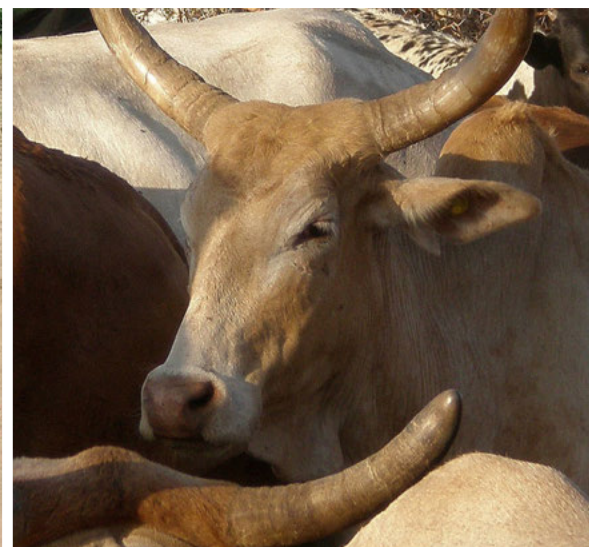# FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative

Karamoja Resilience Support Unit (KRSU)

HIDDEN PEAKS
WOMEN'S KNOWLEDGE ON THE SEASONALITY AND ROOT CAUSES OF CHILD MALNUTRITION IN KARAMOJA, UGANDA AND THEIR PROGRAMMING PREFERENCES

November 2018

KARAMOJA RESILIENCE SUPPORT UNIT (KRSU)
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ACRONYMS AND ABBREVIATIONS

FGD	Focus group discussion
FSNA	Food security and nutrition assessment
GAM	Global acute malnutrition
KRSU	Karamoja Resilience Support Unit
NGO	Non-governmental organization
PE	Participatory epidemiology
TLU	Tropical Livestock Unit
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development

SUMMARY

This report describes a participatory analysis of malnutrition in children and mothers in Karamoja, focusing on the seasonality of livelihoods and food availability, and on causes of malnutrition. A key aspect of the analysis was to assess whether the methods and approaches of participatory epidemiology (PE) could be adapted to provide useful information on malnutrition. The work was conducted with a total of 42 groups of women in agro-pastoralist and pastoralist areas of Karamoja and involved an initial ethnographic stage based on 22 focus group discussions (FGDs), followed by the use of monthly calendars and participatory causal analysis with 18 groups. Findings were triangulated against secondary data and literature.

KEY FINDINGS

- Child malnutrition in agro-pastoralist and pastoralist areas of Karamoja peaks in January and February, at the end of the dry season. In pastoralist areas, the peak falls rapidly to lower levels of malnutrition by May. In agro-pastoralist areas, the peak in malnutrition declines more slowly to low levels in July. This pattern of malnutrition is consistent with other dryland areas of East Africa. It is associated with livelihoods that are livestock-based and milk production that depends on access to pasture and water. In agro-pastoralist areas of Karamoja, the longer malnutrition period is related to a greater dependency on crop production, but in a context of high rainfall variability and uncertain crop yields.

- Current food security and nutrition assessment (FSNA) surveys are conducted in May/June and November/December. They measure the point prevalence of global acute malnutrition (GAM) at these times. The retiming of these surveys to January/February and October/November would capture the full variation in GAM each year. PE methods such as monthly calendars would be useful for complementing quantitative surveys since they show monthly variations in malnutrition and related indicators over a full 12-month period.

- The agro-pastoralist and pastoralist systems in Karamoja are driven by rainfall and depend on sufficient levels of livestock ownership to provide milk and animals to sell for grain. Human births show marked seasonality that coincides with rainfall and cow milk availability. Over decades, insufficient livestock numbers have led to low milk production and consumption, less preservation of milk and meat as dry season foods and fewer animals available to exchange or sell for grain.

- Women provide highly plausible accounts of the causes of malnutrition. They explain malnutrition mainly from the perspective of two root causes—the limited availability of livestock and milk, and social norms that make them overburdened with the work of childcare and finding food for the family. These two root causes are interlinked and cascade down into various other issues and problems. Notably, limited livestock ownership has a direct impact on food availability because milk supply is insufficient and also forces households towards more non-livestock sources of food and income, which traditionally are the domain of women. These non-livestock activities include crop production, on small plots and with high risk of rain failure, and a range of other activities that often involve considerable effort for limited reward—and which often hinder childcare. When women are working, unweaned children can remain at home under the care of siblings or other relatives, but with limited or no milk available to feed these children. Further problems stem from the livestock-gender root causes, such as loss of cattle affecting men's self-identity and sense of purpose, men spending more time in villages than in the past and more consumption of local brew and hard liquor.[1] In turn, this leads to even more violence towards wives and a continued non-spacing of pregnancies. For women, increasing workloads, the stress associated with finding food and income, and the risk of violence from husbands also leads to alcohol abuse.

- The root cause of malnutrition of low livestock ownership is consistent with a recent analysis of livestock poverty in Karamoja,[2] which concluded that 56.5% of agro-pastoralist and pastoralist households were "livestock poor" and that such household faced poverty traps. When viewed

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[1] Iyer et al., 2018.

[2] Catley and Ayele, 2018.

against the causes of malnutrition described by women and their weighting of the causes, the concept of "malnutrition traps" arises, whereby households are constantly struggling to meet their food needs and manage seasonal variations in the availability and affordability of different food types; this burden falls largely on women.

- The results of the analysis show a need for a nutrition strategy for Karamoja that takes account of the seasonality of livelihoods and food systems, recognizes low livestock ownership and gender norms as root causes of malnutrition and views the interplay of these two root causes as contributing to a range of other production and household stresses and behaviors.

- Women propose logical solutions for addressing malnutrition and need to be more actively involved in analyzing malnutrition and contributing to program design. Their preferred programming to improve nutrition involved food relief during difficult times, restocking with livestock, income-generation activities that enabled childcare, better education and health, and activities to reduce alcohol consumption. Further participatory work is needed to assess how gender-based violence and more general negative behaviors against women can be addressed by more targeting of men.

I. INTRODUCTION

1.1 CHILD MALNUTRITION IN PASTORALIST AREAS AND KARAMOJA

Pastoralist and agro-pastoralist areas of East Africa and the Horn of Africa have been characterized by high levels of child malnutrition for 30 years or more. Typically, these areas were associated with high levels of acute malnutrition relative to agrarian (or national) populations, which in turn was explained largely by marked seasonality in the diet, a high reliance on animal milk and the impacts of drought in pastoralist areas. In contrast, agrarian populations often had higher levels of stunting (chronic malnutrition) relative to pastoralist areas. However, there is now not only a persistence of acute malnutrition[3] but also rising levels of stunting in some pastoralist areas. At the same time, these areas have experienced human population growth, declining access to rangeland, varying levels of livestock commercialization and conflict, and chronic under-provision of basic services. Important livelihoods outcomes have included increasing socio-economic differentiation and more skewed ownership of livestock towards wealthier herders and "absentee owners." An increasing number of poorer households might own a few animals and rely heavily on non-livestock activities such as wage labor, charcoal and firewood sales and in some countries, receiving regular transfers of food or cash from social protection programs. A greater reliance on crop production is also seen, but often in areas with highly variable rainfall and therefore high risks of crop failure.

To varying degrees, these general trends in dryland areas are evident in Karamoja. The 2011 Uganda Demographic and Health Survey (DHS) reported that 45% of children were stunted in the sub-region and the Food for Peace 2013 baseline survey reported 35% stunting. According to the 2016 Uganda DHS, 35.2% of children in Karamoja were stunted compared to a national average of 28.9%; 10% of children in Karamoja were wasted compared to a national average of 3.6%.[4] In common with many other countries, high levels of acute malnutrition have persisted in specific pastoralist areas despite large-scale development programs and in some cases, improvements in human development indicators nationally. In Karamoja, the most recent food security and nutrition surveillance report

included a review of global acute malnutrition (GAM) prevalence estimates and noted that *"the trend in prevalence of global acute malnutrition among children between 2010 and 2017 during the June and December assessments shows a gradual increase with the prevalence of malnutrition during the June round of assessments having increased from 11.5% in 2010 to 13.8% in 2017 whilst in December it increased from 9.8% to 10.4%."*[5] Simultaneously, there are numerous nutrition programs in Karamoja and a substantial aid investment in nutrition. For example, in 2016 there were 24 nutrition projects or programs in Karamoja implemented by 17 organizations.[6]

Concerns about malnutrition and health in Karamoja are not new. For example:

- In 1980, famine in Karamoja was attributed to multiple causes—drought, livestock disease, cattle raiding, looting, and disruption of markets and transportation.[7]

- From the mid-1990s, a long-running research program on human adaptability in Karamoja included specific studies on child and maternal health, child growth and breastfeeding, and dietary change.[8] It provided a highly plausible explanation for the persistence of child malnutrition, viz., a decline in agro-pastoralist production and falling herd sizes due to raids, diseases and disarmament; the multiple responsibilities of women as child carers, meal providers and income generators; and the weak provision of health services. Examining diets in 2004 (two years before the most recent disarmament program of 2006 to 2011), milk accounted for only 3.2% to 4.2% of energy intake in Moroto and Napak over a period of 4.5 months (August to mid-December 2004). This was compared to 10 other African pastoralist groups before 1995, in which no group consumed less than 16% milk intake.

- In 2011, further decline in diets was linked to limited availability of milk and *"serious changes to*

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[3] For example, see the recent analysis of persistent GAM for USAID by Young and Marshak, 2018a.

[4] Uganda Bureau of Statistics and ICF International Inc., 2017.

[5] Government of Uganda, UNICEF, UK aid and World Food Programme, 2018.

[6] Karamoja Resilience Support Unit, 2016.

[7] Biellik and Henderson, 1981.

[8] Gray, 2010; Gray et al., 2008; Gray and Sundal, 2017.

diets and subsequent nutritional status among the populations of Karamoja have been noted since the 1970s. These changes have been shaped not only by environmental pressures, but by politics of marginalization and structural inequality, a history of cattle raiding, an influx of weapons, and more recently escalating insecurity and military presence."[9]

Consistently, the social science literature on Karamoja has explained malnutrition by reference to pressures on agro-pastoralism and the importance of animal milk in the diet. In general terms, factors that cause a decline in livestock ownership and access to milk have direct impacts on the nutrition of mothers and children. Up to 2006 and the start of disarmament, these factors included violent cattle raiding, livestock disease and drought. During the disarmament of 2006 and 2011, further dramatic livestock losses were associated with disease outbreaks in forced kraals. Since 2011, security has improved, but livestock losses due to disease remain high and livestock ownership is reported to be more skewed towards wealthier households. Across these three periods of time, primary human health care systems have remained weak.

Looking more broadly at the causes of persistent GAM across different areas and countries, a recent review for the USAID Center for Resilience noted the limitations of the United Nations Children's Fund (UNICEF) nutrition conceptual framework as a basis for understanding the causes of persistent GAM and specifically the insufficient attention to seasonality, livelihoods and gender in the framework[10] (Box 1). Such limitations are important because the UNICEF framework is widely used by nutritionists as the reference point for assessing the causes of malnutrition.

1.2 SEASONALITY

It is widely recognized that agriculture systems often show marked seasonality, with distinct periods of land preparation, planting, weeding, harvesting and other activities, driven mainly by rainfall patterns. Typically, food insecurity in agricultural areas of low-income countries peaks before the main harvest, due to multiple reasons:

Most of the very poor people in the world live in tropical areas with marked wet and dry seasons. Especially for the poorer people, women and children, the wet season before the harvest is usually the most critical time of year. At that time of year, adverse factors often interact and overlap: food is short and food prices are high; physical energy is needed for agricultural work; sickness is prevalent, especially malaria, diarrhea and skin infections; child care, family hygiene and cooking are neglected by women overburdened with work; and late pregnancy is common with births peaking near harvest. This is

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Box 1. Cross-cutting themes lacking in the UNICEF framework[11]
Seasonality: The prevalence of GAM varies seasonally and is often worst during the rainy season (due to increased transmission of waterborne disease) or prior to harvest (due to hunger). However, seasonal changes present different challenges at different times to different livelihoods groups. Seasonality may also have a more pronounced effect in populations already burdened by chronically high levels of malnutrition. Understanding seasonal trends and patterns is important for understanding persistent GAM.

Livelihoods: Household capacities, access to resources and vulnerabilities influence livelihood strategies and the activities of women and men, which in turn impact all underlying causes of malnutrition. Livelihood goals also influence household decision-making regarding resource allocation. A study in rural Niger revealed the mismatch of views between external interventions, which focus on saving individual children's lives, and local priorities aimed at spreading risk and the preservation of long-term livelihoods. A nuanced and evolving understanding of livelihoods is essential in understanding persistent GAM in the context of complex and protracted emergencies.

Gender: Gender cuts across all three clusters of underlying causes of malnutrition related to food, health and care, and cuts across scales of analysis, from household level to basic causes. While many reports emphasize household-level drivers such as caring practices as drivers of malnutrition and hence conclude GAM is a result of cultural practices, this ignores wider issues linked with discrimination, access to resources, employment opportunities and inequalities in ownership. It is often misleading to identify a lack of care as a driver of malnutrition in a protracted crisis without first looking at the determinants of those behaviors.

