. While World Health Organization (WHO) evidence points to feeding boiled milk, children were often fed raw animal milk at 6 months of age or earlier. This was substantiated by data from Isiolo and Marsabit counties[5] which showed that milk and milk products were 74% of all food consumed by children 6 to 23 months of age and in Marsabit County,[4] as animal milk was noted as the first food consumed after birth. Moreover, Borana communities in Ethiopia mentioned giving animal milk (i.e., goat, camel and cow) to children under age 1,[11] where cow milk was preferred over camel milk, which was

considered taboo.[11] Another study indicated that camel milk accounts for 60% of total nutrient intake of communities in ASAL.[13] Children were also fed largely starch-based foods (i.e., porridge, rice, ugali, pasta, potatoes) as found in other studies[3–5,29,31] and constitute more than 25% of foods consumed by young children on a daily basis.

In addition, despite the perception that cultural practices do not play a role in shaping complementary feeding practices, by some study participants and in a recent Isiolo County-based study,[5] food taboos were found to limit the dietary intake of young children. For example, not feeding children, 6 to 23 months of age goat milk, as it *makes children restless,* or sheep meat, which *delays speech*. Fatty portions of meat, rather than actual pieces of meat (i.e., ground or pounded) were often fed to children. Dried sheep tail fat was viewed as a cure for whooping cough/pneumonia, colds or to reduce fever, while ghee was used to alleviate stomach problems. Preserved foods, such as meat, were perceived to cause constipation or stomachache, which may explain why mothers limited feeding children these foods. Meat and other foods were often pre-chewed by mothers as a means to "*soften*" food, an unhygienic practice which should be addressed as part of complementary feeding counseling. Animal parts were often reserved for specific adult members of the family, rather than fed to children, which is also common amongst tribes in Kenya and Tanzania.[26,29] These findings highlight the need to address cultural beliefs and related feeding practices through context-specific counseling.[32]

Achieving adequate dietary intake in terms of both quantity and frequency has been notably challenging in Isiolo and Marsabit counties.[4,5] This study found a greater adherence to implementing TIPs recommendations in the dry versus the rainy season. TIPs recommendations to increase frequency and quantity of feeding and consumption of fruits and vegetables was feasible for most mothers during the dry season. In the rainy season, mothers cited unavailability of fruits and vegetables due to few market days and lack of money to purchase these foods as a hindrance, which was corroborated in Ethiopia (i.e., Borana tribe).[27] The TIPs recommendation to feed eggs was moderately successful, as over half of mothers counseled were able to carry out the recommendation, considering the cost of acquiring eggs and that some households raise chickens.

Other key challenges

Optimal complementary feeding is a challenge due to food insecurity, as expressed by study participants who bought food when money was available, borrowed/obtained food on credit, obtained food through NGOs/projects or, at times, went hungry (i.e., skipped meals). Similar challenges of food insecurity were also found in Ethiopian agropastoral communities where food choice was affected by income and cost.[27]

At the county level, there is neither a policy nor legislation that guides implementation of food preservation. Isiolo and Marsabit counties primarily use available guidance documents from national Ministry of Health or implementing partners. Inadequate funding by county governments has left a gap in implementation, as activities implemented are donor/partner dependent. Across the two study counties, limited funds allocation and prioritization from the government with more focus on curative versus preventive interventions has hindered implementation of maternal infant and child nutrition (MIYCN) interventions.[33] Finally, the extent of multisectoral collaboration and engagement is inadequate to improve food preservation and complementary feeding practices.

5.0 Recommendations for CRS Nawiri Project implementation

Develop and rollout contextualized health promotion strategies, through use of culturally resonant, valuable existing resources including the community-tested TIPs counseling guide[34] to improve dietary diversity, quantity, feeding animal milk in a safe/hygienic way and modifying preserved foods (i.e., meat, milk, mandazi, fruits and vegetables) for consumption by young children (see Annex 2). Mothers should be encouraged to feed fermented milk to their young children without adding sugar, boil milk prior to fermenting, not chew food for their children and feed preserved meats to children (if pounded, minced, etc.). Implementation of complementary feeding strategies should not only include culturally resonant counseling messages for mothers and families, but also leverage other line ministries, departments and partners to tackle household food insecurity through multisectoral, nutrition-sensitive approaches, in alignment with wider Nawiri aims and ways of working, e.g., strengthening MSP-N capacity in Isiolo and Marsabit counties.[1] This includes, for example, the Ministry of Agriculture and the Ministry of Health teaching households how to preserve and utilize fruits and vegetables, Ministry of Transport and Infrastructure supporting the development of road networks to hasten transportation of food, Ministry of Internal Security to ensure security on the roads, Ministry of Trade to build more markets and establish systems that will increase the number of market days and Ministry of Culture for the safeguarding of beneficial traditional food preservation practices including the use of traditional storage equipment, as well as the elimination of harmful traditional practices such as not giving goat's milk, sheep meat, chicken and eggs for the reasons described, among others already represented on the county MSP-Ns that Nawiri is actively supporting.

- Work to increase children's dietary intake of fruits and vegetables and animal source foods, such as chicken and eggs. Mothers appeared to be better able to increase children's fruit and vegetable intake on a weekly basis (i.e., carrots, tomatoes, kale, cabbage and fruits like mangoes, oranges and bananas, following TIPs counseling on the nutritional benefits and value of these foods). Fathers also relayed being open to providing their children with eggs/chicken, once they understood the nutritional benefits of these foods to their children's health and growth, given these small animals are readily available in study sites.
- It is important that key taboos such as not giving children goat milk or sheep meat (as goat milk is widely believed to *makes a child restless* and sheep meat is perceived to makes a *child slow to speak*) and not feeding children chicken and eggs (associated with religious beliefs that intake of chicken or eggs hinders prayers from being heard) be comprehensively addressed in community-led efforts to improve the dietary intake of these animal-source foods, including among young children. Those family members who are currently consuming the foods considered taboo, like men, should help advocate for their wider consumption.
- Implement community-level strategies to improve infant and young child feeding, using existing Ministry of Health IYCF resources in addition to the TIPs counseling guide[34] given that IYCF advice is typically provided by various community members including elder women/grandmothers and community health volunteers, as well as health care providers. During the FGDs with fathers, they expressed interest in better understanding which foods are appropriate and healthy to feed their children. Given the role of fathers in decision-making at the household level, it's critical for such

key influencers to be involved in future community-level activities, including with regard to improvements in food preservation processes and infant and young child feeding, beyond just breastfeeding and the timing of complementary feeding. Community involvement through the training and support for CHVs is recommended, given many mothers mentioned receiving and trusting the advice they get from health workers and from community health volunteers.

- Continue to strengthen multisectoral collaboration between different line departments within the county and in the subcounties—such as livestock, agriculture, labor and social protection, water and health, among others—to enhance cross-sectoral, nutrition-sensitive approaches to improve household food security. For example, by strengthening related MSP-N capacity to enhance collaboration, coordination and the joint implementation of food security activities including, but not limited to, improving safe and hygienic food preservation practices (i.e., boiling milk before fermentation, cutting meat into thin strips), food safety (hygienic use of storage containers, heating preserved food before eating), advocacy for resources and related community education and using the TIPs counseling guide,[34] among other Ministry of Health IYCF resources.
- Multisectoral training and capacity strengthening, in partnership with the ministries of health and agriculture with community groups for commercial purposes, should also target households and community, especially with regard to the preservation of fruits and vegetables, taking into consideration that vegetables and fruits are typically only available for purchase (for those with purchasing power) on weekly market days. In addition, communities should be encouraged and supported to engage in food crop production where this is feasible (adequate water, etc.), especially during the rainy season. Supporting mothers to preserve fruits and vegetables could help ensure they are available more frequently, as opposed to one or two days a week.
- Support advocacy at the county level to increase resource allocation for activities that enhance food security and safety, including but not limited to training and supporting mothers, fathers and elder women members on complementary feeding (which mothers, fathers and elder women, who play a role in advising or feeding young children, acknowledged as a gap), food safety and hygiene and the potential establishment of home gardens for food crops based on areas and seasons, as feasible in local conditions. In addition, the development/adaptation and rollout of an integrated, multisectoral, nutrition-sensitive policy on food security specific to the ASAL contexts is key.

6.0 Study Limitations

This study had several limitations. During Round 1 data collection during the dry season, most of the households involved did not have preserved foods. One exception to this was Rendille and Samburu households in nine of the households visited, which had freshly preserved food available due to the ongoing circumcision ceremony that occurs once every 14 years (i.e., preserved food availability remains atypical). In addition, during Round 2 (rainy season) the rains were inadequate; hence, most households were not able to preserve food. Sadly, patterns of climate change and their impact in Kenya's ASALs mean that such scenarios and challenges are becoming more frequent. With regards to TIPs, not all recommended practices from TIPs were carried out by mothers in this study, as mothers were constrained for various reasons including the lack of available foods for preservation due to short/inadequate rains, lack of money to purchase the food, contradictory advice/limited support from family members, lack of time to prepare foods and time constraints due to tending to ill children. This highlights why it is important to contextualize and support wider multisectoral, nutrition-sensitive approaches, within the context of cultural beliefs, to address the multiple underlying and basic drivers of acute malnutrition. While most mothers were able to adopt recommended new practices for one week to 10 days during the study period, a small number of mothers had difficulty carrying out some of the recommendations. It remains premature to assess the sustainability of improved practices in the households involved.

Furthermore, both counties neither had the laboratory facilities nor the capacity and know-how to conduct food safety tests for milk and meat, apart from testing dried cereals for aflatoxin and moisture content. In addition, preserved foods were not adequately available to enable testing. As a result, no preserved food samples could be collected for testing. Marsabit and Isiolo counties each include several malnutrition hotspots and diverse tribes and cultures. Given the qualitative and in-depth nature of the TIPs study, it focused on the predominant tribes in Marsabit and Isiolo counties, and the findings cannot be generalized beyond these particular community contexts.

References

1. Mutuku J, Ochola S, Osero J. Maternal Knowledge and Complementary Feeding Practices and their Relationship with Nutritional Status Among Children 6-23 Months Old in Pastoral Community of Marsabit County, Kenya: A Cross-Sectional Study. *Curr Res Nutr Food Sci J*. 2020; 8:862-876. doi:10.12944/CRNFSJ.8.3.17

2. National Drought Management Authority. *IPC ACUTE FOOD INSECURITY AND ACUTE MALNUTRITION ANALYSIS*.; 2020. http://www.ipcinfo.org/fileadmin/user_upload/ipcinfo/docs/IPC_Kenya_AcuteFoodInsec_Malnutrition_2020FebJuly.pdf

3. Kenya National Bureau of Statistics. The 2014 Kenya Demographic and Health Survey. Published online 2015.

4. Marsabit County. *Maternal, Infant and Young Children Nutrition Knowledge Attitude and Practices Baseline Survey for Marsabit County*.; 2018. http://www.nutritionhealth.or.ke/wp-content/uploads/MIYCN%20Assessments%20Reports/Marsabit%20County%20MIYCN%20KAP%20Report%20-%20January%202018.pdf
5. Isiolo County. *MATERNAL INFANT AND YOUNG CHILD NUTRITION (MIYCN) KNOWLEDGE, ATTITUDES, BELIEFS AND PRACTICES (KABP) SURVEY REPORT*.; 2017. http://www.nutritionhealth.or.ke/wp-content/uploads/MIYCN%20Assessments%20Reports/Isiolo%20County%20MIYCN%20KAP%20Report%20-%20October%202017.pdf

6. Olunike AA. Storage, Preservation and Processing of Farm Produce. Published online 2014:6.

7. Thuita FM, Pelto GH, Musinguzi E, Armar-Klemesu M. Is there a “complementary feeding cultural core” in rural Kenya? Results from ethnographic research in five counties. *Matern Child Nutr*. 2019;15(1). doi:10.1111/mcn.12671

8. Asogwa IS, Okoye JI, Oni K. Promotion of Indigenous Food Preservation and Processing Knowledge and the Challenge of Food Security in Africa. *J Food Secur*. 2017;5(3):75-87. doi:10.12691/jfs-5-3-3

9. Dabasso B, Roba H, Makokha A. Understanding Traditional Meat Processing Knowledge among the Borana Pastoralist of Northern Kenya. *J Food Res*. 2018;7:30. doi:10.5539/jfr.v7n4p30

10. WFP. *Mainstreaming Human Nutrition in Resource Management in the Arid and Semiarid Areas FIELD PRACTITIONERS GUIDE NO. 4*.; 2018. https://kilimo.go.ke/wp-content/uploads/2021/02/Field-Guide-4-Human-Nutrition-in-Resource-Management-in-Arid-and-Semi-Arid-Zones.pdf

11. Amenu K, Wieland B, Szonyi B, Grace D. Milk handling practices and consumption behavior among Borana pastoralists in southern Ethiopia. *J Health Popul Nutr*. 2019;38(1):6. doi:10.1186/s41043-019-0163-7

12. Gemechu AT, Tola YB. Traditional butter and ghee production, processing and handling in Ethiopia: A review. Published online 2017. doi:10.5897/AJFS2016.1544

13. Ogolla JA, Dede C, Okoth MW, Hensel O, Sturm B. Strategies and Technologies for Camel Milk Preservation and Utilization of Non-Marketed Milk in Arid and Semi-Arid Areas. *East Afr Agric For J*. 2017;82(2-4):144-167. doi:10.1080/00128325.2017.1363686

14. Wayua FO, Okoth MW, Wangoh J. Survey of postharvest handling, preservation and processing practices along the camel milk chain in Isiolo district, Kenya. *Afr J Food Agric Nutr Dev*. 2012;12(7). doi:10.4314/ajfand.v12i7

15. Agyei D, Owusu-Kwarteng J, Akabanda F, Akomea-Frempong S. Indigenous African fermented dairy products: Processing technology, microbiology and health benefits. *Crit Rev Food Sci Nutr*. 2020;60(6):991-1006. doi:10.1080/10408398.2018.1555133

16. Wanjala NW, Matofari JW, Nduko JM. Antimicrobial effect of smoking milk handling containers' inner surfaces as a preservation method in pastoral systems in Kenya. *Pastoralism*. 2016;6(1):17. doi:10.1186/s13570-016-0064-y

17. Werikhe G, Kunyanga CN, Okoth MW, Roba HG. Status and process analysis of koche, a traditional pastoral meat product in Kenya. *Pastoralism*. 2019;9(1):6. doi:10.1186/s13570-019-0140-1

18. Gichure J, Kunyanga C, Mathi P, Imungi J. The Present Status of Meat Processing and Preservation in the Pastoral Regions of Kenya. Published online March 29, 2019.

19. Dabasso B, Makokha A, Onyango A, Roba H, Mathara J. Process characterization and nutrient profiling of traditional meat products of the Borana communities in northern Kenya. *MOJ Food Process Technol*. 2018;6. doi:10.15406/mojfpt.2018.06.00169

20. Koskei P, Bii CC, Musotsi P, Muturi Karanja S. Postharvest Storage Practices of Maize in Rift Valley and Lower Eastern Regions of Kenya: A Cross-Sectional Study. *Int J Microbiol*. 2020;2020:e6109214. doi:10.1155/2020/6109214

21. Njoroge AW, Baoua I, Baributsa D. Postharvest Management Practices of Grains in the Eastern Region of Kenya. *J Agric Sci*. 2019;11(3):p33. doi:10.5539/jas.v11n3p33

22. Jans C, Kaindi D, Meile L. Innovations in food preservation in pastoral zones. In: ; 2016.

23. Gogo E, Opiyo A, Ulrichs C, Huyskens-Keil S. Postharvest treatments of African leafy vegetables for food security in Kenya: a review. *Afr J Hortic Sci*. 2016;9:31-40.

24. Oguntoyinbo FA, Fusco V, Cho G-S, et al. Produce from Africa's Gardens: Potential for Leafy Vegetable and Fruit Fermentations. *Front Microbiol*. 2016;7. doi:10.3389/fmicb.2016.00981

25. Omaiyo DG, Abong GO, Okoth MW, Gachuiri CK, Mwangombe AW. Current Status of Guava (Psidium Guajava L) Production, Utilization, Processing and Preservation in Kenya: A Review – Current Agriculture Research Journal. Published 2019. Accessed July 9, 2021.

https://www.agriculturejournal.org/volume7number3/current-status-of-guava-psidium-guajava-l-production-utilization-processing-and-preservation-in-kenya-a-review/

26. Chege PM, Kimiywe JO, Ndungu ZW. Influence of culture on dietary practices of children under five years among Maasai pastoralists in Kajiado, Kenya. *Int J Behav Nutr Phys Act*. 2015;12(1):131. doi:10.1186/s12966-015-0284-3

27. Gebremichael B, Asfaw A. Drivers of Food Choice among Pastoral/Agro-Pastoral Community in Somali Regional State, Eastern Ethiopia. *Adv Public Health*. 2019;2019:e1472487. doi:10.1155/2019/1472487

28. Isiolo County. *INTEGRATED SMART SURVEY ISIOLO COUNTY KENYA-JANUARY 2019*.; 2019. http://www.nutritionhealth.or.ke/wp-content/uploads/SMART%20Survey%20Reports/Isiolo%20County%20SMART%20Survey%20Report%20-%20January%202019.pdf

29. Kibona MG, Mwanri AW. Infant and Young Child Feeding Practices among Pastoralist and Crop Farming Communities in Mvomero District, Tanzania. *Tanzan J Agric Sci*. 2020;19(1):22-33.

30. FAO. *The Global Forum on Food Security and Nutrition*.; 2012. http://www.fao.org/3/ap095e/ap095e00.pdf

31. Mengistu G, Moges T, Samuel A, Baye K. Energy and nutrient intake of infants and young children in pastoralist communities of Ethiopia. *Nutr Burbank Los Angel Cty Calif*. 2017;41:1-6. doi:10.1016/j.nut.2017.02.012

32. Ahoya B, Kavle JA, Straubinger S, Gathi CM. Accelerating progress for complementary feeding in Kenya: Key government actions and the way forward. *Matern Child Nutr*. 2019;15(Suppl 1):e12723. doi:10.1111/mcn.12723

33. Nairobi City. County Integrated Development Plan (CIDP) 2018-2022. http://www.kpda.or.ke/documents/CIDP/Nairobi%20County%20Intergrated%20Development%20Plan%20(CIDP)%202018-2022.pdf

34. CRS Nawiri, Kavle Consulting, LLC. *A TIPs Counseling Guide for Consumption of Preserved Food and Associated Feeding Practices of Children 6-23 Months in Marsabit and Isiolo County, Catholic Relief Services (CRS), Kenya, Nawiri Project*.; 2021.

Annex 1: Literature review findings on food preservation methods in Kenya and similar country settings

Title, Author, Year Country/Location Study Methods	Key Findings
Wanjala et. al, 2016 **Antimicrobial effect of smoking milk handling containers' inner surfaces as a preservation method in pastoral systems in Kenya** **Study Location**: Isiolo County, Kenya **Study method/Objective**: To determine the microbial load on smoke-treated milk-handling plastic containers and the effectiveness of the smoking technique to preserve camel milk **Sample Size and Respondent Group** Collected 24 freshly smoked plastic milk handling containers from 13 camel pastoralists Also collected 18 milk samples before and after bulking of harvested milk in smoked, non-sampled, chlorine treated, and non-chlorine treated containers Microbial analyses conducted on total viable count, total coliform county lactic acid bacteria, and identification of typical bacterial colonies	**Introduction**: Forced milk consumption (if area has surplus) means that family uses the milk, or it is given to the calves and/or neighbors, 35% of total camel milk is used by households, 55% of total camel milk produced in Kenya is marketed, and 10% is consumed by calf (2011). Currently 12% of camel milk is marketed; the bulk is sold raw to rural consumers Another study: 38% consumed by camel-keeping households—and 50% goes to waste **Camel milk:** Contaminated milk due to post-harvest handling of raw milk How unclean equipment is sanitized: pastoralists in Kenya use plastic containers (Jerry cans) and fumigate by smoke to disinfect after cleaning; this increases shelf life and adds smoky flavor to milk Smoke can lower bacterial/microbial load and preserve camel milk. Known in Isiolo as "qorasum," smoke is from a tree species. Containers are inverted over hot smoking chips and thought to contain 400 antimicrobial compounds Findings: The chlorine disinfected container had the lowest mean microbial load, followed by the smoked containers washed with the plain water—non-treated or non-smoked containers had the highest mean microbial load. Sources of E. coli were attributed to contamination by milk handlers and smaller volumes of milk in large containers subjecting the milk to a high rate of contamination. Smoking of milk-handling containers as a method of preserving camel milk was recommended where cold chain or processing infrastructure is poor.
Dabasso et. al, 2018 **Understanding Traditional Meat Processing Knowledge Among the Borana Pastoralist of Northern Kenya** **Study Location**: Northern Kenya, Marsabit County. Borana Community **Study methods:** Key informant and narrative interviews were conducted with knowledgeable women through purposive and snowball sampling. Participant	Most women had general knowledge on meat preservation, which included drying, frying, smoking, pounding, and storage Women 50 years and older had greater knowledge and were passionate about traditional meat preservation methods which were ingrained in their culture. Despite women in the rural areas passing on the knowledge to their daughters, less skills transfer on meat preservation occurred. **Sources of meat:** Slaughtering of animals at home Purchases of preserved parts at the butchery Beef was preferred to goat meat because of its size and longer shelf-life

observation of preservation methods. Sound and video recording **Sample Size and Respondent Group** 20 KIIs with knowledgeable women Participant observation groups (consisting of women 20–35 years)	**Meat preservation:** Meat was stripped then air or sun dried to make *koche, guba* and *kataweel* in future. Meat is also dried and smoked over the fireplace for preservation. Smoking is done to add flavor (lower hind legs, forelegs and pancreas) Putting meat strips in between sticks and roasting over hot coals also adds flavor Deep frying entails heating food for 10–20 minutes at a high temperature (200^0C) with the addition of additives such as salt, cardamom and sugar not only for flavor but also to extend the shelf-life by reducing the water activity Cooked meat products are also stored in special smoked containers for flavor and for extending the shelf life. These products were immersed in oil for long term storage. **Preparation of *Koche:*** Select, sort, and strip the meat Air dry the meat Cut the meat into small bean-sized pieces Deep fry the meat Add spices Continuous stirring, then let the meat cool Clean and smoke the storage container Store meat product in oil **Preparation of *Fontuma:*** Strip and cut Roast over hot coals Pound and fry with frequent stirring Smoke the wooden storage container with special sticks with aroma to impart flavor Cool the meat product
Werikhe et al., 2019 **Status and process analysis of *koche,* a traditional pastoral meat product in Kenya** Study location: Kenya, Isiolo and Marsabit counties **Methods:** Cross-sectional study Purposive selection of counties due to large pastoral communities KIIs with processors using unstructured interview guides**;** FGDs with 8-10 participants using a checklist guide **Sample Size and Respondent Group** 10 food preservation processors (all women) were purposively identified based on their knowledge of indigenous food processing methods and being involved in commercial processing; 70% were 46 years and older	**Key description of 'Koche' (traditional meat):** - Koche is a dried traditional meat product which undergoes various stages of processing. - As a way of preservation, women among the Borana community cut meat into thin strips to air dry under the sun for 2 or 3 days. Additionally, they deep-fry the meat to evaporate more moisture. **Processing *Koche:*** - Women processed koche as a main source of income depending on the orders of traders (1) Trim to remove visible fat (2) Salt to reduce the water content then strip and air dry. Deep-frying was done at 100 °C for 30 min to further reduce the water activity. (3) Add spices such as cardamom during deep frying to add flavor. (4) The product is cooled, and the quality evaluated based on taste and color only. - Meat processing hygiene was poor and quality control measures were not observed.
Amenu et al., 2019 **Milk handling practices and consumption behavior among Borana pastoralists in southern Ethiopia.**	**Milk Consumption Behavior:** - Cow milk was widely preferred due to the ease of converting it to yogurt or butter, ghee and butter milk. - Butter derived from cow milk was used as hair treatment - Camel milk was mostly sold to Kenya or consumed fresh without any treatment.

Study location: Yabello District, Borana zone, Ethiopia; 4 Villages were selected (Dharito, Elweya, Surupha, and Did Yabello) **Methods** Qualitative participatory research methods. Individual semi-structured IDIs, FGDs, informal discussions, observations Data collected on milk handling practices, perceptions of milk safety and quality, awareness of milk-borne diseases and perceptions towards milk boiling practices. Interviews and discussions were audio recorded and notes were taken **Sample Size and Respondent Group** 10 women from each of the 4 villages. 4 FGDs (one in each village) with 6-8 women	- Using of camel milk was considered a taboo by some clans like Qallu Karayu. - Goat milk was produced in small volumes and was consumed by children mostly from the udder or by mixing it with boiling tea. Goat milk was not processed. - Sheep were not milked. **Traditional milk processing and products:** **Ititu (traditional yogurt)**: - Fermented whole milk prepared by accumulating milk for several days - weeks (7-30 days) and removal of the whey continuously as fresh milk is added. The milk is allowed to curd without any starter culture and stored in clean and smoked containers to ensure quality and extend shelf life and for flavor. - The yogurt is likely to be sour thus sugar or butter ghee is added to increase palatability - The yogurt is often served to the household head or special guests during festivities. - Milk given to children younger than 1 year old is boiled to prevent curding after ingestion as fresh milk may cause a baby to suffocate after vomiting due to formation of curds in the stomach. Boiled milk is diluted before giving it to children. **Butter:** - Milk is accumulated for several days and allowed to curd in clean and smoked containers. - Churning is done after several days by moving the container back and forth for several hours. - Afterwards the butter is removed by hand, kept in a container for home consumption or for sale or used as hair treatment by women. - Though not common, sometimes butter is converted into ghee by melting and separating the fat from the non-fat solid part. **Milk Hygiene:** - Pastoralists believe that milk from a healthy animal is healthy, and contamination occurs after milking. - Therefore, consumption of raw milk is common among the Borana. Boiling of milk is not common as they believe that nutrients are destroyed by boiling (Boiled milk is dead milk) - They had a low awareness of milk-borne diseases but believed that milk had medicinal properties. - Some ailments were attributed to milk consumption and milk products such as gastritis or delay in wound healing after drinking sour milk or milk from non-smoked containers. Brucellosis is believed to be caused from taking milk of an animal that has aborted. - Pastoralists were not keen to observe hygiene during milking and consumption of the milk - The udders were not cleaned - They didn't clean their hands before and during milking different animals - Traditional containers used were difficult to clean - Same cup was used by different people who drank milk at the marketplace without proper washing, - Due to the thickness of the yogurt, women used their hands to scoop it out into serving cups - Sale of milk was done in dusty markets or in the market - Health extension and research activities have changed the perception of pastoralists about milk quality and safety

Gogo et al., 2016 Post-harvest treatments of African leafy vegetables for food security in Kenya: a review **Study Location**: Kenya **Methods:** Review of various studies on common postharvest handling and postharvest treatment of traditional African Leafy Vegetables (ALVs) grown and consumed in Kenya **Sample Size and Respondent Group** Number of articles reviewed not indicated	**African Leafy Vegetables:** - At least 200 varieties of African Leafy Vegetables (ALVS) have been documented - Only a few have been recognized but most have been neglected by researchers and national agricultural programs - Many ALVS grow in the wild or are cultivated. - ALVs affected by severe post-harvest losses (50%) due to lack of knowledge on appropriate post-harvest treatment and preservation technologies as well as insufficient pre-harvest conditions, insect pest and diseases, poor storage conditions, and poor handling along the value chain. **Post-harvest handling and treatments**: - E.g., cleaning, sorting, grading, cold storage, packaging, blanching, drying, and fermentation improve the shelf-life and quality of vegetables and reduce contamination - Other studies indicate that blanching and drying reduce the quality of vegetables. - Traditional post-harvest treatment methods used in Kenya include sprinkling cold water on leaves to maintain freshness, sun drying, and use of poor packaging (gunny bags and non-perforate polythene bags) or leaving them in the open overnight. In supermarkets, vegetables are stored in cold shelves together with other vegetables and fruits **Appropriate preservation methods to ensure availability and quality throughout the year:** - **Blanching**: short heat treatment prior to processing by immersion in hot water or spraying stream. - Dehydrated vegetables are blanched prior to drying. A new recipe was developed at Maseno University to preserve ALVs through blanching followed by freeze drying, where vegetables were removed from the boiling water and plunged into ice cold water to stop the cooking process then packaged for storage in freezers. - **Drying:** Sun drying is the most common preservation measure practiced by Kenyan ALVs farmers. - Solar drying is more efficient because drying time is shorter since the temperature required for drying is higher. - The quality of the dehydrated product is reflected in its texture, flavor, color and its ability to rehydrate close to the original product by soaking in water. - **Fermentation:** Fermentation improves palatability, taste, aroma and texture of vegetables; extends the keeping quality; increases nutritional value and improves safety of food products. Brining or salting or pickling are methods used to ferment. **Packaging of processed ALVs:** - Packaging protects against spoilage and decay, preserves quality and ensures ease in handling ALVS. Led to the development of laminated products and plastic materials for storage
Wayua, 2012 **Survey of postharvest handling, preservation, and Processing practices along the camel milk chain in Isiolo District, Kenya,** **Study location:** Isiolo, Kenya (Kulamawe and Isiolo town) **Methods:** 167 camel milk producing households 50 primary (in Kulamawe who buy milk from households), and 50	**Handling of camel milk:** - Camel milk was handled (milking) mostly by herd-boys, male household heads, occasionally spouses, sons and least of all by daughters. Plastic containers were mostly used to handle milk (recycled oil containers) **Post-harvest handling and preservation of camel milk:** - Conducted by the women and rarely by household heads. The decision to process camel milk was largely made by the woman. - All the interviewed households consumed the milk raw. - The primary products were fresh milk and traditionally fermented milk. - Main preservation methods included fumigation (smoking) of plastic storage containers by inverting them over smoking chips and boiling. Fresh camel milk was then put in the containers and could keep for 24 hours.