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[9] Stites and Mitchard, 2011.

[10] Young and Marshak, 2018a.

[11] Young and Marshak, 2018b.

the time of year marked by loss of bodyweight, low birth weights, high neonatal mortality, malnutrition and indebtedness. It is the hungry season and the sick season.[12]

Unfortunately, although the above description of seasonality, food insecurity and malnutrition is highly relevant to crop-based livelihoods, seasonality in many pastoralist areas of Africa is different—pastoralists often describe the main rainy season not as a time of stress but as a time of plenty. This is when livestock produce the most milk, and milk is associated with good nutrition and health. In contrast to agrarian areas, pastoralists describe livelihoods and nutritional stress towards the end of long dry seasons. This is the time of year when livestock milk supply is declining, herders are forced to sell animals in exchange for cereals and livestock are moved long distances from home settlements to find grazing and water. Also, at this time livestock prices tend to be low (because animals are in poor condition) and cereals prices are high (due to limited availability and high demand).[13] This seasonality of pastoralist livelihoods explains why acute child malnutrition can peak in dry seasons and fall in wet seasons.

In Karamoja, seasonality is recognized as an important aspect of food security and malnutrition, but the actual seasonal variations in malnutrition and contributing factors seem not to have been described.[14] In part, this is probably because there are major operational, methodological and funding challenges to using conventional anthropometric surveys to measure malnutrition each month. The biannual FSNA surveys in Karamoja since 2009 are conducted in May/June and November/December and provide point prevalence measures of child malnutrition. If this timing of the surveys is intended to capture seasonal variation, it seems to be tailored towards crop-based livelihoods, i.e., May/June would represent mid-wet season, pre-harvest, and so the early hunger period for agrarian households, whereas November/December would be post-harvest and dry, and a time of high cereal availability. However, although GAM prevalence has been consistently higher in May/June compared to November/December, GAM is still alarmingly high later in the year (see section 1.1). Furthermore, as these surveys do not cover other months, there is a possibility that malnutrition peaks during one or

more of these other months but that this peak (or peaks) remains undetected. Such a peak (or peaks) would probably have different underlying causes relative to a peak in a typical "agrarian hunger gap" and so would have policy and programming implications for Karamoja.

The importance of revisiting seasonality was highlighted recently in a study on malnutrition in Darfur, Sudan.[15] In Darfur, light rains begin in May/June, followed by the main rains from July to September/October; it was previously assumed that acute malnutrition peaked during the rains, but:

> *The study confirms the extreme seasonality of nutritional status and malnutrition in the Darfur context, but challenges current assumptions that the peak in acute malnutrition occurs during the lean season or hunger gap [August/September] … In contrast this study has identified two peaks of acute malnutrition in May and again a somewhat lower peak in August.*

1.3 PARTICIPATORY EPIDEMIOLOGY

In the 1990s, veterinarians in East Africa started to adapt participatory approaches and methods to investigate livestock diseases, especially in remote and conflict-affected pastoralist areas. An important aspect of the approach was a recognition that pastoralists often possessed strong knowledge on livestock production and diseases, including the clinical signs and epidemiology of diseases. Over time, this use of participatory methods became known as "participatory epidemiology" (PE) and was widely used by researchers, practitioners, Government epidemiology units and international agencies such as the World Organization for Animal Health and the Food and Agriculture Organization.[16] One adaptation included the standardization and repetition of PE methods that produced ranks, scores or proportions, thereby creating datasets that could be analyzed statistically. This approach led to estimates of disease incidence and mortality, analysis of seasonality and causation,[17] and an understanding of complex syndromes involving multiple infections.[18] A measure of the uptake of PE by veterinary researchers is that PE is now often reported as a method in peer-reviewed papers and postgraduate dissertations.[19]

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[12] Chambers et al., 1981.

[13] Sadler et al., 2009.

[14] For example, see the nutritional causal analysis for Moroto District in 2017 (Boucher-Castel, 2017).

[15] Young and Marshak, 2018c.

[16] Allepuz et al., 2017.

[17] Catley et al., 2012.

[18] Catley et al., 2001.

[19] Allepuz et al., 2017.

In common with many other sectors and disciplines, the use of participatory approaches and methods by veterinarians has been characterized by diverse interpretations of "participation." For some, participation meant a move towards partnerships with communities, joint analysis of problems and, on the part of professionals, an understanding that livestock keepers can make important intellectual contributions to learning and problem solving. This way of working was broadly in line with the early concepts of community participation and the emergence of participatory rural appraisal.[20] However, other uses of PE have followed far more conventional research and often non-participatory approaches. For example, the use of questionnaires to collect information has rarely been a participatory process and concerns about the limited value of questionnaires were an important driver of alternative methods. Similarly, workshops or other activities involving professional experts have been called "participatory" even when there was limited or no involvement of community members.

In contrast to veterinary research and national livestock disease surveillance systems, the use of participatory approaches and methods in the human health and nutrition sectors has been limited in pastoralist areas. Rare examples include a participatory assessment of women's health in southern Ethiopia[21] and studies on malnutrition in the Somali Region of Ethiopia[22] and in Karamoja.[23]

1.4 EXPLORING MALNUTRITION IN KARAMOJA USING PARTICIPATORY EPIDEMIOLOGY

This report describes an analysis of the seasonality of acute child malnutrition in Karamoja and how women describe and prioritize the causes of malnutrition. The analysis was exploratory in the sense that we developed and tested PE methods. We wanted to assess if these methods could provide useful information on malnutrition. The issues and questions covered in the analysis were as follows:

1. How do women explain malnutrition in children by reference to the diets of healthy and malnourished children? What are the differences in the diets of healthy vs. malnourished children in terms of specific food types and the seasonal availability of food types?

2. The seasonality of malnutrition and related factors.

3. How do women describe and prioritize the causes of malnutrition in children and mothers?

4. What are women's suggestions and priorities for improving malnutrition and what is the reasoning behind their views?

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[20] Chambers, 1994.

[21] Tezera and Desta, 2008.

[22] Sadler and Catley, 2009.

[23] Stites and Mitchard, 2011.

2. DESIGN AND METHODS

The design of the analysis was based on two main stages:

- An initial ethnographic approach to understand the language used by women to describe: seasons and months; malnutrition in children and adults; different types of health, sickness and wellbeing; and women's views on diets and the causes of malnutrition in children and mothers.

- Drawing on the ethnographic work and secondary literature, standardization of PE methods and repetition of methods with groups of women informants.

2.1 LANGUAGE, CONVERSATIONS AND PERSPECTIVES

The first stage of the analysis used an ethnographic approach to gain insights into women's general awareness and understanding of malnutrition and related issues, and how they described the causes of malnutrition in children and mothers. Central to the approach was understanding local language and the extent to which specific words or phrases were used in relation to malnutrition, and why. This produced useful information in its own right but also guided the design of PE methods (section 2.2) by ensuring that relevant and appropriate language was used with the methods and that some potential non-sampling errors were prevented.

This work was conducted in four districts, viz., Amudat (language: Pokot), and Moroto, Kaabong and Kotido (language: Ngakarimojong) in May and June 2018 and used 22 focus group discussions with between 5 to 8 women in each group. Further site details are provided in Annex 1.

2.2 PARTICIPATORY EPIDEMIOLOGY METHODS

Participatory epidemiology methods were used with groups of women in Kotido, Moroto and Amudat. We categorized Kotido and Moroto as agro-pastoralist (n = 16 groups) and Amudat as pastoralist (n = 8 groups). There were 8 to 12 women per group; the specific locations are listed in Annex 1. Locations were selected purposively and differed from the locations visited under section 2.1.

Based on the findings of the ethnographic stage, three specific PE methods were developed and tested as described below. The work was conducted by a team of facilitators comprising 5 women (2 fluent in Ngakarimojong and 3 fluent in Pokot) who had received orientation in the methods in a workshop in Moroto in June 2018. The women facilitators were supported by 2 male facilitators, both with more than 15 years of experience of using participatory methods in pastoralist areas of East Africa. The methods were used in July and August 2018.

2.2.1 Monthly variations in malnutrition and related indicators

A monthly calendar is a visualization method showing the pattern of selected "indicators" against months. Local names were used for the months (Annex 3). Information gathered during the ethnographic stage (section 2.1) indicated some variation in local names for months within and between locations in Kotido and Moroto (language: Ngakarimojong). However, the women agreed on the use of pictures or local symbols/objects, to represent each month. These pictures or local symbols/objects were drawn from work activities undertaken in each month, which women were very familiar with. Among Pokot women in Amudat, there was agreement within and between locations on the local names for the months (Annex 3) and the work activities that symbolized each month. Pokot women vividly recalled the local names for months using a song that had existed in the community for generations.

A detailed guide to the method is provided in Annex 2. Key features were:

- The calendar is constructed on the ground, using diagrams to represent months and other diagrams to represent the indicators. The use of diagrams means that illiterate informants can participate; no written materials are used.

- Rainfall was selected as the first indicator and informants were asked to show the pattern of rainfall against each month; local names were used for the months. The rainfall pattern was illustrated using 100 stones that were distributed across the months. The use of rainfall as the first indicator ensures that informants understand the method because the rainfall pattern can easily be cross-checked against actual rainfall data.

- During the placing of the stones, informants are asked to show the pattern of rain distribution rather than count the stones to be assigned to each month.

- The informants were asked to consider a "typical year."

- After the rainfall pattern is illustrated, informants are asked to explain the pattern; this further questioning ensures that the method has been understood.

- The method was used with groups of women; the "scoring" of rainfall by month is done based on discussion within the group.

- After rainfall had been scored, the stones were left in place and further indicators were scored, one by one, with discussion and further questions for each indicator. Nine further indicators were selected based on the ethnographic work and a literature review. This number of indicators was also considered to be appropriate in terms of the amount of time we felt that women should spend on the method. The full list of indicators was as follows:
  - Rainfall;
  - Availability of cow milk for children;
  - Availability of goat milk for children;
  - Availability of own sorghum (agro-pastoralist areas) or own maize (pastoralist areas);
  - Women's work in their own gardens;
  - Women's other work, especially work for income;
  - Occurrence of child malnutrition;
  - Occurrence of child malaria;
  - Occurrence of child diarrhea;
  - Occurrence of human births.

  To make the child malnutrition indicator age-specific, women were asked to focus on a 2-year-old child.

The final calendar showed the patterns of all 10 indicators, enabled further questions across indicators and showed the relationships between indicators (for example, see Plate 1). Although the calendar was a visualization method, the use of 100 counters per indicator enabled the results to be recorded numerically. A total score was calculated for each month and indicator, and for agro-pastoralist and pastoralist groups. The results also comprised responses to questions on the reasoning behind the scores and the relationships between indicators. Further analysis used the Kendal coefficient of concordance to assess the level of agreement between groups.

2.2.2 Milk availability and use of own-produced cereals

The interviews with women during the ethnographic stage of the analysis (section 2.1) indicated that the consumption of specific foods related to both the seasonal availability and the absolute availability. Although a preferred food might peak in availability at a particular time of year, this peak might still be insufficient relative to the amount of the food required. As this issue was often related to livestock ownership and milk supply, proportional piling was used to estimate the proportion of households with sufficient and insufficient access to cow milk and goat milk. The method was used at the same time as the monthly calendar, after women had scored the monthly variations in cow and goat milk availability.

Proportional piling was also used to assess use of own-produced cereals (sorghum in agro-pastoralist sites and maize in pastoralist sites) in terms of consumption, sales and other uses.

2.2.3 Participatory causal diagrams

The interviews with women during the ethnographic stage of the analysis (section 2.1) showed they explained malnutrition by reference to specific causes. In an attempt to capture this information more systematically, diagrams were used to represent each cause and a malnourished 2-year-old child. The diagrams of causes were placed on the ground in a circle around the diagram of the child in the center and women were asked to show the relative importance of each cause using a pile of 100 stones (i.e., proportional piling). This visualization and scoring of the causes enabled further questions and discussion on the relative importance of the causes and how different causes related to each other sequentially. The method was then repeated with a malnourished mother at the center of the diagram.

3. RESULTS

3.1 THE LANGUAGE OF MALNUTRITION AND HEALTH

Women in the four districts used language that categorized children according to gender, age, growth, size and health conditions. They also described different causes of malnutrition in children. They categorized mothers at the different stages of pregnancy, at birth and at different stages of lactation. They described pregnant mothers with different health conditions and different causes of malnutrition in the mothers. The findings are summarized in Tables 1 to 5.

Notably, even among the Karamoja groups in Moroto, Kaabong and Kotido that are known for speaking the same language, there were variations in language between areas. Some communities had more local terms for a particular item or issue relative to others. Typically, women could not differentiate between terms such as "malnourished" and "weak" but differentiated according to the different causes of malnutrition and weakness.