secondary (in Isiolo County) milk traders were interviewed. 97% of respondents were Borana, 51% were women, and all were Muslim. **Sample Size and Respondent Group** Cross sectional survey and FGDs were used to assess existing post-harvest handling, preservation and processing practices for camel milk by pastoralists in Isiolo County, Kenya To identify survey households, a two-stage sampling procedure was used	- Smoking of the containers was also done to impart special taste and flavor to the milk and disinfect the containers, thus extending the shelf life. **Hygiene:** - Hygiene of milking was observed as poor as hands and udders were not cleaned - Most households had received information on hygienic handling of milk, processing of dairy products with extended shelf life such as fermented milk using starter cultures, and ghee through local NGOs, but picking up on the new technology hasn't been done. **Traditional preparation of Suusa (fermented milk):** - Putting raw camel milk in a clean and fumigated container. Covering the container with a cloth and keeping in a warm place for natural fermentation. - After a day, whey (the liquid part) floats and is removed using a straw and more milk is added. The process is repeated for 3-4 days. The whey is not discarded but used as a laxative to relieve stomach upsets. The fermented milk is mainly for household use.
Omayio et. al., 2019 **Current Status of Guava (*Psidium Guajava* L.) Production, Utilization, Processing and Preservation in Kenya: A Review** **Study location:** Kenya **Methods:** Number of articles reviewed not indicated **Sample Size and Respondent Group:** A review focused on guava production utilization, processing, and preservation, with emphasis on Kenya	**Guava in the Kenyan context:** - Kenya has a favorable climate for guava farming as it is resilient, highly productive with high returns and requires minimal care. - Guava farming in Kenya is carried out by small scale farmers, thus hindering fruit species experimentation and diversification. - Consumption of guava in Kenya is mainly at the household level **General guava characteristics:** Guava is climacteric and has a high perishability thus high post-harvest losses (20%-40 %) when in season as a result of physiological processes due to wilting. Shriveling and chilling dents due to fungi and bacterial attacks and mechanical injuries. **Guava preservation methods:** Freeze-drying of guavas and guava pulp has been used to preserve the fruits at (-200 ºC to -500 ºC). This technique has been found to be the most appropriate method for drying products, especially fruits and vegetables, that are highly sensitive to heat. **Guava processing methods**: Guavas can be processed into commercial products (jam, juice, nectar, wine, and fruit leather), thus improving the farmers household income and enhancing their utilization. Other products include guava powder (used in preparation of yogurt) and spray dried soluble extracts containing high antioxidants concentration. **Commercial guava products:** **Guava pulp:** Guava pulp provides a convenient way of preservation, and the pulp can be processed into other products such as juices, guava nectar, and guava leather. Blending guava pulp with other fruit pulps improves the product's appearance, nutritional value, and flavor. **Dehydrated guava products**: Guavas can be dried in the sun or through solar drying, which is the cheapest preservation method. However, solar drying results in contaminated and poor-quality products compared to products obtained through osmotic dehydration, vacuum, freeze, and spray drying techniques. **Jams and jellies**: Obtained after cooking guava pulp, adding sugar, jellifying substances, and other additives. - **Guava juice and nectars**: Guava juices are prepared from either fresh fruits or the guava pulp. Juice is extracted by squeezing the guava fruits or from the pulp after dilution with water and then filtered. Nectars are obtained by addition of water to guava pulp or fresh juice. Guava juices and nectars can be blended with other juicesto boost their nutritional values. **Recommendations:** - Household processing of guavas is achievable, and efforts should be made to educate farmers about - technologies that can help reduce post-harvest losses.

	Promotion of guava processing and preservation requires a multi-sectoral approach.
Jans et. al., 2016 **Innovations in food preservation in pastoral zones** **Study location:** Pastoralists communities in Botswana, Niger, Togo, Benin, Mali, South Africa, West Pokot Kenya, Asia, Europe, and America **Methods:** None, Descriptive only **Sample Size and Respondent Group**: Descriptive article on preservation techniques in the pastoral context, targeting the major dietary components of milk, meat, and cereals; related health risks; and potential innovations for food preservation	**Pastoralists diets:** - Largely animal products (meat and meat products) and cereals (sorghum, millet and maize). - Meat, blood, and fat mostly consumed during the dry season and milk consumption is higher during the rainy - season. Preservation methods include drying meat and meat products and fermenting vegetables and fruits. **Meat, meat products, and fish:** - Meat is preserved by drying, salting, curing, smoking, fermenting, cooling, cooking, pressing, oil application, - and combinations of the above methods. Drying meat and slight salting without combining is another method widely used all over the world (ex. *Biltong* in South Africa). The process may be modified to include roasting before salting and drying. - Fish is preserved by slight smoking and drying. **Meat preservation:** - Repeated curing (adding preservatives) and drying is also used in meat preservation. - Fruit-paste extract from the fruit of the *Ziziphus abbysinica* shrub is used by pastoralists of West Pokot, Kenya to preserve meat. In Asia, a large variety of sausage meats, blood, and fat are preserved through boiling and freezing, smoking, drying, and fermentation. - Meat preservation benefits from combining methods. For example, drying can be done more than once, - paired with heat encapsulation (clay balls where meat is covered in leaves, encased in clay and heated), - fermentation, or - the addition of preservatives. Fermentation is done by stuffing meat or fat into intestine casings, stomach or - skin, buried in pits and allowed to ferment. **Milk preservation:** - In Europe, America, and Central Asia, major preservation methods for milk include freezing or cooling milk products. Traditionally milk is preserved via spontaneous fermentation or back slopping, a process of adding a small amount of previously fermented milk to the fresh milk. This is usually combined with drying and smoking for long term storage. - A heat-preservation step is recommended during fermentation of milk as fermentation does not inhibit acid-tolerant microorganisms. However, this step runs contrary to cultural beliefs and has not been widely accepted; this is why fermentation after heat treatment would require introduction of bacteria or starter culture. - For long-term storage, raw and fermented milk products are regularly further processed by extended continuous fermentation over several years or by boiling, curdling, drying, freezing, smoking, or combinations of the above methods. - Sun dried balls are formed when whey is drained from the boiled yogurt, and afterwards dried into balls to form qurut. Sometimes the yogurt is boiled first, so that it curdles, and is then dried into cheese; this process can also be followed by smoking.

	- Milk is also preserved by fermentation then transformed into butter. In Sudan, this is done through - fermentation. **Cereal preservation:** - Raw cereals are preserved by drying combined with the addition of ash, minerals, or activated charcoal to absorb moisture and oxygen. Physical barriers, pesticides, or insecticides against rodents and insects are also used. However, the application of toxins must be carried out very carefully to avoid toxicity to humans and livestock. - Cooked cereal products are preserved through cooling, drying, salting, pickling or traditional fermentation - to extend the shelf life. **Vegetable and fruit preservation:** - Vegetables and fruits are not regular dietary components of pastoralists, but when available, are preserved by drying - Yams are preserved by the production of sun-dried yam chips - Improved fermentation processes for the traditional preparation of attiéké, a dish made from cassava, is used to reduce aflatoxin levels - Mangoes are preserved through improved methods of sun drying in West Africa
Agyei et. al., 2019 **Indigenous African fermented dairy products: Processing technology, microbiology and health benefits** **Study location:** Different African nations: Kenya, Nigeria, Ghana, Cote d'Ivoire South Africa, Egypt, Sudan Somalia, Zimbabwe, Mali, Ethiopia, Mozambique, Namibia, Cameroon, Uganda, Algeria, Rwanda, Zambia. **Methods:** Number of reviewed articles not indicated **Sample Size and Respondent Group**: A review of the traditional African fermented dairy processing technologies, as well as technologically relevant microorganisms and health benefits associated with fermented dairy products.	**Fermentation:** - Fermentation in Kenya is a preservation method and serves to diversify milk products while improving the - functionality and digestibility of milk products. It's one of the oldest methods of food preservation and processing of cheese and yogurt. Food preservation recipes are handed down from generation to generation. - Fermented cereal products include *poto* from Maize in Congo, *Ogi* from Maize, or millet in Nigeria, *Kenkey* - and *Banku* from maize in Ghana, and *Togwa* from sorghum in Tanzania **African fermented dairy products:** - Fermentation was the common technique of food preservation in the majority of African homes before the - introduction of refrigeration to improve the nutritional quality, digestibility and safety of milk. - Fermentation processes in Africa (mostly done at the household and small-scale levels) are mostly spontaneous and do not rely on well-defined starter cultures, duration of fermentation and temperatures. - Majority of fermented dairy products are made from cow's milk, but milk from goat, buffalo, camel or ewe are also used. This produces spontaneously fermented yogurt-like products that are known using different local names in different African regions. - During fermentation, milk may be mixed with cereals or other plant materials to yield uniquely rich products - of cereal and milk-based blends. - During fermentation, fresh milk (using raw or heat-treated milk) is first sieved to remove any debris. - Fermentation is done through spontaneous fermentation or back-slopping where fresh milk is added to a - fermented product with continuous consumption with time.

	- The duration of fermentation varies and may take a few hours to a few months up to a year thus allowing for indefinite shelf-life and availability when fresh milk is unavailable. - *Gariss* from South Sudan is made using continuous fermentation. Camel milk is put in leather bags (goat skin) - which is placed on the backs of walking camels leading to continuous shaking. Fresh milk is continuously - added to the fermented batch as its depleted during consumption. - Fermentation of some products may include processes such as churning/ defatting then stirring and whipping - to make the yogurt-like product. The milk churns are used to make cream (ghee). - Another process may involve the removal of whey, stirring, and whipping to make the final product. - Fermentation vessels in Africa include gourds, calabashes, gourds, clay pots, leathers bags or plastic containers which are usually pre-treated with smoke from the burning end of a special tree to impart aromas and distinct flavors in the - product.
WFP, 2018 **Mainstreaming Human Nutrition in Resource Management in the Arid and Semiarid Areas** **Study location:** Kenya **Methods:** Guide **Sample Size and Respondent Group:** Field Practitioners guide	**Preservation methods at household level:** **Drying:** - Foods that can be dried include fruits, vegetables, roots and tubers and meat. Foods can be sun dried directly under the sun and also solar dried. - Hygiene should be observed during drying of food. Any moldy raw material should be discarded. - Meat and fish are dried through sun exposure **Steps to dry fruits and vegetables:** (1) Sort (discard any rotten, injured, or diseased fruits or vegetables) (2) Wash (3) Blanch (for vegetables, dip vegetables in boiling water for 1-2 minutes. Dip vegetables in cold water (4) immediately, remove vegetables and spread them out to dry) (5) Peel (6) Cut and slice: dip the sliced fruit in salt or lemon solution to prevent oxidation (7) Spread in drying trays. Make sure the pieces do not overlap (8) Dry. Dry in the sun for 2-4 days, keep flies and other insects away **Smoking:** - Smoking is used to preserve meat and fish by smoke drying over low fire for 1-5 days and longer for fresh meat. - Properly smoked meat and fish can keep for up to 1 year. **Salting**: - Meat and fish are preserved by dipping in brine (solution with a high salt concentration) or by simply rubbing salt on the meat. Salted food can be smoked to increase the shelf life. **Heating food:** - Heating food kills microbes and prevents biological processes that spoils food. Heated food e.g., - through boiling must be consumed within a day. Food must be heated to sufficient temperatures - and not just warming. **Fermentation**: - Fresh milk and some vegetables are preserved through fermentation which includes natural fermentation - or introduction of a fermenting agent. - Fermented milk products include yogurt, *music (*Kalenjin*), edodo (*Turkana*)* and *soyo (*Pokot)

Asogwa et. al., 2017 **Promotion of Indigenous Food Preservation and Processing Knowledge and the Challenge of Food Security in Africa** **Study location:** African countries **Methods:** Number of reviewed articles not indicated **Sample Size and Respondent Group:** A review of the indigenous knowledge systems used by rural farmers in Africa to process, preserve and store food crops.	**Sun drying:** - Drying of food is a responsibility for women. It's the oldest means of food preservation, it's the intermediate method in food processing e.g., before grinding into flour. Foods that can be dried include tubers, cereals, vegetables, fruits, fish, meat. - Foods can be sun dried by spreading directly under the sun. Meat and fish are dried over smoke - to increase the shelf life and add flavor. - Other foods are first salted to prevent decaying during drying such as meat, mushrooms and tomatoes and afterwards dried. Dried tomatoes are soaked in warm water and turned to tomato sauce. - In Sudan, meat is first cut into strips, salted, smeared with powdered coriander, and dried for a week to produce "*shermout"* - Pastoralists in Northern Kenya and Ethiopia cut meat into strips *(quanta),* smear with pepper, apply salt then dry over the fireplace for 5-7 days. In Somalia, dried meat *(otkac or nyirnyir*) is prepared from camel meat (*hilib gel*). Strips of sun-dried meat are cut into small pieces, fried in oil with garlic and *iliki a*nd immersed in camel ghee *(subag*). *Nyirnyir* can last up to several months. - In Nigeria, sun dried tomatoes are soaked in warm water and ground to prepare sauce. Dried tomatoes - can keep for up to a year. - In Malawi, dried vegetables are parboiled, sun dried stored in large pots called *mtsuko*, in order to - maintain flavor. The pots are used only to store vegetables which can keep for up to a year. - In Zimbabwe, vegetables are boiled in salted water for a few minutes, sun dried then stored in a - safe, dry place. This method is also used to dry edible insects such as white ants, termites, and caterpillars. - Other crops sun dried to increase their shelf life include maize, beans and groundnuts. - Drying in Africa is done on flat stones, linen, canvas, wire-mesh, or leaves and even on the soil where there is little control of the process and exposed to contaminants. - Disadvantages of drying food include loss of color, loss of flavor and loss of vitamins. - The losses can be mitigated by not drying the food too long. **Fermentation:** One of the oldest methods of food preservation used to preserve vegetables and also enhances the flavor of the meal through imparting acid flavor. Other foods preserved by fermentation include products sourced from cereals, fruits, legumes, meat, fish, milk and wild foods. Root and tubers such as cassava and sweet potatoes are fermented to add variety to diet. *Gari* and *fufu* are cassava products from natural fermentation. Fermented meat products from Sudan include fermented strips of fatty meat, products from fermented intestines and offal, fermented camel milk products such as *gariss,* which is fermented in a skin bag that is attached to a camel's saddle and cheese called *kush*. **Traditional preparation of *gari:***

	Fermenting cassava pulp in cloth bags from peeled and grated roots; after dewatering, the mash is sifted and fried resulting in a pre-gelatinized grit *(gari*) Other food processing methods include soaking, cooking and germinating popular with grains and seeds, legumes and cereals. Sorghum for instance is soaked, germinated, eaten or ground into flour and mixed with ungerminated cereal flour. **Traditional storage practices:** In Kenya, sneeze wood (*Ptaeroxylon obliguum*) is used to store maize. The bark of the tree is burned and acts as an insect repellent and the ash mixed with maize grains for storage. The smoke is also effective in warding off insects. Corn, dried pepper and dried vegetables are stored over the fireplace or in bags with a combination of local pesticides such as neem leaves, pepper, tobacco and wood ash. In Malawi, *Msanja*, a raised wooden structure, is constructed above the fireplace and used to store grains. In Zimbabwe, local granaries are smeared with cow dung, filled with grain then completely sealed. Other storage methods include storing in baskets, storing cocoyams and potatoes and soil and pit storage.
Koskei et. al., 2020. Postharvest Storage Practices of Maize in Rift Valley and Lower Eastern Regions of Kenya: A Cross-Sectional Study **Study location:** Kenya, Rift Valley (Bomet, Nakuru and Trans Nzoia) Lower Eastern regions of Kenya (Machakos, Makueni, Kitui) **Methods:** 165 farmers in Rift Valley; 149 farmers in Lower Eastern **Sample Size and Respondent Group:** A comparative cross-sectional study conducted in 3 counties from each of the regions. A pre-tested semi-structured questionnaire was used to conduct interviews to household heads by trained research assistants.	**Maize storage practices:** Most maize farmers used chemical insecticide for insect and pest control. Other's sun dry and air their produce while others use ash. Other storage methods include leaving the maize on the cobs out in the field (without covering after harvesting especially those from the Eastern region of Kenya) thus providing an environment for insect and fungal infestation. Those in the Rift Valley covered their maize harvest. Few farmers took their maize to commercial storage facilities while the majority stored the maize at home. Farmers used traditional methods to determine if their maize was dry through weighing, listening to the sounds that grains made, touching, change in color and if the maize was hard to chew. Some farmers believed moldy maize to be safe for human consumption after a rigorous cooking process, others fed it to livestock. **Spoilage:** Maize spoilage was attributed to bad weather, dampness of the maize, dampness of the storage place and harvesting maize earlier than usual.
Global Forum on Food Security and Nutrition, 2013 Indigenous methods of food preparation: what is their impact on food security and nutrition? **Study location:** North America, Europe, Asia, Africa, Latin America, Southwest Pacific. **Methods:** Online discussion 41 online contributors from 22 countries	**Western vs. Indigenous knowledge**: Western (modern or scientific) knowledge is centralized and linked with public and private institutions (research institutes and universities). Indigenous (traditional, local, cultural) knowledge is dispersed and associated to rural life and can be pictured as an "organic relationship between the knowledge and its community." **Why are traditional practices valuable?** Poor households lack modern food preservation appliances such as fridges and rely on alternative methods that have been passed from generation to generation. For example, sweet potatoes are preserved as chips, which can keep for up to a year. Green leaves,

Sample Size and Respondent Group: Online discussion (Global Forum) over a period of 3 weeks with 41 contributions being shared by participants from 22 countries. Members of the FSN forum were invited to participate in the discussion.	vegetables and fruits are preserved by drying. Pickling is common in Asia and Europe. Traditional methods of food preparation such as sprouting and soaking of grains reduce the content of anti-nutrients thus increasing the bioavailability of some nutrients such as iron. **Successful traditional food preparation methods:** **Sweet potato chips in Zambia (“*Shilengwa* or *Insemwa*”):** The potatoes are washed and boiled, and a pinch of salt is added. The cooked chips are sliced, sun dried, and can keep for up to six months **Meat preservation and use of banana leaves in Uganda:** Teso people smoke meat then cover it in a mold of soda ash. The meat can keep for six months. The meat is then prepared by first soaking and then cooking in groundnut paste. In Uganda, banana leaves are used to wrap food being cooked. Food such as meat is wrapped in banana leaves together with other ingredients such as bananas. The package is steamed until ready to eat. ***Injera* in Ethiopia:** Thin fermented bread made from previously fermented dough and can keep for 3-4 days at room temperature. **Traditional vegetable & blood preservation:** **Nepalese *Gundurk:*** To preserve vegetables for use in the lean season, Nepalese farmers prepared *Gundurk* by fermenting and drying the leafy vegetables. The practice preserves nutrients and increases the taste and adds flavor. **Blood *Charqui* (by Peruvians):** Prepared by boiling and drying of animal blood for later consumption, which is a culturally acceptable practice in the region. The practice has, however, been declining as blood has begun to be treated as waste or as animal feed. The product is rich in iron and can be stored or fed to toddlers without additional cost.
Ogolla et. al., 2017 **Strategies and Technologies for Camel Milk Preservation and Utilization of Non-Marketed Milk in Arid and Semi-Arid Areas** **Study location:** Kenya, Isiolo County **Methods:** 216 Respondents; 145 interviews with producers, 6 FGDs and 12 KIIs **Sample Size and Respondent Group:** The study used a cross-sectional design concurrent with a mixed methods design conducted between Aug and Sept 2015. Purposive and multistage sampling procedures used. Quantitative data collected through structured questionnaires. Quantitative data collected through participant observations, KIIs (12) and 6 FGDs with 6-8 participants.	**Camel milk in Kenya:** - In Kenya, camel milk accounts for 60% of total nutrient intake of communities in ASAL. It's the most - important source of Vitamin C (30 times more than bovine milk and 6 times more than human milk) - due to vegetables and fruits scarcity. - Seasonal variations is the major determinant of camel milk yield with the highest yield recorded in the wet - season as 64% of producers milked their camels thrice a day. - Animal breeding, animal husbandry and milking was a man's responsibility while milk handling, preservation, and marketing were a woman's domain. The camels belong to the men, but the milk belongs to the women. **Strategies employed for milk spoilage reduction:** - Higher volumes of spoiled milk were recorded during the wet season than the dry season. - Spoilage was attributed to poor hygienic practices and lack of preservation technologies. - During milking, producers ensured the use of clean milk handling equipment, cleaning the udder, use of clean hands, prevention of contamination by camel urine, calf saliva and insects. - Traders filtered the milk to remove particles and dust. Spoilt and non spoilt milk were separated during bulking. - Spoilt boiled camel milk was discarded as it couldn’t be processed into another product or consumed

Pre-testing done with 10 producers and 5 traders who were excluded from the study. Enumerators spoke the local dialect.	- since it results in poor curding as opposed to fresh milk. **Milk preservation:** - Traditional and modern strategies used to extend the shelf-life included smoking of the storage containers and boiling and cooling of the milk. 95% of the total milk produced was smoked while 5% was refrigerated during transit. - Non smoked milk was processed into fermented milk, pasteurized milk and yogurt in the urban areas. **Smoking (fumigation) of milk containers:** - Done to impart flavor and increase the shelf life for 12-24 hours without refrigeration at the household level, by the herders or the traders in Isiolo County. - Entailed cleaning the plastic storage container or the *damela* used for milking. Community specific smoking shrubs were ignited, extinguished and inserted in the containers which were closed and shaken. - The burned particles were then removed or left to be sieved off in the cooling hub. **Boiling:** - Milk was boiled to approximately 60^0c and then cooled. Common in areas such as Kulamawe with unreliable transport and limited access to cooling facilities. Boiled milk was sold to final consumers in Isiolo town. **Cooling technologies used:** - **Qoodha:** A traditional oval shaped milk storage container that can keep milk for up to 72 hours. - The container is woven from tree fibers into a pot like basket. The inside is smoked repeatedly until it - becomes compact due to formation of layers. The container is then filled with milk and then tied onto - the roof of a grass thatched - house supported by a casing from a camel or cows hide. Milk preservation is dependent on the cooling - properties of the container, or the antimicrobial properties acquired through smoking. - Commercial camel milk producers rarely use this technology, but it is still used by isolated communities away from the commercial centers. - **Simple evaporative cooling:** 20-liter milk jerrycans with wrapped gunny bags or hemp bags dipped in water. - This practice was used when transporting milk from the milking point to and from the primary milk collection point where the - containers were placed under tree shade while awaiting transportation to cooling hubs. - A simple charcoal evaporative cooler in - Kulamawe was not utilized by local communities due to inadequate supply of water and high cost of charcoal. - **Chilling:** This was extensively done in Isiolo town by traders either individually or in groups for milk - destined for urban markets and sold as fresh milk. Rejection of milk at the chiller was based on milk - adulteration. Monthly charges for using the chiller were based on the utility charges. - **Freezing:** Milk was stored in individual freezers owned or rented by individuals. Renting costs for the freezer

	varied seasonally $30 in dry season and $50 during the wet season monthly. The inside of the freezers had milk residues due to spillages when milk was transferred to the storage containers from the transportation containers. In the freezers the milk was kept in aluminum cans (provided by NGOs), 2-liter polythene bags, plastic jerry cans and plastic buckets. Aluminum cans were not popular as they were expensive and not easily portable. **Value added products:** - Camel milk was processed into cheese, butter and yogurt during the milk glut during the wet season. - Despite having been trained on pasteurization, traders in Isiolo didn't use this technology as they considered it for the high-end market. Consumption of fermented milk (*suusa*) prepared through spontaneous fermentation was common. - Energy sources used in milk preservation include electricity (63%) in the freezers and chillers in Isiolo town, charcoal (28%) and firewood (8%) were used in Kulamawe and in Isiolo town by retailers. **Forms of camel milk consumption:** - Camel milk was mostly consumed raw, smoked or boiled but rarely in fermented forms. Pasteurized - and powdered milk were not consumed at all. In the milk bars, milk was sold as fresh or as tea. - Camel milk was preferred over other types of milk due to the medicinal value of camel milk, - long shelf life and low-fat content. **Feasibility of camel milk powder acceptability:** - Despite having used powdered cow milk, none of the respondents had consumed powdered camel milk. - Those who had consumed cow milk powder were more likely to purchase powdered camel milk as opposed to those who hadn't.
Rwubatse et. al., 2014 **Traditional Drying Techniques for Fruits and Vegetables Losses Alleviation in Sub-Saharan Africa** **Study location:** Sub Saharan African Countries **Methods:** Number of articles reviewed not indicated **Sample Size and Respondent Group:** Review of traditional drying techniques for fruits and vegetables in African countries.	**Post-harvest technologies:** - Fruits and vegetables suffer 44% of post-harvest losses attributed to poor post-harvest technology and management in SSA, causing food insecurity and loss of income to stakeholders. - Preservation technologies are expensive and require electricity, which is a major obstacle. **Drying**: - Simple method of moisture removal from a product. - Drying heat sources can either be electricity or solar radiation. The use of new solar drying techniques could reduce post-harvest losses and favor fast drying of perishable produce, such as fruits and vegetables. **Traditional drying techniques:** - **Sun drying:** Involves laying the products in the sun on mats, roofs, drying floors or hanging the produce under a shelter on trees or on racks. - **Solar Drying:** A cleaner and healthier way of preserving produce in an enclosed unit keeping food safe from damage, insects and rain. Solar drying provides higher amounts of heat compared to that available under ambient conditions.

	- **Solar energy driers:** Classified into passive (natural circulation air dryers) and active driers (hybrid solar dryers). Passive dryers include direct (box or tent) and indirect (cabinet dryer) where heat is circulated in the crop through buoyancy or through wind pressure acting alone or in combination. - Active dryers are also called hybrid or forced convention air dryers. - They include natural convention dryers with additional biomass backup heaters and hybrid solar biomass dryers. - The use and adoption of these drying techniques would be the right choice for companies, organizations, research institutions and governments in alleviating fruits and vegetable losses. Dried fruits and vegetables would be available even after harvesting season and easily transported to market.
Gichure et. al., 2019 **The present status of meat processing and preservation in the pastoral regions of Kenya** **Study location:** Nairobi, Kenya, and 4 pastoral counties: Marsabit, Turkana, Garissa and Kajiado **Methods:** Purposive sampling: 8-12 per focus group, but total participants not provided **Sample Size and Respondent Group:** A market survey on diversity of current meat products made using preservation techniques. Focused group discussions and key informant interviews with officers in the veterinary department & knowledgeable persons in the pastoral community.	**Introduction:** - Approximately 67% of red meat is from the arid and semi-arid lands under the pastoral production system. - Red meat in Kenya accounts for over 80% of all the meat and is derived mainly from cattle, sheep, goats and camels. About 34% of red meat goes through informal rather than formal channels. - Post-harvest losses can be as high as 50% of the meat produced, which may cause food insecurity and reduced profit margins. Most of these losses are caused by inappropriate post-harvest handling, processing, and preservation techniques. **Objective:** To document different types of drying processes for meat/meat products. **Results:** - In the pastoral regions, the main preservation techniques by the different communities were salting, sun-drying and deep frying. - Common salt was used to extend shelf-life by reducing the water activity. - Drying by hanging the slender strips of meat directly under the sun accelerated removal of water from the - meat. Sun-dried meat products that resembled South African biltong were made in Turkana and Marsabit - Counties by conventional and small-scale processors. These products were occasionally marinated to improve acceptability. - Deep-frying was used to increase shelf-life products; around two to six months based on degree of hygienically handling storage. - *Nyirinyiri* is preserved meat by the Somali and Borana communities in Garissa and Marsabit- counties - *Enyas* from the Turkana community and Olpuda from the Masaai community in Kajiado the pastoral areas, - each community uses specific containers to pack the meat products. The packaging material is used to - prolong shelf-life of the products and to minimize contamination by external agents. - Traditionally, wooden containers with leather bases and lids were used by all the communities. However, due to scarcity coupled with the high cost of these containers, metallic (similar to those used to transport milk) and plastic (recycled cooking oil) containers are now used.