Table 1. Language for children and adults by age and gender

Description	Moroto District	Kaabong District	Kotido District	Amudat District
Girl (0–59 months)	*Akaeon*	*Ipethe, ngakipi, itokeng*	*Nyipethe, nyinaas* (nurse)	Newborn (0–2 weeks): *Nyarkil (titike)* 2 weeks–5 years: *Tengan*
Girl (5 years and above)	*Apese*	*Ipethe*	*Nyapethe*	5 years–11 years: *Chepto* 12–18 years: *Angirision* 19–25 years: *Ateran* 26–35 years: *Korka* 35 years and above: *Kokonyon*
Boy (0–59 months)	0–5 months: *Ikoku, nika ekisina, iperomoding* 6–9 months: *Ikoku ni ageiki ekimuje* 10 months–5 years: *Ikoku ngini imuji bon*	0–5 months: *Muzee, idia, ithapat, apakeng, ikoku ngini eroko enaki, nyingwee* 6–9 months: *Ikoku ngini imuji tanaki, aburianiki, aliya* 10 months–5 years: *Ikoku ni imuji bon, itagae, arotoki*	0–59 months: *Nyethapat, idokto* (doctor)	Newborn (0–2 weeks): *Nyarkil (kokwe)* 2 weeks– 5 years: *Tengan*
Boy (5 years and above)	*Isapat*	*Idia*	*Nyethapat*	5–11 years: *Chumum* 12–18 years: *Karachinin* 19–35 years: *Mron* 35 years and above: *Poy*

Table 2. Language for child size and growth

Description	Moroto District	Kaabong District	Kotido District	Amudat District
Child is growing well	*Ikoku ni elosi akwan ejok*	*Ikoku ngini etumit, ikoku ngini engale jik*	*Ikoku ngini ejok akwan, ngini ulap, ngini ulak*	*Moning nyo karamach kisen*
Retarded body growth but feeding well	*Ikoku nipe nyepoloe ejok kimuji ejok (tobong akwan kahu)*	*Ikoku ngini korod*	*Ikoku ngini egogong ngakoyo*	*Moning nyo nghach kisen*
Feeding well but slim (due to parent's genetics)	*Ediim akwan*	*Ekotor*	*Ikoku ngini diim, ngini kurab akwan*	*Mningporion*
Strong (due to parent's genetics)	*Ebutur*	*Etumit*	*Ikoku ngini angikup, Ikoku ngini anginerin*	*Lenyo por nyopo kame* (like mother); *Lenyo por nyopo paponyi* (like father)
Child with stunted growth	*Ikoku nithirij akwan* (before 5 years) *Ikabuut/iteenge* (after 5 years)	*Nyakibobwang, nyabuth angitunga, nyikaliwoliwot, ikoku niwuriyen, ikoku nibabwi, tukulung, ikoku nitekeny, ikoku niketer, eonit kiu*	*Ikoku ngini babui, ngini gonge, ngini kurab angakoyo, ngini itiitii, ngini euruana*	*Moning nyole konjirion (moning nyo moyetunye)*
Underweight child		*Ikoku ni edoun eroko ngirwa*	*Kutete, ikoku ni eridarit atokeng, ikoku ngini ilongulongunitae*	
Child born with physical deformities		*Emunaara*	*Engwalit*	

Table 3. Language for children with different health conditions and different causes of malnutrition

Description	Moroto District	Kaabong District	Kotido District	Amudat District
A healthy child from birth to 5 years	*Ikoku ni epolouni ka ngatameta keng ejoak, ikoku ni emam eter ngolo etapit, ikoku ni emam ngatiokisio na etapito*	*Ikoku ni eyerit, ikoku ni etumit*	*Ikoku ngini enaikinit, ikoku ngini etumit, ikoku ngini emam nyichanchani akwan*	*Moning nyo kinar portanyi nyo karam*
Unhealthy child—born healthy but becomes unhealthy later	*Ikoku ngini edeakana, ikoku ngini kichiongakin akwan alongaren, ikoku ni etukuruwo edeke ekimuje*	*Ikoku ngini ekara, ikoku ngini kadekan, ekara, ajaka edeke, aditawu ikoku*	*Ikoku ngini adekan, ikoku ngini kekaran, ikoku ngini epeaka ngaakot*	*Kachangul moning* Boy: *Kachangul weri* Girl: *Kachangul chepu* Before weaning: *Kachangul nyarkiliani* At weaning: *Kachangul tenganani* After weaning: *Kachangul toyontoni*
Malnourished due to poor diet	*Ikoku nika erogo/ikoku ni angopiki akimuj naajokon imuji*		*Ikoku ngini imuji apei kimuj*	*Kekar moningu ompo chopoto omosio nyo karam*
Malnourished due to food insufficiency		*Akoro, ikoku ngini ekadit akimuj*	*Ikoku ngini imuji apei kimuj*	*Kekar moningu ompowolo kirorchi omisio*
Malnourished due to disease	*Ikoku ni amunaaya loitakel* Stage 1 of being unhealthy: *Ikoku ni adekakin* Stage 2 of being unhealthy: *Ikoku ni echwangakin akwan* Stage 3 of being unhealthy: *Ikoku ni amunaiar*	*Ikoku ngini ethikar edeke* Stage 1 of being unhealthy: *Ekara* Stage 2 of being unhealthy: *Ikadekan* Stage 3 of being unhealthy: *Abothia*	*Ikoku ngini ka edeke* Stage 1 of being unhealthy: *Ikoku ngini adekan* Stage 2 of being unhealthy: *Ikoku ngini ebelok edeke* Stage 3 of being unhealthy: *Ikoku ngini ekarun* (given up on the child)	*Kilit moning somewo nganyona kekar* Stage 1 of being unhealthy: *Ksate moning* Stage 2 of being unhealthy: *Chirate moning* Stage 3 of being unhealthy: *Meghan moning*
Malnourished due to non-spaced pregnancies	*Ikoku nika eeter*	*Tutukan/itungi*	*Ikoku ngini a nyeneto*	*Kekar moningu ompowolo kakitengan kmining*
Malnourished due to poor quality of breast milk	*Ikoku ni epeaka ngakile atotokeng*	*Epeaka ngakile aitoke*	*Ikoku ngini epeaka atokeng ngakile angikithin*	*Kekar moningu ompowolo mesnye chepo kame*

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Table 3. Language for children with different health conditions and different causes of malnutrition

Description	Moroto District	Kaabong District	Kotido District	Amudat District
Malnourished due to inadequate breast milk	*Ikoku ni ekadito ngakile angisikin*	*Ekadito ngakile atotokeng*	*Ngini euchuriana atokeng*	*Kekar moningu ompowolo mtir kame*
Malnourished due to poor relationship between father and mother		*Ni angichan, ni achaka apakeng*		*Kekar moningu ompowolo mominye kalya kongwa*

Table 4. Local names for mothers at different stages of pregnancy, at birth, at different stages of lactation

Description	Moroto District	Kaabong District	Kotido District	Amudat District
At different stages of pregnancy:				
2 weeks to 3 months	*Aberu na eweiyarit*	*Irumiyarit, epotiyorit, ekama akook*	*Aberu ngina irumiarit*	*Pununon*
4–6 months	*Aberu na awua ngaakot*	*Atakanu akook, apotiyo*	*Aberu ngina epoti*	*Komiir*
7–9 months	*Aguothu/aberu na adol akidoun*	*Agothu akook*	*Aberu ngina adou*	*Konikisit*
At birth:				
Has just given birth	*Aberu na alek*	*Alek; engarakin*		*Yoo nyo kolusio*
Still in the house—up to 1 to 2 weeks	*Aberu na erongo nyipuduno kinga*	*Eyei kai, imanyurit*		*Kama moning*
Umbilical cord of the baby not yet cut	*Aberu na erongo nyedengoro*			
Out of the house—after 1 to 2 weeks	*Aberu ngina epudun kinga/aberu ngina elotun*	*Apudu alokai*		*Kama moning nyo kolitu sany*

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Table 4. Local names for mothers at different stages of pregnancy, at birth, at different stages of lactation

Description	Moroto District	Kaabong District	Kotido District	Amudat District
At different stages of lactation:				
0–9 months (sometimes up to 2 years)	*Aberu ngina itanaki*	*Itanaki*	*Aberu ngina manangit, ngina ketanakan*	*Mosowon*
9 months–2 years (may not be breastfeeding anymore)	*Aberu ngina apeto*	*Apeto*	*Aberu ngina apeto*	*Yoo nyo kopustegho moning kitin*
Breastfeeding beyond 2 years			*Aberu ngina kori, ngina ewoyakinit*	*Olion*

Table 5. Local names for pregnant mothers with different health conditions and different causes of malnutrition

Description	Moroto District	Kaabong District	Kotido District	Amudat District
Healthy pregnant women due to good diet	*Aberu na epoti tangalee, aberu na epoti kimuji ejok*	*Aberu ngina epoti totumite, na eyarit noi, engale akekwaan, kejoiki apot*	*Aberu ngini ebene akekwan*	*Yoo nyo narate (nakunate), yoo nyo miroi akwomisiyi nyokaram*
Healthy due to lack of disease	*Aberu ngina epoti tamam edeke*			*Yoo nyo miroi akitirus ametingnye someu*
Malnourished/ weak due to lack of appetite	*Aberu na itengerioritae ekimuje/aberu na itengeriorit apot kori ngaakot aikoku ekimuje*	*Imakuwat, ekara, edwarikinit*	*Aberu ngina edwarikinit apoti, ngina inuikinit*	*Yoo nyo miroi aki karate (changulan), yoo nyo kekar ompowolo kasas muu omisio aki pununo*
Malnourished/ weak due to lack of appetite because of disease	*Aberu na itengeriorit edeke ekimuje*			*Yoo nyo kekar ompowolo nyo kasas muu omisio ompo kosotio*
Malnourished/ weak due to food shortage	*Aberu na engopikinit akimuj*	*Ekadit akimuj*		*Yoo nyo miroi nyo kekar ompowolo chopoi omisio*
Malnourished/ weak due to disease	*Aberu na epoti todeaka*	*Edeak*		*Yoo nyo miroi nyo kekar ompo someu*

3.2 MONTHLY VARIATIONS IN CHILD MALNUTRITION AND RELATED INDICATORS

Data from monthly calendars were summarized in the form of graphs for agro-pastoralist and pastoralist areas. To prevent too much information being shown on a single graph, four graphs were used for each area, with each graph showing malnutrition, rainfall and selected indicators. The graphs lack a y-axis scale because although 100 stones were used to score each indicator against 12 months, this number is arbitrary and has no absolute meaning. When a line shows a peak, the peak represents the highest level of that indicator during the year; when a line shows a trough, it represents the lowest level of the indicator during the year, although this level might not necessarily be zero in absolute terms. Monthly patterns of child malnutrition and related indicators for agro-pastoralist and pastoralist areas are shown in Figures 1 and 2 respectively.

3.2.1 Key findings: agro-pastoralist areas

In terms of an initial validation of the method, the rainfall pattern (Figure 1a) described by the women's groups strongly agrees with meteorological (rainfall gauge) data for Karamoja, indicating that the groups understood the monthly calendar method. Furthermore, child diarrhea and malaria peaked with rainfall in April and May (Figure 1a); this relationship has a strong technical plausibility. Child malnutrition peaked in January following a sharp increase from December; child malnutrition slowly declined during February to June and reached its lowest levels from July to November; this shows a longer period of peak malnutrition relative to pastoralist areas (see section 3.2.2). As malnutrition peaked four months before diarrhea and malaria, these health problems seemed unlikely to be primary causes of malnutrition earlier in the year but might contribute to malnutrition between March and June (Figure 1a).

Moving through a year, peak malnutrition in January corresponds with very low availability of cow milk and goat milk, and declining availability of sorghum. Falling malnutrition then corresponds with the increasing availability of goat milk from February to April and then later, with a gradually increasing availability of cow milk from March to June. An increase in sorghum availability corresponds with low levels of malnutrition from August to November, before the cycle repeats itself. However, as shown in Figure 1d, a sharp increase in women's workload in December due to "other work" is closely correlated with the increase in malnutrition at that time, and workload then broadly follows a similar pattern to malnutrition. In addition, comparing Figures 1b and 1d shows that peaks in both women's work in gardens and other work in May corresponds with a peak in births, also in May. This temporal analysis, tracking monthly patterns of milk and sorghum availability, women's other work and births indicates that malnutrition results from the interplay of these three factors.

The information shown in the monthly calendars was complemented by information on the sufficiency of milk supply derived from proportional piling. In agro-pastoralist sites, the median proportions of households with sufficient access to cow milk and goat milk were only 18% and 23% respectively. This finding further explains the malnutrition pattern and in particular, the persistence of malnutrition as milk availability increases in March to May (Figure 1c). In practice, this milk supply was low even at the time of year when it reached its highest level.

Figure 1b shows a very close correlation between rainfall and human births, and Figure 1c shows a similar correlation between rainfall and the availability of cow milk; the latter has a strong technical plausibility. Comparing the two figures shows a very close correlation between human births and availability of cow milk.