Gemechu and Tola 2014 Traditional Butter and Ghee production processing and handling in Ethiopia; a review **Study location:** Ethiopia **Methods:** No sample size provided, nor an indication of number of documents reviewed **Sample Size and Respondent Group:** Descriptive review of traditional/indigenous processing practices in Ethiopia	**Objective:** To review traditional/indigenous processing practices of butter and ghee from cow milk in Ethiopia. **Introduction:** - Most of the milk produced in the rural areas of Ethiopia is processed at the household level into milk - products such as butter using traditional technologies. - In rural areas, about 40% of the milk produced is converted to butter. **Quality of dairy products (including butter):** - **Substandard**: moisture content of *dhadha/ kibe* ranges from 20% to 43% as compared to the international commercial standard of 16% (Mekdes, 2008). - **Spoilage** when dhadha/ kibe is stored at room temperature for a long time is probably due to microorganisms. **Preservation & processing of local dairy products/butter:** - **Souring milk/fermented milk:** Milk for churning is accumulated over several days by adding fresh milk - to the milk already accumulated in traditional spherical earthenware vessel or bottle gourds and allowed to sour into itittu or naturally fermented milk. - **Stems and leaves of Ocimum hardiense:** Used for cleaning milk vessels and churns. - **Use of smoking milk vessels:** According to local understanding, the practice of smoking vessels by burning wooden chips of specific trees and shrubs has an advantage of imparting special flavor and odor to the product, and to disinfect the vessels, thus reducing the numbers of micro-organisms and thereby extending the shelf life of the product. Besides imparting a distinct flavor to the butter, this practice has a bacteriostatic effect, and may reduce processing time by heating the churn. - **Churning:** - Churning is the process whereby sour milk or cream is vigorously agitated in such a way that air is incorporated in the liquid. After filling, the churner is tightly closed, and churning is performed for 3-4 hours. **Butter:** - In the traditional butter making, the equipment required for processing sour milk are simple and locally available. Local churners are made from clay, gourds and wood, and can be woven from fiber. - The reason for the preference was that they believe that gourd churns are better in flavor impartation from wood smokes than other local churners. - Most of the traditional methods of milk processing are slow and inefficient. It may take 2-3 hours - depending on temperature, fat content, acidity and the milk volume to be churned. - Traditionally, children of weaning age are fed freshly made butter for different reasons, which vary from - society to society. - In some societies, butter is believed to help the infants maintain body temperature during cold weather. - In others, feeding freshly made butter is believed to help infants begin to speak some words earlier during - childhood. Fresh butter is also fed to newborn babies assuming that it lubricates to help with bowel

	movements. - Ghee has excellent storage stability. In places where ghee is not made, butter is occasionally spiced and heated for increasing its shelf life. **Butter Spoilage:** - Molds are the primary spoilage factors in butter and their presence in butter indicates post-production contamination from air or water. Bacteria, yeast and mold counts found to show unhygienic handling of butter. **Traditional methods of butter preservation and their reported shelf life**: - A leaf of plant called koba/inset (false banana) is the most common material used for butter packaging in southern parts of Ethiopia. Koba/inset is believed to be important to keep butter fresh until marketed. - Gourd is used as a storage vessel or packaging material **Recommendations:** - Butter and ghee can have a longer shelf life if they are stored in cool place, using airtight, light-proof and - moisture-proof containers to slow down the development of rancidity. - Quality of ghee can be affected by many factors, such as type of packaging material, permeability oxygen and moisture.
Folarin A. Oguntoyinbo et al., 2016 **Produce from Africa's Gardens: Potential for Leafy Vegetable and Fruit Fermentations** **Study location:** Africa **Methods:** Number of studies reviewed not indicated **Sample Size and Respondent Group:** Review of different lactic fermentation methods of fruits and vegetables utilized in Africa	**Fermentation of vegetables:** - Cowpeas, kales in milk - These are sometimes not suitable for consumption based on certain bacteria. - Process: Wash, shred, and dry **Fermentation of seeds:** - To remove anti-nutrient properties and use as meat substitute. Wet de hulling, oiling, and fermentation. **Recommendations:** - Need to scale up fermentation of African leafy vegetables - Manufacture of quality starter culture - Use technology for safety
Anastasia W. Njoroge, Ibrahim Baoua, and Dieudonne Baributsa, 2019 **Postharvest Management Practices of Grains in the Eastern Region of Kenya** **Study location:** Eastern region of Kenya **Methods:** 613 farmers randomly interviewed (94% of target) from 50 villages (16 in Tharaka Nithi, 17 in Makueni and 17 in Machakos. Farmers of various ages both men and women **Sample Size and Respondent Group:** Structured and semi structure questionnaires designed and administered using Kobo Toolbox via android tablets	**Crop losses**: - Before and after harvesting, inadequate drying, inefficient storage, preservation technologies **Key Takeaways:** - Foods grown are maize, common beans and pigeon peas - Drying challenges due to rodents, insects and birds, rain, contamination - Drying on the ground (2/3) and on tarpaulin/mat (1/3) - Sun drying, field drying, smoking, shade, house - Storage for six months for home consumption - Grains stored by hermitic and pesticides - Ground drying: possible aflatoxin contamination
Adeyeba Alice Olunike, 2014 **Storage, Preservation and Processing of Farm Produce**	**Food Preservation:** - Food preservation used to prevent spoilage. - Drying technique used for many years and is still used.

Study location: West Africa, Nigeria **Methods:** Not specified; written more like chapter in a textbook **Sample Size and Respondent Group:** Literature review	- High post-harvest loses due to inappropriate processing technologies, careless harvesting - and inefficient post-harvest practices, bad roads/rail systems, bad market practices, inadequate storage facilities, packing houses - and market infrastructures. - Traditional preservation methods passed down from generation to generation, but methods - have been lost over the years. **Drying:** - Types of drying: sundry/solar drying, oven drying, roller drying, vacuum drying, spray drying, roasting on fire/hot oven, tunnel drying, freeze drying - Advantages: inexpensive, reduces weight, easy to store, portable - Disadvantages: loss of color, flavor, vitamins - Affected by: The amount of surface area exposed, environment, equipment, arrangement on - the drying material in relation to the heat source or medium **Smoking**: reduces weight, changes flavor, color and taste. **Salting**: rub fish with salt. **Fermentation**: oldest food preservation method. Reduces aflatoxins and nutritional stress factors. Increases and bioavailability. **Roasting**: enhances palatability and reduces anti nutritional factors (ex. Groundnuts in sand in a pan). **Blanching** **Hanging basket**: basket over kitchen fire with fish/ **Canning/bottling/refrigeration/freezing/irradiation** **Some Key Takeaways:** - Old methods are laborious and time consuming - Some upgraded methods/technologies have been rejected **Recommendation:** Need for standardization, modernization while still retaining qualities of food

Buke Dabasso et. al., 2018 **Process characterization and nutrient profiling of traditional meat products of the Borana communities in northern Kenya** **Study location:** Kenya, Marsabit County **Methods:** Borana speaking people Groups 45 participants **Sample Size and Respondent Group:** Cross sectional design Villages inhabited by Borane Chiefs identified elders to be interviewed, gathered names and contacted details then used snowball technique to reach all Purposive sampling	**Key Takeaways:** - Women prepared the preserved meat products. - Preserved meat and fermented milk for special occasions and special guests. - When preparing meat, the perishables are eaten first. The bones are repeatedly boiled for soup. - The meat is cut into strips to make koche and guba, while the fat is extorted by frying and used as oil - Meat from hind legs dried for long term use (goat). - Bull: cut into long thin strips and hung on skin rope to dry. Then, cut into pieces and cooked in melted ghee and preserved the rest in smoked containers. - Children eat pieces of meat with soup. - Organ meat eaten first due to short expiry. - Only 16% have traditional meat products available in their houses/ majority did not. - Most use beef from cattle compared to goat. - Looked at consumption for adults – no focus on younger children. - Traditional meat products used commonly at ceremonies. - 14 meat products documented but only four meat preservation methods are still practiced. - Meat sharing done in the community after slaughtering, which mitigated food insecurity. - Preserved meats have higher nutrient content due to the process of preservation and additives used. **Food preservation methods:** - Smoking: for flavor; lower hind legs/forelegs/pancreas - Roasting: of strips over red charcoal for flavor Deep frying
Marsabit County, January 2018 MIYCN KAP Baseline Survey for Marsabit County **Study location:** Kenya, Marsabit County (All sub counties: Moyale, Saku, North Horr, Laisamis) **Methods:** The target population: caregivers of children 0-23 months, men and women, CHVs, HCWs, community leaders, grandmothers' religious leaders and implementing partners. 2230 WRA and 2102 children participated in the survey. 38 KIIs (community and religious leaders, health workers, TBAs, CHVs and grandmothers) 10 FGDs (Fathers), 10 (mothers of children 0-23 months), 1 (CHVs) **Sample Size and Respondent Group:** The survey was a cross-sectional study that utilized both quantitative and qualitative research methods. A two-stage stratified cluster sampling used to achieve the	**Breastfeeding practices:** - EBF for six months: 75.7% attributed to caregivers' positive attitude with regards to breastfeeding. - Barriers to sustained breastfeeding to 1 and 2 years were maternal workload, close birth spacing - and poor maternal health. - Responsive feeding was practiced by 59.7% of the mothers. Children were fed less milk and less food when ill. 67.9% attributed to loss of appetite. - Main decision maker on child feeding was the mother (97.8%). The grandmother (0.9%), house help, friends and relatives (0.9%) and fathers (0.4%) were also involved in making decisions on child feeding. **Complementary feeding practices:** - Caregivers with knowledge of complementary feeds (solid, semi-solid or soft foods): 49.6% - Care givers who had given their children (6-8 months) complementary feeds the day before: 44.3% - Minimum dietary diversity (4 out of the 7 food groups): 15.5% - Among breastfed: 15.3% - Among non-breastfed children: 46.7 % - Minimum meal frequency (2 meals per day): 48.5% - Complementary feeds were introduced to children as early as 3 months (Porridge, Anjera and animal milk). **Food Consumption:** - Consumption of iron rich and iron fortified foods was poor: 20.2% - Consumption of multiple micronutrient powders: 8%

desired representative sample for quantitative data collection. Stage 1: selection of villages based on probability proportional to size. Stage 2: random simple sampling of households. KII informants were purposively sampled while FGDs were picked randomly from the sampled clusters. Data collection tools used the standard MIYCN tools recommended by WHO.	- Main fortified foods consumed were breakfast cereals (Weetabix, Oats, Quick porridge) (37.2%) corn soya blend (36.0%) and *Cerelac* milk and other formula (20.1%) - The main solid, semi-solid or soft foods consumed by the children (6 to 23 months were cereal based - foods (74.3%), beans and lentils (45.2%), roots and tubers (33.3%), flesh meat (27.7%), dark green leafy vegetables (16.8%), organ meats (14.2%), fruits and vegetables (12.5%), eggs (11.6%), cheese and other milk products (7.5 %). **Barriers:** - Barriers to appropriate complementary feeding include food insecurity, poverty and prolonged drought, lack of knowledge on food and child feeding, cultural beliefs and perceptions that hinder children from consuming certain foods. **Facilitating factors:** - The facilitating factors include support from older women, grandmothers and fathers as well as health facility health talks. **Providers of information:** - Main providers of information on IYCN were grandmothers and health care providers. Most first-time mothers' food choices are influenced by the mothers in law and to some extent older mothers.
Isiolo County, October 2017 MIYCN KAP Baseline Survey for Isiolo County **Study location:** Kenya, Isiolo County **Methods:** The target population: mothers/ caregivers of children 0-23 months, men and women, CHVs, county and sub county health stakeholders and implementing partners. 1003 mothers and caregivers and 977 children participated in the survey. 10 FGDs (Mothers), 6(CHVs), 4 (Fathers) **Sample Size and Respondent Group:** The survey utilized a mixed methods design using both quantitative and qualitative data collection methods. A two-stage cluster sampling based on proportion to population size. Stage 2: random simple sampling of households. At the household level, the Kenya Ministry of Health (MoH) KAP questionnaire on Maternal, Infant and Young Child Nutrition (June 2015) was used to collect the quantitative data.	**Breastfeeding practices:** EBF for six months: 74.1% attributed to positive attitude by the mothers and the community with regards to breastfeeding, high level of knowledge in the community about breastfeeding. Responsive feeding was practiced by 80.7% of the mothers. Children were fed less milk and less food when ill which was attributed to loss of appetite Main decision maker on child feeding was the mother (98.2%) and only 0.4% of fathers were involved in making decisions on child feeding. **Complementary feeding practices:** Caregivers/ mothers who had received information on complementary feeding: 67.9% Caregivers/ mothers with knowledge of complementary feeds (solid, semi-solid or soft foods): 77.3% Care givers who had given their children (6-8 months) complementary feeds the day before: 68.5% Minimum dietary diversity (4 out of the 7 food groups): 39.7% Among breastfed: 36.9% Among non-breastfed children: 57.3 % Minimum meal frequency: 46.1% Minimum acceptable diet: 24.0% **Food Consumption:** Consumption of iron rich and iron fortified foods: 43.3 % Consumption of multiple micronutrient powders in the last six months: 10.5 % Consumption of MNPs in the correct frequency (every third day): 18.4% Main fortified foods consumed were flours (maize, 91.7% and wheat, 82.7) salt (85.4%), coking fat and oils (73.4%) and fortified margarine (14.3%) The main solid, semi-solid or soft foods consumed by the children (6 to 23 months were cereal based foods (82.9%), milk and milk products (74.1%), legumes (42.6%), roots and tubers (55.6%). The least consumed foods were flesh

	foods (2.2 %) and organ meat (10.7%) **Barriers:** Barriers to appropriate complementary feeding include food insecurity, inadequate knowledge on IYCN, maternal workload, family conflicts and violence and alcoholism among mothers. **Facilitating factors:** The facilitating factors include positive attitude in the community with regards to breastfeeding and complementary feeding, knowledge among mothers on breastfeeding and low influence on IYCN by cultural beliefs. **Providers of information:** Main providers of information on IYCN were community health volunteers, other mothers and mothers in law and less by health workers at the facility level.

Annex 2: A Counseling Guide for Improving Complementary Feeding Practices, Including Consumption of Preserved Foods, for Children 6 to 23 months of age in Marsabit and Isiolo Counties

Based on Results of Trials of Improved Practices (TIPs) Assessment, August 2021

Contents

Age Group: Six to Eight Months

Ideal feeding practices:

- Continue breastfeeding on demand, both day and night.
- Increase the amount of food gradually to half a cup and ensure the food is given in a separate bowl to guarantee the child finishes all the given.
- Frequency of meals per day: feed at least three meals per day for the breastfed child; the non-breastfed child should receive one to two cups of milk and one to two extra meals per day.
- Feed child a variety of energy giving foods – (e.g., cereals, tubers) and nutrient-dense foods (vegetables/fruits), sources of vitamin A and foods prepared with healthy oils, such as vegetable oils.
- The food should contain at least four of the seven food groups: 1) cereals, roots, tubers and plantains; 2) legumes, nuts, and seeds; 3) dairy products (fresh milk, fermented milk, yogurt); 4) flesh foods (meat, fish, poultry, liver/organ meats; 5) eggs; 6) vegetables and fruits rich in vitamin A (yellow, orange or green); and 7) other vegetables and fruits.
- Feed child meat, poultry, fish or eggs daily. During times when these foods are not available, feed the child beans, peas or lentils.
- When there is plenty of meat and milk, preserve and use to feed the child when they are unavailable.
- Practice responsive feeding: Feed child directly and encourage child to eat. Feed patiently.

SIX TO EIGHT MONTHS		
Feeding challenges identified	**Recommendations**	**Motivations**
Child is given broth/soup from cooked meat instead of the actual meat because the child does not have teeth.	▪ Give the child the meat itself and not just the broth/soup. ▪ Modify the meat to enable to child to chew and swallow easily by mincing or pounding or grinding.	▪ Giving the child the meat instead of broth/soup provides him/her with all the nutrients that can be gotten from the food. Broth/soup does not provide enough nutrients to help your child grow and develop well. ▪ Children can chew, swallow and digest meat because it has been modified according to their age. ▪ Meat is good for building the body of the baby.
Child is given a piece of fresh	▪ Modify the meat to enable to child to chew and swallow easily by mincing or pounding or grinding.	▪ Giving the child the meat instead of pieces of meat to suck on will provide all the meat's nutrients. Sucking or licking does not provide enough nutrients to help your child grow and develop well.

cooked meat to suck on.	▪ Give the child the meat itself and not just a piece to suck on.	▪ Children can chew, swallow and digest meat because it has been modified according to their age. ▪ Meat is good for building the body of the baby.
Fresh animal milk, such as camel, goat, cow and sheep milk are fed to a child below 1 year old. This includes boxed milk bought from shops	▪ Encourage breastfeeding on demand day and night alongside complementary feeding.	▪ Breastmilk continues to be the most important part of your child's diet and it provides half of a child's nutritional needs for healthy growth and development. ▪ Breastmilk will protect your baby against illnesses and help fight infections and viruses, such as COVID-19.
Child's porridge is thin/watery. The porridge falls off the spoon.	▪ Make thick porridge out of maize flour (or any other flour available to the mother) for the child. ▪ Porridge should be 'eaten' and not 'drank.' ▪ The porridge should be thick such that it does not fall off the spoon or the cup.	▪ Thick porridge is dense enough to provide the required energy for the child's healthy growth and development. ▪ Thick porridge keeps the child satisfied for a prolonged period, thus reducing frequent hunger and feeding.
Child has not been introduced to complementary foods yet (late introduction past 6 months of age)	▪ Add other foods to "complement" breastmilk. ▪ Feed your child mashed/pureed family foods. ▪ By eight months of age, your child can begin eating finger foods. ▪ Thicken your child's food as the child grows older. ▪ Continue giving the child mashed foods. ▪ Food should be thick, not watery (should not fall off a spoon easily)—for example, mashed vegetables (carrot, potato, tomato, cabbage,	▪ Breastmilk continues to be the most important part of your child's diet and it provides half of a child's nutritional needs. ▪ Your child needs food in addition to breastmilk to continue to grow well physically and mentally, as breastmilk alone is not enough to support your child's growth. ▪ Feeding your child family foods, which you have already cooked for your family is cheaper when you use foods available in your home. ▪ Increasing the amount of food per meal and increasing the number of meals your child eats each day will help your child grow and prevent them from being too thin and malnourished. ▪ Feeding your child nutritious foods protects your child from many illnesses.

	kales) and fruits (banana, mango, orange). ▪ When introducing new foods, introduce one new food at a time to learn how the child reacts to it. ▪ Continue increasing the amount of food per meal to half a cup. ▪ Feed the child three times per day.	
Mother does not give baby other foods because it causes the baby to have a stomachache	▪ Add other food to "complement" breastmilk after the child reaches 6 months old. ▪ Ensure that utensils used to feed the baby are well cleaned. ▪ Ensure that the food is well cooked before feeding the baby. ▪ Wash hands before preparing food and feeding the baby.	▪ Giving the child other foods after 6 months old will not cause the child to have a stomachache. ▪ Your child needs food in addition to breastmilk to continue to grow well physically and mentally, as breastmilk alone is not enough to support your child's growth. ▪ Ensuring that the food is well cooked makes it safe for eating. ▪ Use of clean utensils and washing your hands before preparing food and feeding the baby reduces chances of illness.
Child eating unhealthy snacks	▪ Stop giving unhealthy processed products such as soda, processed juice, sweets, biscuits. ▪ Give healthier snacks, such as fruits (e.g., whole bananas, mangoes, oranges), porridge.	▪ Unhealthy snacks only add fats and sugars, do not contain anything to help the child to grow. ▪ These unhealthy snacks will not help your child to grow well and do not contribute to good health. ▪ Healthy snacks are more nutritious. ▪ Fruits improve the appetite of the child. ▪ Unhealthy snacks are more expensive.
Child not eating meat (including beef, camel, goat, sheep, cow, chicken)	▪ Introduce animal source foods including chicken, beef, sheep, cow, goat, camel (based on the meat available). ▪ Include small pieces of organ meats (liver, kidney) in the child's diet. ▪ Modify the meat to enable the child to chew and swallow easily (i.e., grinding, mincing and cutting the meat into tiny pieces).	▪ Meat provides protein and iron that will increase blood in the body. ▪ Meat helps encourage children to eat other foods such as energy-giving foods and vegetables alongside the meat. ▪ Meat has protein, which is especially good for children to help them to grow strong and healthy. ▪ Though chicken are birds (some members of the community believe that birds should not be eaten) chicken and the eggs of chicken are also a good source of meat and protein and can help children grow strong and healthy. Eating chicken does not stop your prayers.

	▪ Cook meat until it is well cooked and soft for the child to chew. ▪ Give meat with other energy giving energy-rich foods such as ugali, potatoes, rice, mandazi, pasta and vegetables such as cabbage, kale, green leafy vegetables.	
Child is eating less than required quantities of food per day	▪ Increase the amount of food gradually to half a cup for each meal. ▪ Use a separate plate to make sure the child eats all the food that has been given to the child.	▪ Enough food protects your child from many illnesses. ▪ Your child will be happier, satisfied, and not hungry, and you can do your housework with less interruption.
Child is fed fewer than three times per day.	▪ Increase the meals to three per day. ▪ Breastfeed the child on demand both day and night. ▪ Feed the child in their own bowl to ensure the child eats all the food given. ▪ Breastfeed between meals and at night. ▪ Include at least one food from each food group	▪ Your child needs to eat more now to grow healthy, taller, play well, and be active and learn in school. ▪ Your child will grow well and be healthy.
Child is given tea as a snack in between meals or as a meal.	▪ Avoid giving tea (with or without milk) to the child at any time. ▪ Replace tea with another healthier snack like porridge.	▪ Tea has little health benefits for the child, and it can prevent absorption of iron in legumes (beans, lentils) and meat. ▪ Breastmilk continues to be the most important part of your child's diet and it provides half of a child's nutritional needs.
Child's diet does not include enough fruits	▪ Increase the amount and variety of fruits given to the child per day. ▪ Mash the fruit to enable the child to eat comfortably.	▪ Fruits are rich in vitamins and minerals to help the child grow well and to keep the child healthy. ▪ Fruits aid in digestion of foods and contain vitamins which protect against illness.

	▪ If the child does not like the fruit (such as lemon), you can disguise it by adding it to other foods. ▪ Use available fruits/fruits in season. ▪ Give a variety of fruits depending on availability.	▪ Fruits can be eaten alone (as a snack) or with other foods (within a meal) to help the child stay full.
Child's diet not inclusive of enough vegetables	▪ Increase the number of vegetables given to the child per day – this should comprise one-fourth of the child's food. ▪ Mash the vegetables to enable the child to eat comfortably. ▪ Give vegetables with other foods, such as rice, pasta, potatoes. ▪ Vegetables should not be overcooked. Cook for a short time to ensure nutrients are not lost. ▪ If the child does not like vegetables, you can disguise it by cooking with other foods.	▪ Vegetables are rich in vitamins and minerals. ▪ Vegetables aid in digestion.
Child not eating eggs	▪ Introduce eggs into the child's diet. ▪ The child should eat both egg yolk and egg white. ▪ Vary cooking methods – boil, fry, scramble. ▪ Cook eggs in/with other foods, e.g., add eggs when making anjera.	▪ Eggs are a good source of protein. ▪ Eating egg does not stop your prayers. ▪ For those who have chicken, eggs are readily available.
Mother prefers to give only food that the child likes.	▪ Give variety of foods. ▪ Introduce one type of food at a time. ▪ When feeding, present the food in an attractive way. ▪ Hide the unliked healthy foods in the preferred food.	▪ Avoids wastage of foods. ▪ If the food is delicious/tasty, the child eats easily and saves on time and wastage. ▪ Giving a variety of foods ensures the child gets all the required nutrients for his/her age.

	▪ Be creative while cooking and make the food delicious. ▪ Vary cooking methods.	
Mother is chewing food (e.g., meat, mandazi) for the child	▪ Do not chew food for the child. ▪ Modify the food by mincing, pounding, grinding or dipping on other foods for the mandazi to enable to child to chew and swallow easily.	▪ Giving the child the food to eat directly, will ensure they get all the nutrients form the food they eat. ▪ Chewing food for the baby is not clean may lead to transfer of illness from the mother to the baby.
Child is given piece of fatty meat to suck on/lick (kurkude)	▪ Give the actual meat instead to the child instead of the fatty piece. ▪ Modify the food by mincing, pounding or grinding to enable child to chew and swallow easily.	▪ Giving the child actual meat will ensure they get all the nutrients from the meat. ▪ The fatty meat may give the child diarrhea.
Children are not allowed to eat organ meats – offals (kidney, intestines, tongue, liver)	▪ Give children offal meat. ▪ Modify the offal by mincing, pounding or grinding to enable to child to chew and swallow easily.	▪ The child will not talk too much because of eating tongue. ▪ Organ meats/offals are rich in protein and other nutrients that help the baby to grow.
Mother is not following hygienic practices	▪ Wash the udder of the animal before milking using warm water. ▪ Wash storage containers and utensils with soap and clean water and leave to dry. ▪ Hand-washing (for both the mother and the child) before feeding.	▪ Proper hygiene reduces the chances of your child getting sick. ▪ Proper hygiene reduces transfer of diseases and illnesses to you and your child.
Mother is not storing food or preserving food in a safe way (i.e., food safety)	▪ Leave the food to cool before transferring to the storage container. ▪ Store food away from dust and other forms of contamination.	▪ Food that is stored before cooling will have moisture and will spoil quickly. ▪ Cutting meat into thin strips will enable it to dry well, thus reducing spoilage. ▪ Boiling milk destroys any germs present in the milk and makes it safe to drink.

	▪ Dry meat until very dry by cutting into thin strips and hanging to dry. ▪ Lock/keep away the storage containers to avoid contamination by children. ▪ Avoid using hands when serving food. Serve using a clean, long, dry spoon to serve foods. ▪ During fermentation of milk, pour out the whey instead of using dujun/straw to avoid contamination. ▪ Vegetables should be dried on a raised surface and covered to avoid dust. ▪ Dried vegetables should be handled using clean and dry spoons. ▪ Heat preserved foods before serving. ▪ Boil milk before use. ▪ Ensure meat is inspected after slaughtering.	▪ Using a clean and dry spoon to serve preserved foods and avoiding use of hands will reduces chances of the food spoiling. ▪ Heating of food before eating will ensure it's free of germs and will reduce chances of getting sick after eating. ▪ Inspection of meat after slaughter will ensure that it is safe to eat. ▪ Drying vegetables on a raised surface ensures that it will not get germs.
Child is not fed preserved meat	▪ Identify appropriate parts of meat that are culturally acceptable. ▪ Cook meat until it is well cooked and soft for the child to chew. ▪ For the preserved meats that are hard, boil to soften the meat for the child the modify. ▪ Modify the meat to enable to child to chew and swallow easily (i.e., grinding or cutting the meat into tiny pieces).	▪ Meat provides protein and iron that will increase blood in the body. ▪ Meat helps children to eat other foods alongside the meat. ▪ Animal source foods are especially good for children to help them grow strong and healthy. ▪ Use of already available preserved meat reduces on the need for the mother to look for other foods to feed the child. ▪ Some preserved meats have already been cut into small pieces or pounded, which can be fed to children 6 to 23 months of age.

	▪ Do not chew the meat for the child. ▪ Give meat with other energy giving foods such as (ugali, potatoes, rice, mandazi, pasta) and vegetables such as (cabbage, kale, green leafy vegetables). ▪ Counsel on importance of preserved meat to improve food security.	
Child is given a piece of preserved fatty meat to suck on, rather than eat.	▪ Modify the preserved meat to enable to child to chew and swallow easily by mincing or pounding or grinding. ▪ Give the child the meat itself and not just a piece to suck on. ▪ Sucking on preserved meat gives the baby only energy from the oil but the child will not get protein from the meat itself.	▪ Giving the child the meat instead of pieces of meat to suck on as this will provide all the nutrients that can be gotten from the meat. Sucking or licking does not provide enough nutrients to help your child grow and develop well. ▪ Children can chew, swallow and digest meat because it has been modified according to their age. ▪ Meat is good for building the body of the baby.
Children are not given preserved foods because they have not reached a certain age and/or do not have teeth or it will choke them.	▪ Introduce preserved foods (Mandazi and meat) that are available. ▪ Do not introduce fermented milk but continue breastfeeding on demand. ▪ Modify the meat by mincing, pounding or grinding. ▪ Soften the mandazi as you give alongside other foods like beat stew, bean stew, lentil stew. ▪ Do not chew food for the baby.	▪ After the age of 6 months, children can eat and swallow any food if it is properly modified. ▪ Mandazi that has been softened and meat that has been modified will not choke the child. ▪ Use of already available preserved meat and mandazi reduces on the need for the mother to look for other foods to feed the child.

Child fed meat that is not dried properly	▪ Dry only lean meat. ▪ Make strips thin. Thick strips take more time to dry than thin ones. It is important that strips be placed in the same batch are of the same cross-section, with only the length differing. ▪ Dry the strips of meat. ▪ Length strips may differ, though it should not be less than 20cm and not more than 70cm.	▪ Drying meat properly reduces chances of your child getting illnesses. ▪ Meat that is properly dried keeps for longer.
Inadequate intake of vegetables due to unavailability	▪ Counsel mothers on how to preserve vegetables. ▪ Ensure hygiene in preparation. ▪ Store the dried vegetables in clean containers away from direct sunlight.	▪ Vegetables are rich in vitamins and minerals such as iron. ▪ Vegetables aid in digestion. ▪ Most vegetables are locally available and affordable when in season or available on market days. ▪ Preserving vegetables will ensure the child eats them daily.
Mother is softening mandazi with tea and feeding to the baby	▪ Avoid softening mandazi using tea. ▪ Soften the mandazi by putting in other hot foods such as meat stew, lentil stew or bean stew or any other stew available.	▪ Tea has little health benefits for the child. ▪ When mandazi that has been softened with tea is eaten with other foods, it can prevent absorption of iron in legumes (beans, lentils) and meat.