Figure 1. Monthly pattern of malnutrition and related indicators, agro-pastoralist areas.
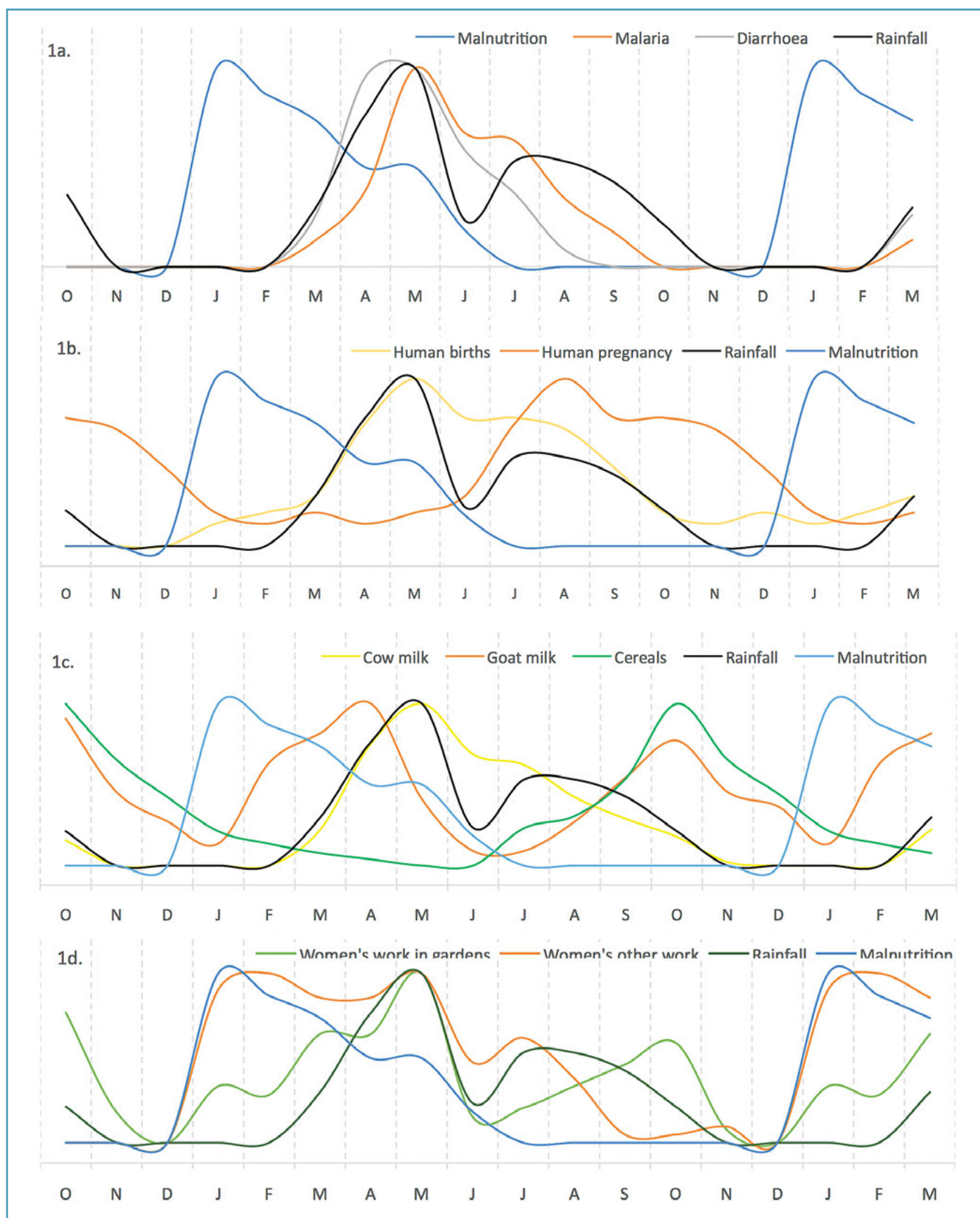
Notes
Figures are derived from monthly calendars with 16 women's groups and total scores; the monthly calendar method used a 12-month period; the figures show an 18-month period to clarify trends between December and January. The method included human births but not pregnancies; pregnancy patterns were derived by subtracting 9 months from the birth data.

Plate 1. Women constructing a monthly calendar.

3.2.2 Key findings: pastoralist areas

The rainfall pattern (Figure 2a) described by pastoralist women strongly agrees with meteorological (rainfall gauge) data for Karamoja, indicating that the groups understood the monthly calendar method. Furthermore, child diarrhea peaked with rainfall in April and May (Figure 2a), and this relationship has a strong technical plausibility. In contrast, malaria peaked two months after the peak in rainfall and diarrhea.

Child malnutrition peaked in January and February and showed a far shorter duration relative to agro-pastoralist areas, with a decline to low levels by May (Figure 2a). Malnutrition peaked three months before the peak in diarrhea and five months before the peak in malaria, and levels of malnutrition were relatively low during the peaks in these two health problems.

Figure 2b shows a very close correlation between rainfall and human births, and Figure 2c shows a similar correlation between rainfall and the availability of cow milk; the latter has a strong technical plausibility.

Comparing the two figures shows a very close correlation between human births and availability of cow milk.

Moving through a year, peak malnutrition in January and February corresponds with very low availability of cow milk, goat milk and maize (Figure 2c). Falling malnutrition then corresponds with the increasing availability of goat milk from February to April and then later, a sharply increasing availability of cow milk from March to June. An increase in maize availability from July to November corresponds with low levels of malnutrition, before the cycle repeats itself. Compared to agro-pastoralist areas (Figure 1d), the workload of pastoralist women due to other work showed a more gradual increase from December to May before falling in June and then increasing again in July to October (Figure 2d).

This temporal analysis indicated that malnutrition resulted mainly from the limited availability of milk and maize at certain times of year. Women's groups reported that only 31% (median) of households had sufficient access to cow milk, but 70% (median) had sufficient access to goat milk.

Figure 2. Monthly pattern of malnutrition and related indicators, pastoralist areas.
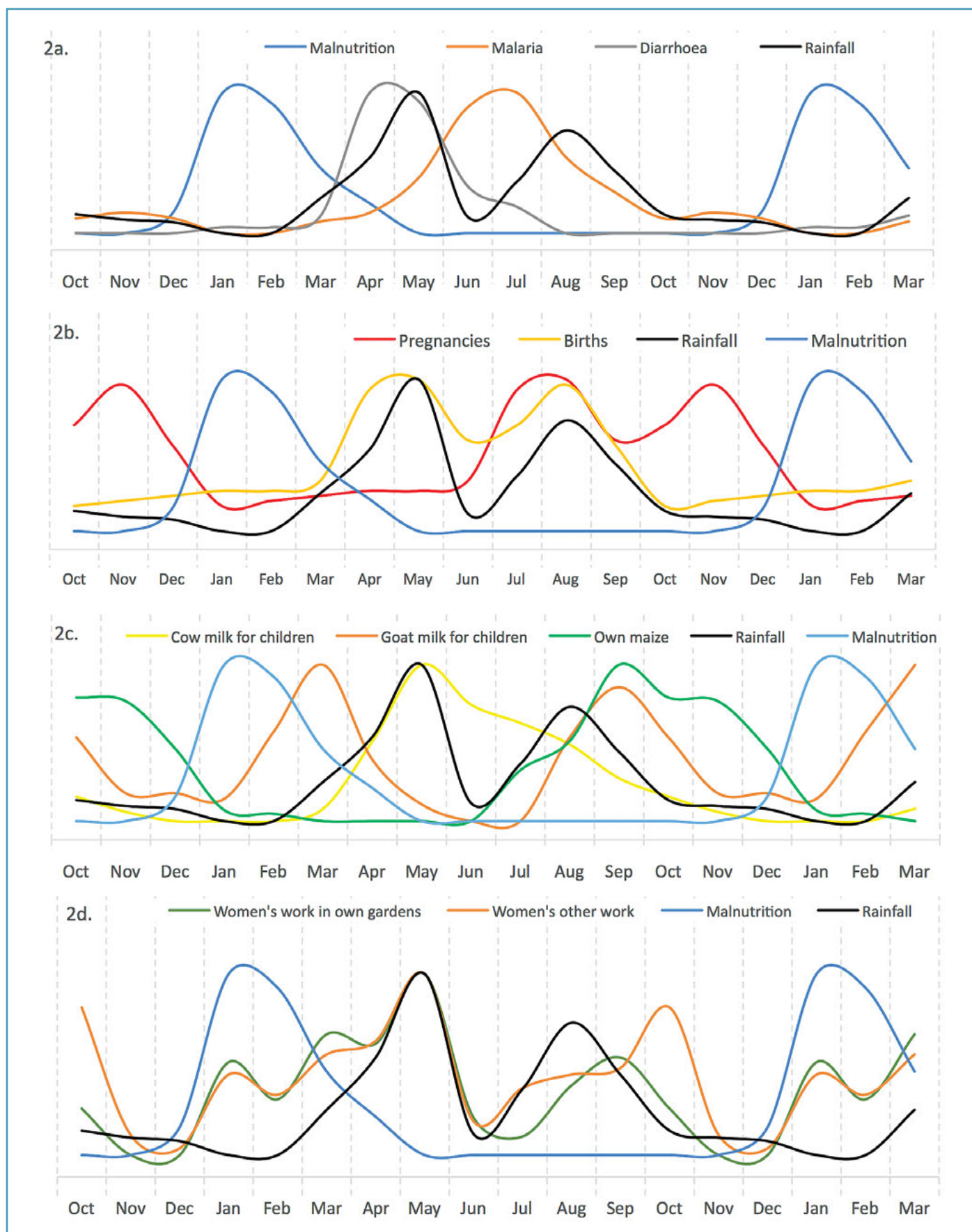
Notes
Figures are derived from monthly calendars with 8 women's groups and total scores; the monthly calendar method used a 12-month period; the figures show an 18-month period to clarify trends between December and January. The method included human births but not pregnancies. Pregnancy patterns were derived by subtracting 9 months from the birth data.

3.2.3 Detailed explanations of monthly patterns

The results presented in sections 3.2.1 and 3.2.2 were supported by narratives from women when they explained the patterns depicted in the monthly calendars. Repeatedly, they underlined two major factors— availability of milk and availability of own grain. They explained that malnutrition is high in the dry season due to the lack of cow milk, the availability but limited amount of goat milk and the low availability of own grain. This led to an overdependence on leaves of wild trees and other foods. They also described malnutrition as falling immediately with the increasing availability of cow milk at the start of the rains. However, this improvement in nutrition was also due to the availability of wild vegetables, white ants (for both pastoralist and agro-pastoralist areas) and pumpkins, melons, green grams, cucumbers and local tomatoes (for agro-pastoralist areas). Nutrition improved further as own grain became available.

3.2.3.1 Availability of cow milk

Women also provided detailed accounts of the monthly availability of cow milk. The pattern was similar in pastoralist and agro-pastoralist areas (Figures 1c and 2c). The availability of cow milk is low in the dry season and high in the wet season (with peaks in April and May). Low availability of cow milk in the dry season is attributed to cows being in the kraals (mobile camps), insufficient water, poor quality of grass and animal reproduction factors such as pregnancies and calf growth. In general, migration to kraals begins in October/November, but in areas with less grazing, migrations begin as early as August or September. The only families in the villages that have milk in the dry season are those that keep a few cows and use supplementary feeding with tree products or crop residues, or those that have preserved milk. Cows that are known to be hardy and that can withstand dry conditions are purposively selected to remain in the villages, but not everyone has access to the milk from these animals. Families with no access to milk in the dry season feed their children with poor diets such as tea and porridge without milk or on the leaves of trees such as sokoria (Pokot) and ekorete (Ngakarimojong).

The availability of cow milk increases with rainfall. At this time, pasture and water are available, cows are giving birth and the cows have returned to the villages. In the pastoralist areas, cows return to the villages together and over a relatively short period in March and April, leading to an early and sharp increase in milk availability in these villages. In agro-pastoralist areas, there is more movement of cattle (milking cows, dry cows, oxen for cultivation) between the villages and kraals, implying both a staggered return of cows to villages and early migrations to kraals. Although this is partly a strategy to protect sorghum on the farms, it affects the availability of milk in the villages, as some milking cows remain in the kraals for herders. Diseases such as contagious bovine pleuropneumonia, East Coast fever and trypanosomosis were reported to affect milk production in this season.

Even with better availability of milk in the rainy season, some families—especially those with few or no animals— have less or no access to milk. Such families access milk by buying it, using income from local brew (prepared from their grain), Aloe vera sales, sale of firewood and charcoal, casual labor, social protection programs, mining, quarrying, brick laying or bartering grain and vegetables with milk. They can also access milk free of charge during celebrations such as marriages. Children from poor families can also herd animals of the wealthier groups. Access to milk is assured for these children. The poor can also beg or borrow milk from neighbors, friends and relatives, or they are given a milking cow on loan. This practice of sharing milk or loaning a milking cow was reportedly more common in pastoralist areas than in agro-pastoralist areas because pastoralists tend to have more cows. The long-term aim of the poor is to restock, first by buying goats and then later by exchanging them for cows. Income for goat purchases is derived from work such as local brewing or from bridewealth when daughters are married. Non-governmental organizations (NGOs) and Government are also seen to restock poor families with goats.

3.2.3.2 Dynamics in the availability of goat and cow milk in relation to nutrition

In both agro-pastoralist and pastoralist areas, goats are managed to provide milk for children in the villages towards the end of the wet season, in the dry season and just before cows return to the villages. At these times, the availability of cow milk is low. In the agro-pastoralist areas, movement of cows between the villages and kraals imply an early migration, while in pastoralist areas migrations only start in October or November. In terms of return to the villages, in pastoralist areas most cows return around April, while in agro-pastoralist areas the return is staggered between April and June. Therefore, pastoralist children have a more rapid start to accessing cow milk as well as a longer period of accessing this milk (six months, from April to October) compared to agro-pastoralist children. These practices could explain why child malnutrition in pastoralist areas drops sharply when the main rains begin, reaching a low level in May (Figure 2c), while it persists in agro-pastoralist areas until July (Figure 1c).