Age Group: Nine to 11 Months

Ideal feeding practices:

Continue frequent breastfeeding on demand, day and night.
Feed child nutritious meals, such as eggs and pounded, mashed/chopped foods.
Frequency of meals per day: Feed at least three meals and one snack per day for the breastfed child; the non-breastfed child should receive one to two cups of milk and one or two extra meals per day in addition to the recommended three meals and one snack per day.
Feed child a variety of energy and nutrient-dense foods, sources of vitamin A, and foods prepared with healthy oils, such as vegetable oils.
The food should contain at least four of the seven food groups: 1) cereals, roots, tubers and plantains; 2) legumes, nuts and seeds; 3) dairy (milk, yogurt); 4) flesh foods (meat, fish, poultry, liver/organ meats; 5) eggs; 6) vegetables and fruits rich in vitamin A (yellow, orange, or green); and 7) other vegetables and fruits.
Feed child meat, poultry, fish or eggs daily. During times when these foods are not available, feed the child beans, peas or lentils.
When there is plenty of meat and milk, preserve and use preserve to feed the child when they are unavailable.
Increase the amount of food to three-quarter cup per meal. Use a separate bowl or plate to ensure the child eats all the food that is served.
Practice responsive feeding. Feed child directly and encourage child to eat. Feed patiently.

NINE TO 11 MONTHS		
Feeding challenges Identified	**Recommendation**	**Motivation**
Child is given broth/soup from cooked meat instead of the actual meat because the child does not have teeth.	▪ Give the child the meat itself and not just the broth/soup. ▪ Modify the meat to enable the child to chew and swallow easily by mincing or pounding or grinding.	▪ Giving the child the meat instead of broth/soup provides him/her with all the nutrients that can be gotten from the food. Broth/soup does not provide enough nutrients to help your child grow and develop well. ▪ Children can chew, swallow and digest meat because it has been modified according to their age. ▪ Meat is good for building the body of the baby.
Child is given a piece of preserved fatty meat to suck on, rather than eat.	▪ Modify the meat to enable to child to chew and swallow easily by mincing or pounding or grinding. ▪ Give the child the meat itself and not just a piece to suck on.	▪ Giving the child the meat instead of pieces of meat to suck on as this will provide all the nutrients that can be gotten from the meat. Sucking or licking does not provide enough nutrients to help your child grow and develop well. ▪ Children can chew, swallow and digest meat because it has been modified according to their age. ▪ Meat is good for building the body of the baby.
Fresh/raw animal milk, such as camel, goat, cow and sheep	▪ Encourage breastfeeding on demand day and night alongside complementary feeding.	▪ Breastmilk continues to be the most important part of your child's diet and it

milk, is fed to a child below 1 year this includes boxed milk bought from shops		provides half of a child's nutritional needs. ▪ Breastmilk will protect your baby against illnesses and help fight infections and viruses, such as COVID-19.
Child's porridge is thin/watery. The porridge falls off the spoon	▪ Make thick porridge, out of maize flour (or any other flour available to the mother) for the child. ▪ Porridge should be 'eaten' and not 'drank'. The porridge should be thick such that it does not fall off the spoon or the cup.	▪ Thick porridge is dense enough to provide required energy for the child's healthy growth and development. ▪ Thick porridge keeps the child satisfied for a prolonged period of time, thus reduces frequent hunger and feeding.
Child eating unhealthy snacks	▪ Stop giving unhealthy processed products such as soda, processed juice, sweets, biscuits. ▪ Give healthier snacks, such as fruits (e.g., whole bananas, mangoes, oranges), porridge.	▪ Unhealthy snacks only add fats and sugars, and no other nutrients. ▪ These unhealthy snacks will not help your child to grow well and do not contribute to good health. ▪ Healthy snacks are more nutritious. ▪ Fruits improve the appetite of the child. ▪ Unhealthy snacks are more expensive.
Child not eating meat (including beef, camel, goat, sheep, cow, chicken)	• Introduce animal source foods including, chicken, beef, sheep, cow, goat, camel (based on the meat available). • Include small pieces of organ meats (liver, kidney) in the child's diet. • Modify the meat to enable the child to chew and swallow easily (i.e., grinding, mincing and cutting the meat into tiny pieces). • Cook meat until it is well cooked and soft for the child to chew. • Give meat with other energy giving foods such as (ugali, potatoes, rice, mandazi, pasta) and vegetables such as (cabbage, kale, green leafy vegetables)	• Meat provides protein and iron that will increase blood in the body. • Meat helps encourage children to eat other foods such as energy giving foods and vegetables alongside the meat. • Meat has protein, which is are especially good for children to help them to grow strong and healthy. • Though chicken are birds (some members of the community believe that birds should not be eaten) chicken and the eggs of chicken are also a good source of meat and protein and can help children grow strong and healthy. Eating chicken does not stop your prayers.
Child is eating less than required quantities of food per day	• Increase the amount of food gradually to3/4 of a cup for each meal. • Use a separate plate to make sure the child eats all the food that has been given to the child.	• Enough food protects your child from many illnesses. • Your child will be happier, satisfied, and not hungry, and you can do your housework with less interruption.
Child is fed fewer than three times with one snack per day.	• Increase the meals to three with one snack per day. • Breastfeed the child on demand both day and night. • Feed the child in their own bowl to ensure the child eats all the food given. • Breastfeed between meals and at night. • Include at least one food from each food group.	• Your child needs to eat more now to grow healthy, taller, play well, and be active and learn in school. • Your child will grow well and be healthy.

Child is given tea as a snack in between meals or as a meal.	▪ Avoid giving tea (with or without milk) to the child at any time. ▪ Replace tea with another healthier snack like porridge.	▪ Tea has little health benefits for the child, and it can prevent absorption of iron in legumes (beans, lentils) and meat. ▪ Breastmilk continues to be the most important part of your child's diet and it provides half of a child's nutritional needs.
Child's diet does not include enough fruits	▪ Increase the amount and variety of fruits given to the child per day. ▪ Mash the fruit to enable the child to eat comfortably. ▪ If the child does not like the fruit (such as lemon), you can disguise it by adding it to other foods. ▪ Use available fruits/fruits in season. ▪ Give a variety of fruits depending on availability.	▪ Fruits are rich in vitamins and minerals to help the child grow well and to keep the child healthy. ▪ Fruits aid in digestion. ▪ Fruits can be eaten alone (as a snack) or with other foods (within a meal).
Child's diet not inclusive of enough vegetables	• Increase the number of vegetables given to the child per day – this should comprise one-fourth of the child's food. • Mash/ the vegetables to enable the child to eat comfortably. • Give vegetables with other foods, such as rice, pasta, potatoes. • Vegetables should not be overcooked. Cook for a short time to ensure nutrients are not lost. • If the child does not like vegetables, you can disguise it by cooking with other foods.	• Vegetables are rich in vitamins and minerals. • Vegetables aid in digestion.
Child not eating eggs	Introduce eggs into the child's diet. The child should eat both egg yolk and egg white. Vary cooking methods – boil, fry, scramble. Cook eggs in/with other foods e.g., add eggs when making Injera.	Eggs are a good source of protein. Eating egg does not stop prayers. For those who keep eggs, they are readily available.
Mother prefers to give only food that the child likes.	▪ Give variety of foods. ▪ Introduce one type of food at a time. ▪ When feeding, present the food in an attractive way. ▪ Hide the un-liked healthy foods in the preferred food. ▪ Be creative while cooking and make the food delicious. ▪ Vary cooking methods.	▪ Avoids wastage of foods. ▪ If the food is delicious/tasty, the child eats easily and saves on time and wastage. ▪ Giving a variety of foods ensures the child gets all the required nutrients for his/her age.
Mother is chewing food (e.g., meat, mandazi) for the child	▪ Do not chew food for the child. ▪ Modify the food to enable to child to chew and swallow easily (i.e., grinding or cutting the meat into tiny pieces)	▪ Giving the child the food to eat directly, will ensure they get all the nutrients form the food they eat. ▪ Chewing food for the baby is not clean may lead to transfer of illness from the mother to the baby.

Child is given piece of fatty meat to suck on / lick (kurkude)	▪ Give the actual meat instead to the child instead of the fatty piece. ▪ Modify the food to enable to child to chew and swallow easily (i.e., grinding or cutting the meat into tiny pieces).	▪ Giving the child actual meat will ensure they get all the nutrients from the meat. ▪ The fatty meat may give the child diarrhea.
Children are not allowed to eat organ meats - offals (kidney, intestines, tongue, liver)	▪ Give children offal meat. ▪ Modify the offal by mincing, pounding or grinding to enable to child to chew and swallow easily.	▪ The child will not talk too much because of eating tongue. ▪ Organ meats are rich in protein and other nutrients that help the baby to grow.
Mother is not following hygienic practices	▪ Wash the udder of the animal before milking using warm water. ▪ Wash storage containers and utensils with soap and clean water and leave to dry. ▪ Hand washing (for both the mother and the child) before feeding.	▪ Proper hygiene reduces the chances of your child getting sick. ▪ Proper hygiene reduces transfer of diseases and illnesses to you and your child.
Mother is not storing food or preserving food in a safe way (i.e., food safety)	▪ Leave the food to cool before transferring to the storage container. ▪ Store food away from dust and other forms of contamination. ▪ Dry meat until very dry by cutting into thin strips and hanging to dry. ▪ Lock / keep away the storage containers to avoid contamination by children. ▪ Avoid using hands when serving food. Serve using a clean long dry spoon to serve foods. ▪ During fermentation of milk, pour out the whey instead of using dujun/ straw to avoid contamination. ▪ Vegetables should be dried on a raised surface and covered to avoid dust. ▪ Dried vegetables should be handled using clean and dry spoons. ▪ Heat preserved foods before serving. ▪ Boil milk before use. ▪ Ensure meat is inspected after slaughtering.	▪ Food that is stored before cooling will have moisture and will spoil quickly. ▪ Cutting meat into thin strips will enable to dry well thus reducing spoilage. ▪ Boiling milk destroys any germs present in the milk and makes it safe to drink. ▪ Using a clean and dry spoon to serve preserved foods and avoiding use of hands will reduces chances of the food spoiling. ▪ Heating of food before eating will ensure its free of germs and will reduce chances of getting sick after eating. ▪ Inspection of meat after slaughter will ensure that it is safe to eat. ▪ Drying vegetables on a raised surface ensures that it will not get germs.
Child is not fed preserved meat	▪ Identify appropriate parts of meat that are culturally acceptable. ▪ Cook meat until it is well cooked and soft for the child to chew. ▪ For the preserved meats that are hard, boil to soften the meat for the child the modify. ▪ Modify the meat to enable to child to chew and swallow easily (i.e., grinding or cutting the meat into tiny pieces). ▪ Don't chew the food for the child. ▪ Give meat with other energy giving foods such as ugali, potatoes, rice, mandazi, pasta and	▪ Meat provides protein and iron that will increase blood in the body. ▪ Meat helps children to eat other foods alongside the meat. ▪ Animal source foods are especially good for children to help them grow strong and healthy. ▪ Use of already available preserved meat reduces on the need for the mother to look for other foods to feed the child.

	vegetables such as cabbage, kale, green leafy vegetables. ▪ Counsel on importance of preserved meat to improve food security.	
Child is given a piece of preserved fatty meat to suck on, rather than eat.	▪ Modify the preserved meat to enable to child to chew and swallow easily by mincing or pounding or grinding. ▪ Give the child the meat itself and not just a piece to suck on. ▪ Sucking on preserved meat gives the baby only energy from the oil but the child will not get protein from the meat itself.	▪ Giving the child the meat instead of pieces of meat to suck on as this will provide all the nutrients that can be gotten from the meat. Sucking or licking does not provide enough nutrients to help your child grow and develop well. ▪ Children can chew, swallow and digest meat because it has been modified according to their age. ▪ Meat is good for building the body of the baby.
Children are not given preserved foods because they have not reached a certain age and / or do not have teeth or it will choke them	▪ Introduce preserved foods (Mandazi and meat) that are available. ▪ Do not introduce fermented milk but continue breastfeeding on demand. ▪ Modify the meat by mincing, pounding or grinding. ▪ Soften the mandazi as you give alongside other foods like beat stew, bean stew, lentil stew. ▪ Do not chew food for the baby.	▪ After the age of six months, children can eat and swallow any food if it is properly modified. ▪ Mandazi that has been softened and meat that has been modified will not choke the child. ▪ Use of already available preserved meat and mandazi reduces on the need for the mother to look for other foods to feed the child.
Child fed meat that is not dried properly	▪ Dry only lean meat. ▪ Make strips thin. Thick strips take more time to dry than thin ones. It is important that strips be placed in the same batch and are of the same cross-section, with only the length differing. ▪ Dry the strips of meat. ▪ Length strips may differ, though they should not be less than 20 cm and not more than 70 cm.	▪ Drying meat properly reduces chances of your child getting illnesses. ▪ Meat that is properly dried keeps for longer.
Inadequate intake of vegetables due to unavailability	▪ Counsel mothers on how to preserve vegetables. ▪ Ensure hygiene in preparation. ▪ Store the dried vegetables in clean containers away from direct sunlight.	▪ Vegetables are rich in vitamins and minerals such as iron. ▪ Vegetables aid in digestion. ▪ Most vegetables are locally available and affordable when in season or available on market days. ▪ Preserving vegetables will ensure the child eats them daily.
Child is not fed any preserved fruits and vegetables, or mother is not aware of this practice	▪ Counsel mothers on preservation of vegetables/ fruits during the wet season (Refer to guide on food preservation) ▪ Ensure hygiene in preparation. ▪ Store the dried vegetables/fruits in clean containers away from direct sunlight.	▪ Vegetables are rich in vitamins and minerals such as iron. ▪ Vegetables aid in digestion. ▪ Most vegetables are locally available and affordable when in season.

Mother is softening mandazi with tea and feeding to the baby	▪ Avoid softening mandazi using tea. ▪ Soften the mandazi by putting in other hot foods such as meat stew, lentil stew or bean stew or any other stew available.	▪ Tea has little health benefits for the child. ▪ When mandazi that has been softened with tea is eaten with other foods, it can prevent absorption of iron in legumes (beans, lentils) and meat.