In response to the varying availability of cow milk, pastoralist goats are managed to ensure that goat milk is available or kidding takes place at two critical periods when cow milk is less available, viz., between January and April, and between September and December (Figure 2c). Goats are also managed so that they produce less milk between May and August, when cow milk is available. Moreover, goat milk production is minimized in the rainy season because of inherent production challenges. These

challenges include cold weather or wetter conditions that affect feeding, as well as higher incidence of health problems such as contagious caprine pleuropneumonia, foot rot and lameness, diarrhea and abortion. People try to ensure that goats are pregnant at this time and give birth at times when cow milk is less available. However, as browse is also less available at this time, supplementary feeds are used, e.g., acacia pods (*sakaram*), lalop seeds (*Balanites aegyptiaca*), tree leaves, crop residues and, in some locations, local brew residue. Other factors favoring goat production at this time include drier grounds and relatively low incidence of diseases.

In agro-pastoralist areas, due to controlled breeding there is a staggered increase in goat milk between January and April to ensure availability of milk in the dry season and just before cows return to the villages (a movement that is also staggered). In pastoralist areas, there is a sharp increase in goat milk between February and March (Figure 2c), indicating that goats are managed to provide milk mainly in the late dry season and not into the "first rainy season" (as cows return to the villages as early as March or April, and so cow milk becomes available).

Despite careful management practices that use goats to provide milk when cow milk is less available, the overall ownership of livestock is low, and so the supply of goat milk is insufficient. Additionally, goat milk is available for only about a month after giving birth. Households with only a few goats are less likely to share or sell milk; goat ownership is generally lower in agro-pastoralist areas relative to pastoralist areas. The challenge of agro-pastoralist goat milk production targeted for the dry season is that in areas with fewer shrubs and trees, goat milk production is very low in absolute quantity.

Although most villages follow this cow-goat milk production pattern, some villages strategized for goats to give birth in the rainy season when there is more browse available. Women in these villages reported a fall in child malnutrition at this time due to availability of goat milk.

3.2.3.3 Availability of own sorghum for agro-pastoralists and maize for pastoralists

Grain stocks peak at harvest time (September/October). Immediately after harvest (October/November) a decline is observed, i.e., at the beginning of dry season (e.g., Figure 1c). The decline in stocks continues during the dry season and into the first three to four months of the wet season. Availability only improves during the later months of the wet season. The rate of decline of grain stocks during the dry season is more rapid in agro-pastoralist areas (Figure 1c) compared to pastoralist areas (Figure 2c). This is attributed to the wider practice of brewing in agro-pastoralist areas for ceremonies and income; women's other works and malnutrition rises sharply in these areas from December.

The decline in grain stocks during the dry season and first months of the wet season is due to home consumption, including by herders in kraals, and giving grain to neighbors as gifts. Grain is also sold for income to buy goats and for school fees, medical care, veterinary medicines and household items (e.g., sugar, salt, clothes, bed sheets, shoes), and is used for hiring laborers in the next cropping season. Other uses include selling to buy alcohol to entertain visitors, brewing for ceremonies (e.g., weddings, childbirth and Christmas festival) and brewing for income (especially among agro-pastoralists). Grain can also be used to pay fines for offences such as elopement. When grain stocks are low, households sell livestock or use income from Aloe vera and casual labor to buy food. Irrespective of these uses, some grain is reserved for seeds and for hiring casual laborers during the planting season. Although most households lose all their grain to the above uses, some households are able to reserve some grain for the hunger period.

The availability of grain starts to rise from July and peaks in September/October (Figure 1c and 2c). For pastoralists, only fresh maize is available in July and August, and only small amounts are harvested and fed to children. Sufficient maize for household consumption only becomes available in September/October, when it is ripe and harvested; pastoralists still go through a period of hunger between July and September. In contrast, agro-pastoralists may plant two types of sorghum to ensure that a reasonable amount of sorghum is available by July. They use the early maturing (three months) white sorghum for harvest in July/August and the late maturing red sorghum for harvesting by September/October. Although this practice means that agro-pastoralists have better access to grain between July and October compared to pastoralists, agro-pastoralists also see a higher rate of decline in grain stocks due to brewing. From proportional piling, median proportions of 59% of sorghum was consumed, 13% was sold and 24% was used for other purposes (e.g., brewing) in agro-pastoralist areas. In pastoralist areas, median proportions of 44% of maize was consumed, 56% was sold and 0% used for other purposes.

3.2.3.4 Women's work
a. Women's work in own gardens

In both agro-pastoralist and pastoralist areas, women's work in their own gardens increased gradually between January and May, fell during June and then increased again from around August to October. Against this general pattern, the specific activities differed slightly between agro-pastoralists (sorghum) and pastoralists (maize) due to the different crops planted. Table 6 illustrates the amount of time that women spend on these activities. Notably, women's work in their own gardens was highest in May (Figures 1d and 2d), when women may spend up to 10 hours a day weeding (Table 6).

Table 6. Illustration of women's activities and times in own gardens by month

Month	Pastoralist areas	Agro-pastoralist areas
January	Clearing bushes for new gardens or cleaning the existing gardens. Men support women in clearing bushes. - 9 am to 12 pm - 10 am to 6 pm	Land preparation—clearing bushes for new gardens or cleaning the existing gardens - 6 am to 12 pm then 3 pm to 6 pm - 7 am to 4 pm or up to 6 pm - 7 am to 12 pm - 8 am to 12 pm or up to 1 pm
February	Gathering and burning waste from the cleared bushes and previous harvest. Some people start digging the gardens despite the dryness. - 9 am to 12 pm, then 4 pm to 5 pm - 10 am to 6 pm	Gathering and burning waste from the cleared bushes and previous harvest - 7 am to 10 am - 6 am to 1 pm
March	Digging with hand hoes (one village reported using tractors) - 10 am to 5 pm - 10 am to 6 pm	Digging with hand hoes - 7 am to 2 pm - 7 am to 3 pm or up to 5 pm - 5 am to 3 pm
April	Planting maize (and some sorghum) and chasing squirrels - 9 am to 6 pm - 10 am to 6 pm - 7 am to 6 pm	Ox-ploughing; planting sorghum and some beans, maize and millet - 7 pm to 1 am then 4 am to 12 pm or up to 3 pm - 3 am to 11 am or up to 1 pm
May	Weeding - 9 am to 6 pm - 8 am to 6 pm	Weeding - 7 am to 2/3/4 pm or up to 6 pm
June	Final weeding and harvesting of beans - 1 hour	Final weeding; harvesting pumpkins, vegetables and beans; scaring birds and cows/goats from gardens - 7 am to 1 pm; 6 am to 6 pm
July	Cutting sticks for constructing granaries, scaring birds, sleeping in the garden to chase monkeys, porcupines and wild pigs, and harvesting fresh maize - 7 am to 6 pm, sometimes sleep in the garden	Harvesting millet, white sorghum and beans (not much); harvesting melons, pumpkins and wild/local vegetables; scaring birds, monkeys and baboons from gardens
August	Construction of granaries - 9 am to 6 pm	Harvesting white sorghum; harvesting red sorghum fallen by frogs, armyworm/butterflies and rain; scaring birds - 7 am to 11 am
September	As in August	Some red sorghum ready and harvested; construction of granaries
October	Harvesting maize, heaping on farms, shelling and storing in granaries - 9 am to 6 pm or up to 7 pm - 10 am to 6 pm	Intensive harvesting of red sorghum, heaping on racks on farms, threshing and winnowing, and storing in granaries - 7 am to 2 pm or up to 3 pm or up to 6 pm
November	Beadwork, construction of houses	Threshing and winnowing sorghum; construction of houses - 7 am to 4 pm
December	As in November	Construction of houses

Women's work in their own gardens has at least three important impacts on malnutrition.

- First, the physical nature of the work means that dietary energy requirements increase with workload. Taking the case of peak workload in May (Figures 1d and 2d), this corresponds with the peak in cow milk availability in May (Figures 1c and 2c) but limited availability of cereals. However, despite the peak in cow milk at this time, the amount of milk is insufficient; as described in sections 3.2.1 and 3.2.2, in agro-pastoralist sites the median proportion of households with sufficient access to cow milk was only 18% and in pastoralist sites, 31%. Furthermore, when limited milk is available, it is preferentially fed to children. Therefore, women face severe problems with their own food intake at a time when food is needed for work.

- Second, births peak in May. Therefore, compounding women's need for food to support their work is a need for food to support childbirth and early lactation but as explained above, both milk and cereals are in short supply at this time of year.

- Third, the nature of work means that mothers have to strategize how to feed children when they are working for so many hours.

  o For children at pre-weaning age (below 5 months), three strategies are used: women carry them to the garden, keep them in the shade (e.g., under a tree) and breastfeed when the child wakes or cries; the child is carried on the mother's back while she works and is breastfed as needed; or older children also go to the garden to assist with childcare.

  o Children at weaning and post-weaning age are in most cases left at home with older children, grandmothers or neighbors and fed on tea, milk, vegetables, porridge (plain, or mixed with milk or tamarind), sorghum/maize bread (plain, or mixed with milk or vegetables) and local brew residue.

Critically, women's workload peaks at the same time as childbirth and at the same time as limited availability of cereals and milk, despite the peak in cow milk availability.

b. Women's other work

The monthly pattern of women's other work in both pastoralist and agro-pastoralist areas was explained by reference to the need to find non-livestock food and income activities to support the family at times of food shortage.

Activities in the dry season included: Aloe vera harvesting and processing; mining; casual labor in towns such as fetching water and cooking in homes and restaurants; sorting maize/sorghum and transporting to granaries; cutting grass and selling to neighbors and restaurants; selling firewood/charcoal (but less common in pastoralist areas due to Government restrictions); and working in other people's gardens. Making and selling local brew was important in agro-pastoralist areas.

In the first months of the rainy season, many of the activities listed above still apply but other activities include casual work in other people's gardens such as land preparation, planting and weeding. In the later months of the rainy season, activities implemented in addition to those in the dry season include casual labor related to harvesting, shelling and storage of maize (for pastoralists) or threshing and winnowing sorghum (for agro-pastoralists), and construction of granaries.

For pastoralist and agro-pastoralist areas, the number of hours spent by women in each of these activities, including start and end time, varies across villages, as shown in Table 7. The implications for this pattern of work on malnutrition are similar to those for work in own gardens but with a higher likelihood of physical separation of mother and child during work due to the nature and location of the work, and therefore limited options for breastfeeding. Again, taking the month of May when there is a peak in workload, this month corresponds with limited availability of cereals, a peak in cow milk availability but limited quantities and a peak in births. In cases where unweaned children are left at home and cared for by siblings or relatives, in theory cow milk should be available as a food for these children. In practice, cow milk supply is insufficient.

There were some notable differences in other work between pastoralist and agro-pastoralist areas. For example, pastoralist women's other work was far higher in the late wet season (September–October) compared to agro-pastoralist women. This was attributed to less cereal production in pastoralist areas and a longer hunger gap, forcing women to seek other food and income. Also, there was a sharp peak in other work for agro-pastoralist women after the harvest due to the work of brewing and ceremonies, whereas in pastoralist areas brewing was far less common.

Table 7. Illustrative women's work activities and time spent

Activity	Pastoralist areas	Agro-pastoralist areas
Aloe vera harvesting processing	9 am to 6 pm; some people stay in the bush for two weeks	8 am to 6 pm
Working in mines	7 am to 5 pm but not common	4 am to 5 pm
Casual labor in towns (cooking or selling food in restaurants, cooking in homes, fetching water, washing clothes)	7 am to 6 pm	6 am to 6 pm
Casual labor in other people's gardens—clearing gardens, digging, planting, weeding, harvesting/ heaping/storage of grain	On average, 9 am to 6 pm	7 am to 1 pm
Sale of firewood and charcoal	Not common—Government restricts cutting of trees for firewood and charcoal. Most villages are far from town centers (where demand exists).	- Charcoal burning and selling—takes up to three weeks to get a batch for sale - Firewood collection and sale— collection (4 am to 11 am or up to 1/2/3/4 pm depending on distance; selling—5 am to 12 pm or sometimes longer if demand is low

3.2.3.5 Pregnancies and births

In both agro-pastoralist areas and pastoralist areas, pregnancy occurs mainly between June and December (Figures 1b and 2b), leading to births in March to September. The main birth period correlates closely with rainfall and the availability of cow milk (Figures 1c and 2c). The pattern of pregnancies was explained by women as follows:

- April/May—some early pregnancies in this period are attributed to return of men from kraals at the end of the dry season; some milk is also available.

- July/August—most courting takes place at this time, women's work in their own gardens tends to decline, and there is milk and traditional dances.

- October/November—this is the time of high cereal availability and of many ceremonies such as marriages accompanied by dances and drinking of local brew (drinking of local brew is more common in agro-pastoralist areas).

- December—in the pastoralist areas, pregnancies were attributed to church congregations/camps and community fundraisings that are common at this time. In agro-pastoralist areas, pregnancies at this

time were common among girls and were attributed to sexual abuse that takes place in towns that they visit for casual labor and income.