Age Group: Twelve to 23 Months

Ideal feeding practices:

- Continue frequent breastfeeding on demand, day and night.
- Feed child family foods (with an adequate texture for age, avoiding foods that are too dry or hard to swallow).
- Frequency of feedings per day: Feed at least three meals per day for the breastfed child and include two snacks; the non-breastfed child should receive one to two cups of milk and one or two extra meals per day in addition to the three meals and two snacks per day.
- Feed child a variety of energy and nutrient-dense foods, sources of vitamin A, and foods prepared with healthy oils, such as vegetable oils.
- The food should contain at least four of the seven food groups: 1) cereals, roots, tubers, and plantains 2) legumes, nuts, and seeds; 3) dairy (milk, yogurt); 4) flesh foods (meat, fish, poultry, liver/organ meats; 5) eggs; 6) vegetables and fruits rich in vitamin A (yellow, orange, or green); and 7) other vegetables and fruits.
- Feed child meat, poultry, fish, or eggs daily. During times when these foods are not available, feed the child beans, peas, or lentils.
- When there is plenty of meat and milk, preserve and use to feed the child when they are unavailable.
- Serve child about one cup of food per meal.
- Practice responsive feeding. Feed child directly Encourage child to eat. Feed patiently.

TWELVE TO 23 MONTHS		
Feeding challenges identified	**Recommendation**	**Motivation**
Child is given broth/soup from cooked meat instead of the actual meat because the child does not have teeth.	▪ Give the child the meat itself and not just the broth/soup. ▪ Modify the meat to enable to child to chew and swallow easily by mincing or cutting into small pieces or pounding.	▪ Giving the child the meat instead of broth/soup provides him/her with all the nutrients that can be gotten from the food. Broth/soup does not provide enough nutrients to help your child grow and develop well. ▪ Children can chew, swallow and digest meat because it has been modified according to their age ▪ Meat is good for building the body of the baby.
Child is given a piece of preserved fatty meat to suck on, rather than eat.	▪ Modify the meat to enable to child to chew and swallow easily by mincing or cutting into small pieces or pounding. ▪ Give the child the meat itself and not just a piece to suck on.	▪ Giving the child the meat instead of pieces of meat to suck on as this will provide all the nutrients that can be gotten from the meat. Sucking or licking does not provide enough nutrients to help your child grow and develop well. ▪ Children can chew, swallow and digest meat because it has been modified according to their age. ▪ Meat is good for building the body of the baby.

Child's porridge is thin/watery. The porridge falls off the spoon	▪ Make thick porridge, out of maize flour (or any other flour available to the mother) for the child. ▪ Porridge should be 'eaten' and not 'drank'. ▪ The porridge should be thick such that it does not fall off the spoon or the cup.	▪ Thick porridge is dense enough to provide required energy for the child's healthy growth and development. ▪ Thick porridge keeps the child satisfied for a prolonged period of time, thus reduces frequent hunger and feeding.
Child eating unhealthy snacks	▪ Stop giving unhealthy processed products" such as soda, processed juice, sweets, biscuits. ▪ Give healthier snacks, such as fruits (whole bananas, mangoes, oranges), porridge.	▪ Unhealthy snacks only add fats and sugars, and no other nutrients. ▪ These unhealthy snacks will not help your child to grow well and do not contribute to good health. ▪ Healthy snacks are more nutritious. ▪ Fruits improve the appetite of the child. ▪ Unhealthy snacks are more expensive.
Child not eating meat (including beef, camel, goat, sheep, cow, chicken)	▪ Introduce animal source foods including, chicken, beef, sheep, cow, goat, camel (based on the meat available). ▪ Include small pieces of organ meats (liver, kidney) in the child's diet. ▪ Modify the meat by grinding, mincing and cutting the meat into tiny pieces to enable the child to chew and swallow easily. ▪ Cook meat until it is well cooked and soft for the child to chew. ▪ Give meat with other energy giving foods such as (ugali, potatoes, rice, mandazi, pasta) and vegetables such as (cabbage, kale, green leafy vegetables).	▪ Meat provides protein and iron that will increase blood in the body. ▪ Meat helps encourage children to eat other foods such as energy giving foods and vegetables alongside the meat. ▪ Meat has protein, which is are especially good for children to help them to grow strong and healthy. ▪ Though chicken are birds (some members of the community believe that birds should not be eaten) chicken and the eggs of chicken are also a good source of meat and protein and can help children grow strong and healthy. Eating chicken does not stop your prayers.
Child is eating less than required quantities of food per day	▪ Increase the amount of food gradually to a full cup for each meal. ▪ Use a separate plate to make sure the child eats all the food that has been given to the child.	▪ Enough food protects your child from many illnesses. ▪ Your child will be happier, satisfied, and not hungry, and you can do your housework with less interruption.
Child is fed fewer than three times	▪ Increase the meals to three meals with two snacks per day.	▪ Your child needs to eat more now to grow healthy, taller, play well, and be active and learn in school. ▪ Your child will grow well and be healthy.

and two snacks per day.	▪ Breastfeed the child on demand both day and night. ▪ Feed the child in their own bowl to ensure the child eats all the food given. ▪ Breastfeed between meals and at night. ▪ Include at least one food from each food group.	
Child is given tea as a snack in between meals or as a meal.	▪ Avoid giving tea (with or without milk) to the child at any time. ▪ Replace tea with another healthier snack like porridge.	▪ Tea has little health benefits for the child, and it can prevent absorption of iron in legumes (beans, lentils) and meat. ▪ Breastmilk continues to be the most important part of your child's diet and it provides half of a child's nutritional needs.
Child's diet does not include enough fruits	▪ Increase the amount and variety of fruits given to the child per day. ▪ Mash the fruit to enable the child to eat comfortably. ▪ If the child does not like the fruit (such as lemon), you can disguise it by adding it to other foods. ▪ Use available fruits/fruits in season. ▪ Give a variety of fruits depending on availability.	▪ Fruits are rich in vitamins and minerals to help the child grow well and to keep the child healthy. ▪ Fruits aid in digestion of foods and contain vitamins which protect against illness. ▪ Fruits can be eaten alone (as a snack) or with other foods (within a meal) to help the child stay full.
Child's diet not inclusive of enough vegetables	▪ Increase the number of vegetables given to the child per day – this should comprise one-fourth of the child's food. ▪ Mash/ the vegetables to enable the child to eat comfortably. ▪ Give vegetables with other foods, such as rice, pasta, potatoes. ▪ Vegetables should not be overcooked. Cook for a short time to ensure nutrients are not lost. ▪ If the child does not like vegetables, you can disguise it by cooking with other foods.	▪ Vegetables are rich in vitamins and minerals. ▪ Vegetables aid in digestion.
Child not eating eggs	▪ Introduce eggs into the child's diet. ▪ The child should eat both egg yolk and egg white.	▪ Eggs are a good source of protein. ▪ Eating egg does not stop prayers. ▪ For those who keep chicken, eggs are readily available.

	▪ Vary cooking methods – boil, fry, scramble. ▪ Cook eggs in /with other foods e.g., add eggs when making anjera.	
Mother prefers to give only food that the child likes.	▪ Give variety of foods. ▪ Introduce one type of food at a time. ▪ When feeding, present the food in an attractive way. ▪ Hide the un-liked healthy foods in the preferred food. ▪ Be creative while cooking and make the food delicious. ▪ Use different methods when cooking various foods such as boiling, frying, stewing.	▪ Avoids wastage of foods. ▪ If the food is delicious/tasty, the child eats easily and saves on time and wastage. ▪ Giving a variety of foods ensures the child gets all the required nutrients for his/her age.
Mother is chewing food (e.g., meat, mandazi) for the child	▪ Do not chew food for the child. ▪ Modify the food to enable to child to chew and swallow easily (i.e., grinding or cutting the meat into tiny pieces).	▪ Giving the child the food to eat directly, will ensure they get all the nutrients form the food they eat. ▪ Chewing food for the baby is not clean may lead to transfer of illness from the mother to the baby.
Child is given piece of fatty meat to suck on / lick (kurkude)	▪ Give the actual meat instead to the child instead of the fatty piece. ▪ Modify the food by grinding or cutting the meat into tiny pieces to enable to child to chew and swallow easily.	▪ Giving the child actual meat will ensure they get all the nutrients from the meat. ▪ The fatty meat may give the child diarrhea.
Children are not allowed to eat organ meats- offals (kidney, intestines, tongue, liver)	▪ Give children offal meat. ▪ Modify the offal by mincing, pounding or grinding to enable to child to chew and swallow easily.	▪ The child will not talk too much because of eating tongue. ▪ Organ meats or offals are rich in protein and other nutrients that help the baby to grow.
Mother is not following hygienic practices	▪ Wash the udder of the animal before milking using warm water. ▪ Wash storage containers and utensils with soap and clean water and leave to dry. ▪ Hand washing (for both the mother and the child) before feeding.	▪ Proper hygiene reduces the chances of your child getting sick. ▪ Proper hygiene reduces transfer of diseases and illnesses to you and your child.
Mother is not storing food or preserving food in a safe way (i.e., food safety)	▪ Leave the food to cool before transferring to the storage container. ▪ Store food away from dust and other forms of contamination.	▪ Food that is stored before cooling will have moisture and will spoil quickly. ▪ Cutting meat into thin strips will enable to dry well thus reducing spoilage. ▪ Boiling milk destroys any germs present in the milk and makes it safe to drink.

	▪ Dry meat until very dry by cutting into thin strips and hanging to dry. ▪ Lock / keep away the storage containers to avoid contamination by children. ▪ Avoid using hands when serving food. Serve using a clean long dry spoon to serve foods. ▪ During fermentation of milk, pour out the whey instead of using dujun/ straw to avoid contamination. ▪ Vegetables should be dried on a raised surface and covered to avoid dust. ▪ Dried vegetables should be handled using clean and dry spoons. ▪ Heat preserved foods before serving. ▪ Boil milk before use. ▪ Ensure meat is inspected after slaughtering.	▪ Using a clean and dry spoon to serve preserved foods and avoiding use of hands will reduces chances of the food spoiling. ▪ Heating of food before eating will ensure its free of germs and will reduce chances of getting sick after eating. ▪ Inspection of meat after slaughter will ensure that it is safe to eat. ▪ Drying vegetables on a raised surface ensures that it will not get germs.
Child is not fed preserved meat	▪ Identify appropriate parts of meat that are culturally acceptable. ▪ Cook meat until it is well cooked and soft for the child to chew. ▪ For the preserved meats that are hard, boil to soften the meat for the child the modify. ▪ Modify the meat to enable to child to chew and swallow easily (i.e., grinding or cutting the meat into tiny pieces) ▪ Don't chew the food for the child ▪ Give meat with other energy giving foods such as (ugali, potatoes, rice, mandazi, pasta) and vegetables such as (cabbage, kale, green leafy vegetables). ▪ Counsel on importance of preserved meat to improve food security.	▪ Meat provides protein and iron that will increase blood in the body. ▪ Meat helps children to eat other foods alongside the meat. ▪ Animal source foods are especially good for children to help them grow strong and healthy. ▪ Use of already available preserved meat reduces on the need for the mother to look for other foods to feed the child.

Child is given a piece of preserved fatty meat to suck on, rather than eat.	▪ Modify the preserved meat to enable to child to chew and swallow easily by mincing or pounding or grinding. ▪ Give the child the meat itself and not just a piece to suck on. ▪ Sucking on preserved meat gives the baby only energy from the oil but the child will not get protein from the meat itself.	▪ Giving the child the meat instead of pieces of meat to suck on as this will provide all the nutrients that can be gotten from the meat. Sucking or licking does not provide enough nutrients to help your child grow and develop well. ▪ Children can chew, swallow and digest meat because it has been modified according to their age. ▪ Meat is good for building the body of the baby.
Delay in giving of preserved foods to children because they have not reached a certain age and / or do not have teeth or it will choke them	▪ Give preserved foods (Mandazi, meat, milk) that are available. ▪ Modify the meat by mincing, pounding or grinding. ▪ Soften the mandazi as you give alongside other foods like beat stew, bean stew, lentil stew. ▪ Do not chew food for the baby. ▪ Give fermented milk with other foods such as rice, potatoes, ugali, mandazi and fruits such as ripe bananas to make it less sour.	▪ Children can eat and swallow any food if it is properly modified. ▪ Mandazi that has been softened and meat that has been modified will not choke the child. ▪ Use of already available preserved meat, milk and mandazi reduces on the need for the mother to look for other foods to feed the child.
Child fed meat that is not dried properly	▪ Dry only lean meat ▪ Make strips thin. Thick strips take more time to dry than thin ones. It is important that strips be placed in the same batch are of the same cross-section, with only the length differing. ▪ Dry the strips of meat. ▪ Length strips may differ, though it should not be less than 20cm and not more than 70cm.	▪ Drying meat properly reduces chances of your child getting illnesses. ▪ Meat that is properly dried keeps for longer.
Inadequate intake of vegetables due to unavailability	▪ Counsel mothers on how to preserve vegetables. ▪ Ensure hygiene in preparation. ▪ Store the dried vegetables in clean containers away from direct sunlight.	▪ Vegetables are rich in vitamins and minerals such as iron. ▪ Vegetables aid in digestion. ▪ Most vegetables are locally available and affordable when in season or available on market days. ▪ Preserving vegetables will ensure the child eats them daily.
Child is not fed any preserved fruits and vegetables, or	▪ Counsel mothers on preservation of vegetables/ fruits during the wet season	▪ Vegetables are rich in vitamins and minerals such as iron. ▪ Vegetables aid in digestion. ▪ Most vegetables are locally available and affordable when in season.

mother is not aware of this practice	(where do they find this information)? ▪ Ensure hygiene in preparation. ▪ Store the dried vegetables/fruits in clean containers away from direct sunlight.	
Child is not fed fermented milk (*ititu)*	▪ Counsel mother on importance of giving fermented milk. ▪ Boil milk before fermentation. ▪ Give the fermented milk with other foods such as potatoes, rice. ▪ Store milk in clean containers.	▪ Milk helps a child to have strong bones and teeth. ▪ Fermented milk is easily digested. ▪ Animal milk provides high-quality protein, potassium and calcium, as well as vitamin B12 and other micronutrients.
Sugar is added to fermented milk to make it sweet for the baby to drink and reduce the sourness	▪ Avoid adding sugar to the fermented milk before giving to the baby. ▪ Give fermented milk with other foods such as rice, potatoes, ugali, mandazi and fruits such as ripe bananas to make it less sour.	▪ Sugar provides only energy to the baby without providing any other nutrients. ▪ Giving fermented milk with other foods will makes the baby more satisfied. ▪ Fruits improve the appetite of the child.
Raw milk is fed (camel, goat, cow)	▪ Boil milk before feeding the child.	▪ A child fed boiled milk so he/she cannot get any illnesses/diseases from the milk. ▪ Boiling milk does not kill the nutrients in it.
Mother is softening mandazi with tea and feeding to the baby	▪ Avoid softening mandazi using tea. ▪ Soften the mandazi by putting in other hot foods such as meat stew, lentil stew or bean stew or any other stew available.	▪ Tea has little health benefits for the child. ▪ When mandazi that has been softened with tea is eaten with other foods, it can prevent absorption of iron in legumes (beans, lentils) and meat.