The correlation between births and rainfall indicates that most births occur in the rainy season when cow milk and grain are available. In theory, this is good for the breastfeeding mother and the newborn child from the perspective of the mother's diet and the quality and supply of breast milk. In practice, low livestock ownership leads to insufficient access to milk throughout the main birth months, even though milk supply peaks at this time of year. In addition, women's workload is high during this period, especially in agro-pastoralist areas.

At weaning age, the following scenarios are evident for children born at different times:

- Born in April/May—children reach weaning age towards the end of the rainy season (September–November) when there is limited cow milk; these children then grow into the dry season when cow milk is even less available in the villages and grain stocks are also low. These timings point to a peak in malnutrition in these children in the late dry season, as is commonly seen in pastoralist areas of east Africa.

- Born in July/August—children reach weaning age in the dry season (December to February) when cow milk has low availability in the villages and stocks of grain are low. This points to malnutrition in these children in the dry season.

- Born in September—children reach weaning age at the beginning of the rainy season when cow milk starts to become available; theoretically, this is good timing but in practice, cow milk availability is insufficient.

- Born in January/February—children reach weaning age between June and August when cow milk and grain are available. Again, this is good timing in theory but hampered by insufficient availability of cow milk.

3.2.3.6 Disease occurrence
a. Malaria

In general, the monthly pattern of child malaria was similar for pastoralist and agro-pastoralist areas, with malaria increasing during the wet season. However, in agro-pastoralist areas, malaria peaked in May, whereas in pastoralist areas, the peak was later, in June–July. In agro-pastoralist areas, factors that favor mosquito populations such as surface water and thickets of grass or vegetation appear more quickly when the rains start and are more widespread relative to pastoralist areas.

In a typical year, malaria peaked four months after the peak in malnutrition in agro-pastoralist areas and five to six months after the peak in malnutrition in pastoralist areas.

b. Diarrhea

The monthly pattern of child diarrhea was similar in pastoralist and agro-pastoralist areas, with a distinct peak in April–May coinciding with peak rainfall. Women explained this incidence of diarrhea by reference to a wetter and dirtier environment during heavy rain, a build-up of flies and more contamination of food; young children were exposed to dirty and wet soils. Diarrhea was also associated with changes of diet, such as: the introduction of milk; feeding too much milk; not balancing milk properly with cereal flour ; introducing beans and fresh maize; consumption of unripe wild vegetables or vegetables, mushrooms or white ants; and with malaria.

Occasional cases of diarrhea in the dry season were associated with children taking tea without milk (which they are not used to), feeding on the leaves of trees such as *sokoria* (Pokot) and *ekorete* (Ngakarimojong), and breastfeeding after many hours of absence (due to women working). Women also felt that the low availability of milk and cereals forces them to use poor-quality diets, which can cause diarrhea.

In both agro-pastoralist and pastoralist areas, child diarrhea peaked three–four months after the peak in child malnutrition.

3.2.4 Levels of agreement between women's groups
The same 10 indicators were used in the monthly calendars in each area. In agro-pastoralist areas, there was strong (significant) agreement between the women's groups for 9/10 indicators and in pastoralist sites, for 8/10 indicators. In each area, there was weak (not significant) agreement on the availability of goat milk for children and in pastoralist sites, also weak agreement on women's other work. See Table 8.

Table 8. Level of agreement on monthly calendars

Indicator	Kendal coefficient of concordance W	
	Agro-pastoralist sites (n = 16 groups)	Pastoralist sites (n = 8 groups)
Rainfall	0.73**	0.77**
Availability of cow milk	0.86**	0.84**
Availability of goat milk	0.10^{ns}	0.18^{ns}
Availability of own sorghum or maize	0.80**	0.84**
Women's work in gardens	0.59**	0.54**
Women's other work	0.46**	0.16^{ns}
Child malnutrition	0.60**	0.28*
Child malaria	0.83**	0.57**
Child diarrhea	0.72**	0.39**
Human births	0.50**	0.41**

Notes
The Kendal coefficient of concordance W measures the level of agreement between the groups in each area and provides a coefficient of between 0 (no agreement) to 1 (perfect agreement). For example, in agro-pastoralist sites, when 16 independent women's groups scored rainfall across 12 months using a total of 192 scores, what was the level of agreement between the groups? A W value of 0.73 in this case represents a high level of agreement. Assigning probability (p) values to W allows the agreement to be expressed in terms of its statistical significance; **$p < 0.001$; *$p < 0.01$; ns–not significant. W values reflect the reliability of the seasonal calendar method and specifically, the method's reproducibility.

3.3 PARTICIPATORY CAUSAL ANALYSIS

3.3.1 Participatory causal analysis for malnourished children

The results from the participatory causal analysis were summarized in the form of diagrams showing the root causes and other causes, with scoring of each cause. The diagrams for agro-pastoralist and pastoralist children are shown in Figures 3 and 4 respectively. The level of agreement between groups is shown in Table 9.

Table 9. Level of agreement—causes of malnutrition

Causes of malnutrition	Kendal coefficient of concordance W
Agro-pastoralist children (n = 16 groups)	0.62, p < 0.001
Pastoralist children (n = 8 groups)	0.45, p < 0.001
Agro-pastoralist mothers (n = 16 groups)	0.62, p < 0.001
Pastoralist mothers (n = 8 groups)	0.47, p < 0.001

Figure 3. Causes of child malnutrition, agro-pastoralist areas.
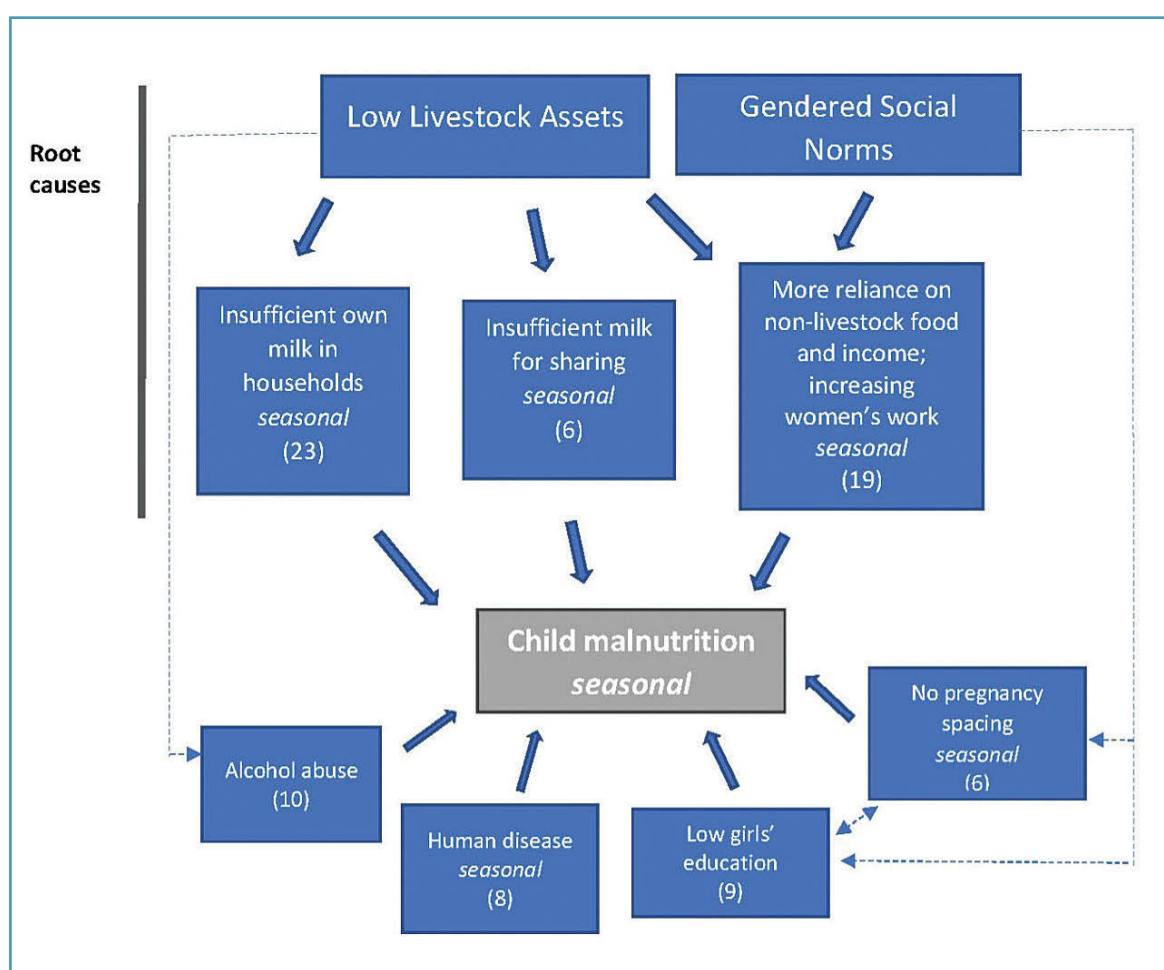
Notes

Figure derived from interviews with pastoralist women in Amudat, followed by proportional piling of causes with eight women's groups. Numbers in parentheses are the median scores from the proportional piling. Causes and problems that are annotated as "seasonal" show significant monthly and seasonal variation—see section 3.2.

Mothers identified several categories of malnourished children based on the stage of growth that malnutrition occurs. These included:

- A child who becomes malnourished before weaning.

- A child who becomes malnourished only at weaning.

- A child who becomes malnourished only after weaning.

- A child who is malnourished from birth through to 5 years old.

Other categories were children born with conditions not necessarily related to nutrition and included a child born underweight, a child born with deformities and a child with stunted growth.

Figures 3 and 4 show common findings across agro-pastoralist and pastoralist areas, with the root causes of malnutrition associated with low livestock ownership and gender issues. The problem of livestock ownership has a direct impact on malnutrition because households and communities with insufficient animals will have limited milk for home consumption or sharing. Low livestock ownership also combines with gender norms to create a situation whereby households are forced to rely more on non-livestock sources of food and income. The responsibility for this food and income resides largely with women. This increases women's workload and especially women's "other work," e.g., see Figure 1d. Although not captured in the diagrams, in addition to the responsibility to provide food and income, women also risk violence from husbands if they fail to fulfil these roles and so there is an element of psychological stress adding to the burden of responsibilities.

Figure 4. Causes of child malnutrition, pastoralist areas.
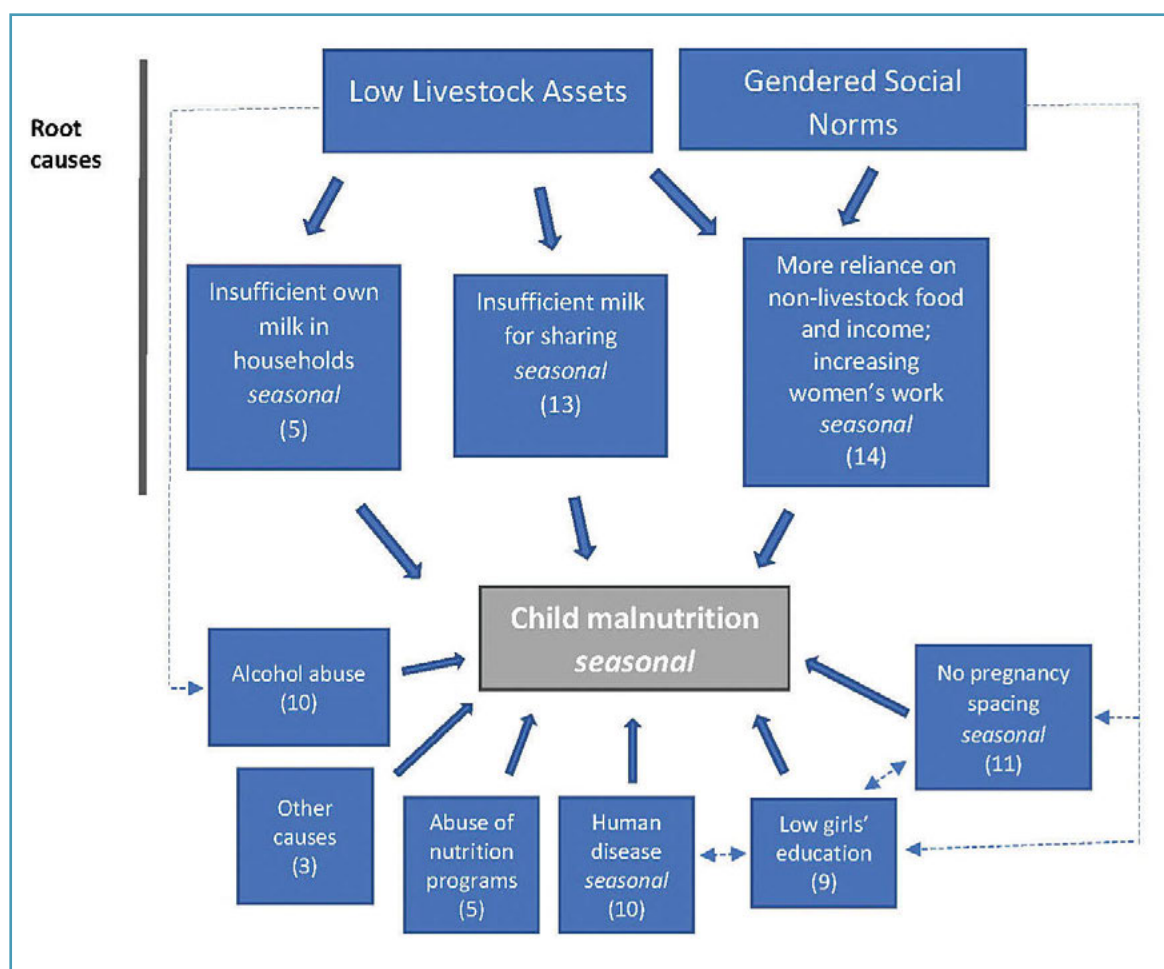
Notes
Figure derived from interviews with women in Moroto and Kotido, followed by proportional piling of causes with 16 women's groups. Numbers in parentheses are the median scores from the proportional piling. Causes and problems that are annotated as "seasonal" show significant monthly and seasonal variation—see section 3.2.

3.3.1.1 Insufficient milk/poor diet

Milk is widely viewed as important in the nutrition of children. In the absence of milk at home, a child may even steal from the neighbors; this act causes inter-family quarrels. When milk is not available, children are fed on a poor diet with no variety, such as local brew residue or plain porridge, i.e., porridge prepared with water, not milk. Lack of food or being forced to feed children a poor diet is worse during drought or famine, when the husband is irresponsible or when the mother has insufficient or poor-quality breast milk or is not breastfeeding a child frequently due to her work. This situation is also exacerbated when food markets are too far away, when a family has few or no animals and when relatives are not supportive. Some families or mothers do not prepare in advance how the child will be cared for after birth. Some mothers do not know how to prepare nutritious food. Nowadays, Government and NGOs try to restrict the use of animal milk, alleging that milk is a source of disease for children. Due to insufficient milk, children eat sorghum/maize bread, with some milk when available.

Table 10. Diets of healthy vs. malnourished children

Age	Healthy children	Malnourished children
0–5 months	Types of food: - Good-quality breast milk - Mother feeding on good diet Other factors - Mother is healthy (no cases of sickness)	Types of food - Low-quality breast milk - Insufficient breast milk - Mother feeding on poor diet Other factors - Mother is sick
6–9 months (up to 1 year)	Types of food - Fresh cattle/goat's milk - Beans (*emaret*) soup - Meat soup and chapati - Meat + butter + groundnut paste - Silverfish (Dodoth—*ngakachede*) - Eggs - Mandazi - Melon seeds (*ngaadekala*) - *Uji* (porridge) + milk + butter	Types of food - Wild vegetables (*edea*)—*ekorete, eejor, ekiliton* - Local brew residue (*adakae*) - Plain porridge (no milk) - Plain posho - Vegetables + salt (no oil/butter) - Plain pumpkins - Mother feeding on poor diet, e.g., plain beans, plain porridge + salt (no oil/butter or other ingredients) Other factors - Sicknesses - Early pregnancy - Mother irresponsible due to overconsumption of alcohol - Poor family—no cows
1–5 years	Types of food - Milk—from animals and purchased - Beans (*emaret*) + meat + oil + onions + butter - *Uji* + sugar + milk + oil - Rice + meat - Macaroni + beans + cabbage + meat + chapati - Eggs - Sour porridge (from fermented sorghum) - Posho + melon seeds + vegetables + sunflower - Milky tea - Vegetables (*edea*) + butter - Blood - Plain butter - Mother feeding on good diet Other factors - Mother knows how to prepare food well - Parents are rich, with many animals	Types of food - Local brew residue (*adakae*) - Wild greens (either plain, with posho alone or just with salt) - Plain sorghum flour - Plain porridge (no milk) - Plain vegetables - Plain beans - Mother feeding on poor diet Other factors - Mother overconsuming alcohol - Family is poor—have no animals; do not do crop farming; mainly dependent on charcoal burning and firewood collection - Children feeding from the neighbors most of the time - Eating once a day or feeding from neighbors - Note: feeding on poor diet leads to diarrhea

Women described differences in diets between healthy and malnourished children (Table 10). In the first month after birth, mothers from both wealthier and poorer families receive support from husbands, friends and relatives. However, differences in this support appear in the second month. Mothers from wealthier families continue to receive support from relatives and friends in the form of gifts, while this support wanes for mothers from poorer families. This is the beginning of nutrition challenges for mothers and children from poorer families. These mothers sometimes have to leave the child at home when they look for work. The mothers commonly feed the child on local brew and the residue of local brew (which people in the community offer for free), sometimes when the child is only about 2 months old.

3.3.1.2 More reliance on non-livestock food and income

Women's involvement in "other work" is purposely to raise income to supplement food needs, especially in the dry season. Such work includes the sale of firewood and charcoal, casual labor in towns, and Aloe vera processing and harvesting. These activities keep mothers away from children for many hours, the amount of time away depending on the activity. For example, charcoal burning can keep the mother away from the child for up to two days. This deprives the child of breast milk unless the mother carries the child with her, but doing so is difficult. Poor breastfeeding stresses the child and predisposes him/her to diseases. Often, mothers have to go to work with children below the weaning age (younger than 5 to 6 months). When carried on the back while working (e.g., burning charcoal), these children are exposed to heat from the sun, and the burning wood and smoke. Children at or after weaning are often left at home with older children, grandmothers or neighbors. In poorer families, children are left at home as early as 1 to 3 months of age, and in families with irresponsible parents (e.g., alcoholics), children are left behind even at 1 week of age. In the absence of food, the child is fed on local brew (*kwete*) or local brew residue (*adakae*), or another breastfeeding mother is persuaded to breastfeed the child. Older children may not pay much attention to the child they are supposed to be caring for. Some families do not have older children. All of these practices predispose a child to malnutrition but have their root cause in insufficient food and income from livestock.

3.3.1.3 Alcohol abuse

Drunken parents spend more money on alcohol than feeding the family or children. These parents give less attention to childcare with regards to breastfeeding, provision of food, hygiene and other needs. Children are not fed on time and or at the required frequency of three times a day. Children are given alcohol as food or to silence them when they cry. In drunkard mothers, breast milk contains alcohol, which is unhealthy for the child. Women in villages in pastoralist areas reported a reduction in alcoholism in the area; this was attributed to the efforts of the church.

3.3.1.4 Human diseases

Women associated the following health problems with child malnutrition: diarrhea, malaria, cough/pneumonia/tuberculosis (respiratory problems), typhoid, brucellosis, body rashes, teething problems, kwarshiokor and marasmus. Some mothers are not keen on children's immunization schedules. Some take a sick child to a traditional medicine man for traditional rituals rather than to the health center.

3.3.1.5 Spacing of pregnancies

This relates to the mother becoming pregnant when the child is still small (below about 5 months of age). Traditionally, a wife cannot resist the husband's demands and to do so places her at risk of violence. Frequent pregnancies also occur when parents are drunkards or when parents are targeting nutrition kits. A consequence of close pregnancies is breast milk is depressed and the child is weaned early (sometimes as early as 2 months of age); this is unhealthy. There was awareness of Government and NGOs targeting birth control, including advice to have a two- to three-year space between pregnancies.

3.3.1.6 Abuse of nutrition programs

There are a few cases where a child is deliberately underfed or poorly fed so as to attract supplementary feeding (nutrition kits) from external agencies. On receipt, these nutrition kits are often sold, particularly by drunkard mothers. Food or nutrition kits from supplementary feeding are also shared with the rest of the family or neighbors rather than being reserved mainly for the malnourished child.

3.3.1.7 Other causes

Hygiene and sanitation—children are fed on foods that are cold and stored overnight. Less attention to the cleanliness of a child's bedding, clothes and body predisposes the child to diseases. This also happens when the mother is not keen on her own hygiene and that of the home environment. Poor hygiene and sanitation was not seen as a major problem nowadays because NGOs and Government have created a lot of awareness.

Disobeying taboos—some women associated malnutrition in children with violation of certain taboos. Taboos require that when a party is held to celebrate the "coming out" of the mother from seclusion (she stays in the house for two weeks after giving birth), certain people are barred from attending, e.g., a sick person or someone with wounds, hearing problems, diarrhea, or women who are menstruating. If these people do attend, the belief is that the child develops wounds and hearing problems. These sicknesses are also associated with malnutrition.

Factors contributing to a child born underweight—as perceived by women, underweight children are born in instances where the mother was overworking during pregnancy to support the family (i.e., the husband is not supportive) or the mother was overeating during pregnancy. Other factors include the fetus being sick in the womb, the mother feeding on foods not nutritious to the fetus or plain foods, or the mother drinking a lot of alcohol during pregnancy.

Factors contributing to children being born with deformities—this was viewed as a natural phenomenon or "God's plan." However, other factors included practices during pregnancy that are culturally forbidden, e.g., eating some forbidden foods, going back to the parent's home without performing rituals, fighting during pregnancy and frequent falls during pregnancy (e.g., because of carrying heavy loads). Other factors include overconsumption of alcohol, disease, too much snuffing of tobacco, too much exposure to heat and smoke during charcoal burning,

overworking during pregnancy and mothers not being keen on antenatal care visits to health centers.

Factors contributing to stunted growth of children—stunted children were those seen as born healthy but not growing as expected up to 5 years of age and beyond. This was attributed to mothers not attending antenatal care clinics, a poor diet, relapsing or recurring disease such as malaria and family genetics (i.e., the family of the mother or father has a history of stunted children). Some women said they do not know the cause, whereas others said it is a natural phenomenon or "God's plan." In some areas, having a stunted child was not regarded as bad luck because some of these children became foreseers.

3.3.2 Participatory causal analysis for malnourished mothers
The causal diagrams for malnourished agro-pastoralist and pastoralist mothers are shown in Figures 5 and 6 respectively.

Figure 5. Causes of malnutrition in mothers, agro-pastoralist areas.
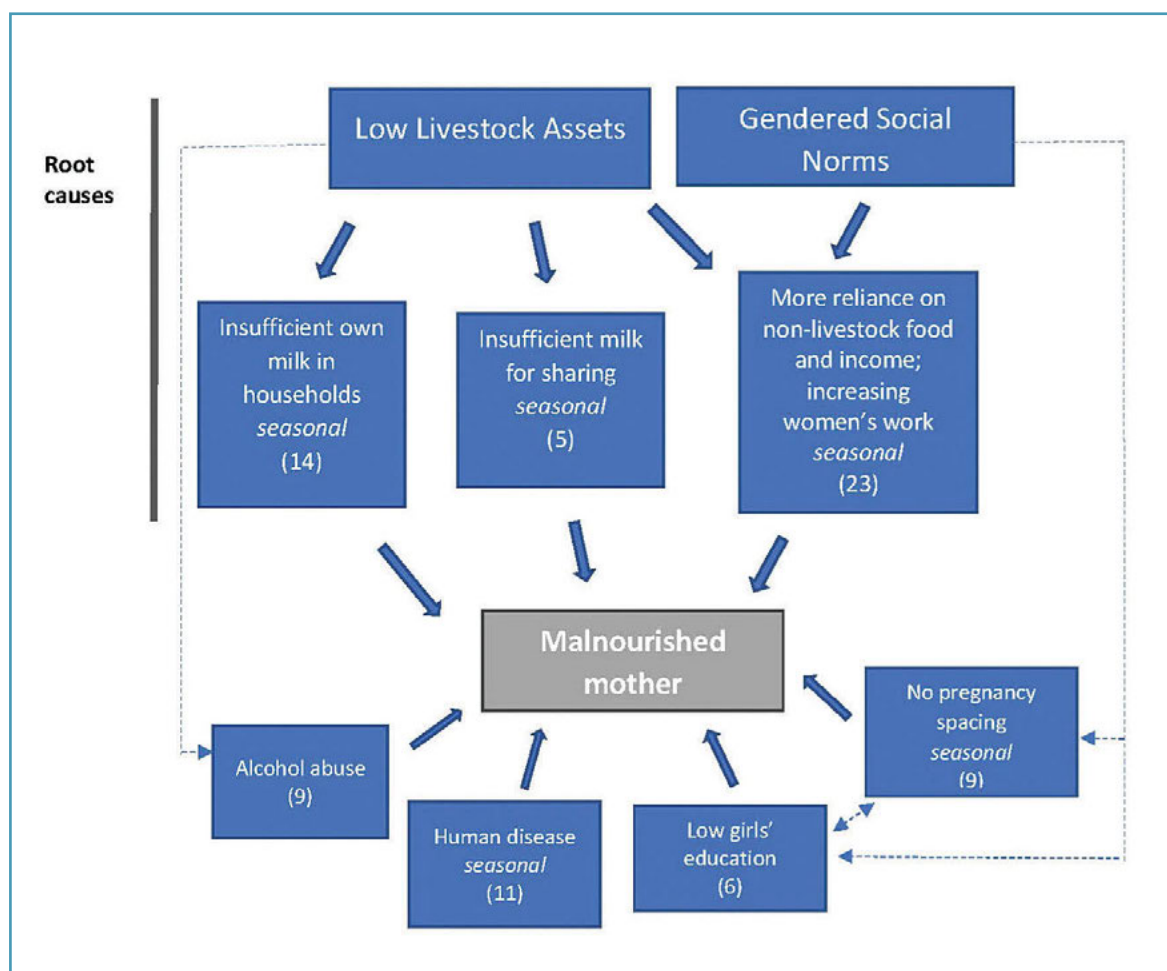
To clearly explain causes of malnutrition in mothers, women categorized mothers as pregnant and lactating mothers, and then further sub-categorized these groups as follows:

Malnourished women:

- A mother who is malnourished/weak during the whole period of pregnancy.

- A mother who is malnourished/weak only in the first trimester (between two weeks and three months).

- A mother who is malnourished/weak only in the second trimester (four to six months).

- A mother who is malnourished/weak only in the third trimester (between seven and nine months).

Malnourished lactating mothers were differentiated according to the stage of growth of the child:

- Malnourished mother only when the child is below 5 months.

- Malnourished mother only when the child is at weaning age.

- Malnourished mother when the child is beyond weaning age (10 months to 5 years).

3.3.2.1 Insufficient milk/poor diet
Lack or insufficiency of good food for mothers affects the quantity and quality of breast milk. The good diet for mothers should comprise foods of animal origin (meat, milk), wild vegetables and fruits, cereals, among others. Drought and lack of money to purchase alternative foods are major contributors to food insufficiency. Due to insufficient food, mothers give priority to children and the husband rather than themselves. Mothers are sometimes compelled to take local brew to enhance production of breast milk. Tables 11 and 12 summarize key differences in the diets of healthy and malnourished mothers.

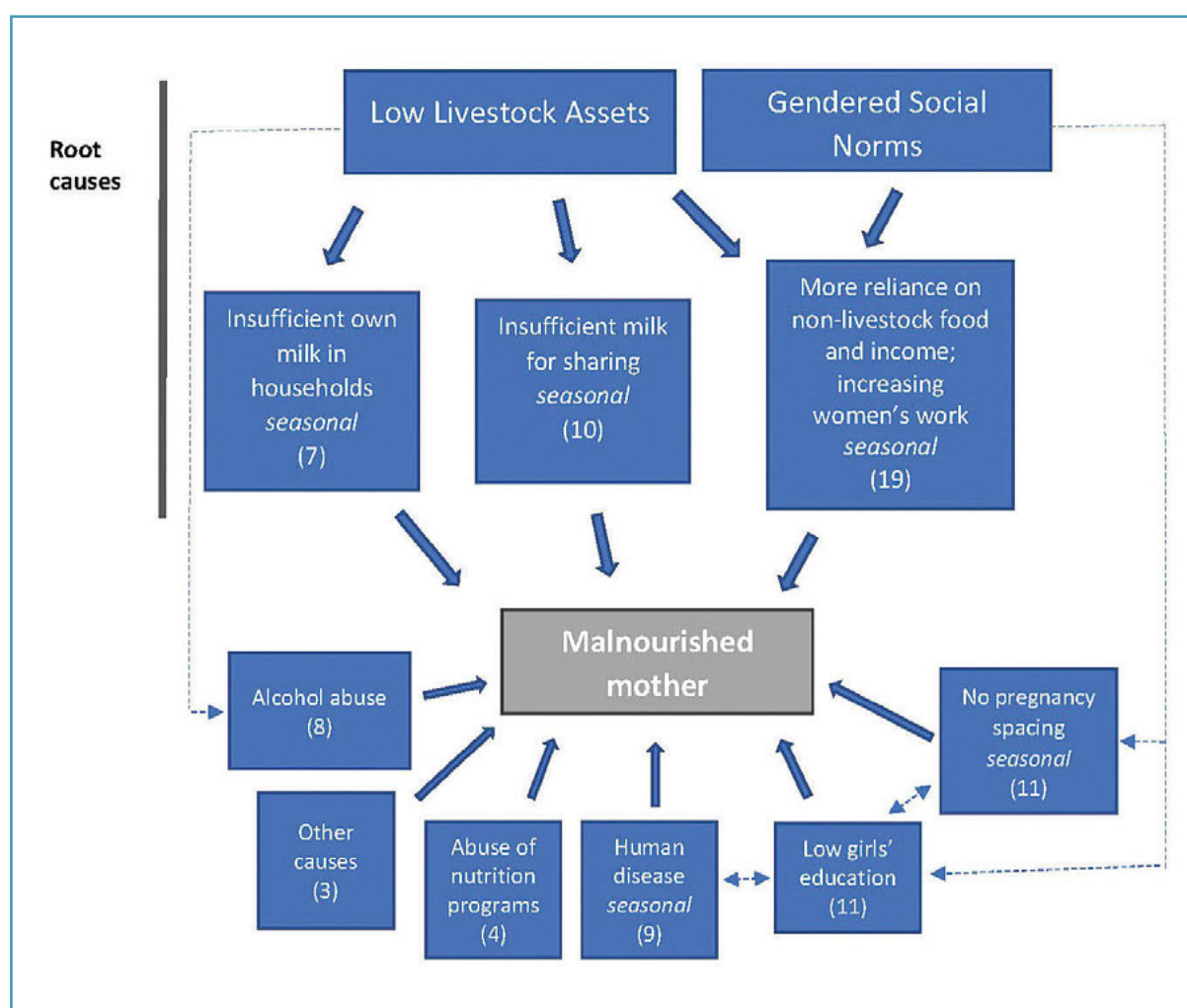**Figure 6. Causes of malnutrition in mothers, pastoralist areas.**

Table 11. Diets of healthy vs. malnourished pregnant mothers

Age category	Healthy pregnant mother	Malnourished pregnant mother
2 weeks to 3 months (first trimester)	Food types - Beans + butter—beans commonly consumed by pregnant women - Eggs - Chicken - Local brew (*kwete*) - Bananas (ripe and unripe) - Milk (fresh and sour) - Wild greens + other ingredients (salt, *ngaadekala*, butter, sorghum flour) - Meat (*akiring*) - Milk tea - *Ngichedei* + tomatoes + onions - Local brew (*ngagwe/ebutiya*) - *Ngikool* - *Malakwang* + *ngaadekala* + *ngikanyim* - Irish potatoes + butter + tomatoes - Rice + other ingredients Other factors - No diseases	Food types - Plain porridge (*ngakima*) (no sugar added) from millet or sorghum. Or just *ngimongo* and *ngapeeru* added - Wild greens (plain), only salt added - Wild tubers (plain) - Wild fruits (plain) - Sorghum flour (plain) - Local brew (*ngagwe*) Other factors - Poor family: no animals; no money to buy good-quality food - Eating just once or twice in a day - Diseases such as malaria
4–6 months (second trimester)	Same as above, but the type of food consumed at a particular time depends on the mother's appetite	Same as above, but the type of food consumed at a particular time depends on the mother's appetite
7–9 months (third trimester)	Same as above, but the type of food consumed at a particular time depends on the mother's appetite	Same as above, but the type of food consumed at a particular time depends on the mother's appetite

3.3.2.2 More reliance on non-livestock food and income sources

Being involved in non-livestock food and income activities is stressful to breastfeeding mothers, especially when their own diet is poor and if they become pregnant again. Stress from work can lead to miscarriage or giving birth to a weak/underweight child or lack of appetite. Activities such as charcoal burning and gathering firewood are risky:

> *Some trees have evil spirits and can make you run mad if you cut them. A tree can fall on you and the child, leading to disability. You are prone to snake bites or attacks by wild animals. You are prone to rape in the bush and sometimes being killed by enemies. If you are killed, your children suffer. (FGD, Kalokori village, Kotido District, July 20, 2018)*

Women prefer specific non-livestock food and income-generating activities that will make it easier for them to look after young children, including: tailoring; beadwork; businesses such as sale of items produced in the household (including membership in savings and loans groups); a job if they are educated or skilled; and cash/food for work programs, e.g., tree planting, clearing roads and digging water pans.

3.3.2.3 Gender imbalances for domestic responsibilitie

Some families have irresponsible husbands, including those who are alcoholic, disappear from home once the wife is pregnant or has given birth, or who have a traditional view that once a woman is married with cows (bridewealth), she then takes on the burden of providing for the family. Polygamy is also a contributing factor, as a husband gives more attention to some wives than others. Husbands often abandon wives they see as lazy. This leaves the abandoned wife to struggle alone with the children. Struggling for children is usually more difficult for mothers who are lazy, alcoholic, disabled, poor or first-time mothers. Furthermore, mothers are stressed due to overwork and constantly worrying about how to support the family, especially in families with many children.

Table 12. Diets of healthy vs. malnourished lactating mothers

Age category	Healthy lactating mother	Malnourished lactating mother
Just given birth (first 2 weeks)— *eroko nyedengoro*	- Plain milk - Milk tea (*echai*) - Meat and meat soup - Porridge (*uji*) + milk + butter - Chicken - Tomatoes + butter - Local brew (*ngagwe/ebutiya*)	- *Kwete* - Sorghum porridge (plain) - Beans (plain), sometimes only when provided by friends and relatives - Chicken—only if provided by friends and relatives - Occasionally other foods if has money to buy
After coming out of the house (2 weeks after delivery up to the time the child is 2 years)—*apetor*	- Meat from slaughtered goat or sheep. Also, buy meat or eat traditionally preserved meat - Meat + other ingredients + cabbage - Milk - *Uji* + sour milk - Beans - Local brew (*ngagwe/kwete*) - Wild vegetables such as *ekorete, eboo, ekiliton, ebolochete* + other ingredients, e.g., butter - Sorghum flour + vegetables + melon + *ngikool* - Tomatoes + butter - Chicken - Eggs Other factors - Responsible husband	- Local brew residue (*adakae*) - Local brew (*ngagwe*) - Sorghum flour—plain - Porridge from sorghum flour + *ngaadekala* - Plain foods - Wild vegetables + salt + sorghum flour (*nyatap*)—plain wild vegetables form the main part of the diet nowadays, given inadequacy or lack of animal proteins that used to form a good component of the diet in the past; limited access to milk - Watermelon (*ngaadekala*)—plain - *Ngikool*—plain - Occasionally other foods if money to buy - Generally, food insufficiency Other factors - Diseases

When a woman asks for support from the husband or when she has not been successful in providing for the family on a certain day, she is often beaten. Drunkard husbands commonly do this. Some husbands are naturally or habitually quarrelsome, which instils permanent fear and stress in the wife. Quarrels from co-wives augment this stress. To manage these stresses, some women turn to alcohol. Some women commit suicide.

In families with responsible husbands, sharing of responsibilities is balanced. The husband concentrates on livestock while the wife explores other ways to support the family, such as brewing for income.

3.3.2.4 Alcohol abuse
Alcohol abuse predisposes parents to irresponsible sex and increases the risk of sexually transmitted diseases such as HIV/AIDS; adultery and rape are common. Alcoholic mothers are away from home most of the time, giving less attention to their own diet and hygiene or the cleanliness of their homes. Alcohol drains the money meant for supporting the family and encourages irresponsibility. Women also noted that alcohol can affect the fetus in the womb and lead to the birth of an abnormal, retarded or foolish child. Other effects of alcohol consumption include fights and quarrels, selling a lot of grain for alcohol, family break up, disposal of assets to drink alcohol or pay alcohol debts, lack of appetite and non-spacing of pregnancies. People may also steal grain or animals from the neighborhood and sell these items to buy alcohol, which can lead to the Government taking animals from the whole village as compensation.

Women were also aware that alcohol consumption leads to diseases such as liver cirrhosis and eventually death. Cases were reported of mothers suffocating and killing children while sleeping with them while drunk. Some alcoholic men become impotent.

In the pastoralist areas, alcohol consumption was reportedly low and more restricted to men. Cows belong to men, who have the absolute authority to sell and acquire what they want, including alcohol. In some villages, there are cases where men sell cows only for alcohol. That is one reason why men do not want girls to go to school—so that they can get cows (bridewealth) to sell for alcohol, among other things. In some families where the man sells cows mostly for alcohol, boys of marriage age take a long time to

marry and consequently get frustrated and start drinking alcohol. The church has played a great role in convincing mainly women to stop consuming alcohol.

Women reiterated that the following factors contribute to increasing alcohol consumption: stress due to family problems (quarrels, women overburdened with responsibilities); the belief that alcohol increases production of breast milk; lack of food; use of alcohol to withstand longer periods of work; use of alcohol to treat malaria in children or to calm children who are stubborn or forever crying. The sale of alcohol was recognized as a lucrative and growing business, as was the influence of outsiders by drinking or selling alcohol. It was also noted that new livestock markets make money available to those who sell livestock mainly for alcohol.

3.3.2.5 Human diseases
Women relate the following health problems with malnutrition in mothers: HIV/AIDS, brucellosis, typhoid, tuberculosis, malaria, heartburn and lack of appetite during pregnancy, frequent abortions and pneumonia. Some mothers are not keen on antenatal care visits to health centers.

3.3.2.6 Spacing of pregnancies
Women saw the non-spacing of pregnancies as weakening a mother's body and stressful due to the difficulty of caring for many children. Some women viewed non-spacing of pregnancies as a major cause of malnutrition in families with irresponsible husbands and/or families with few or no animals. Non-spacing of pregnancies was also associated with drunken parents and men spending more time in the villages due to lack of animals to herd in the mobile camps. Cases of women producing children with the aim of accessing nutrition kits were also reported.

3.3.2.7 Girls' education
Women saw education as a route to a job and being able to take good care of the family. For instance, in a polygamous family where the attention of the husband is divided, an educated woman can still provide for her children. Educated women prepare delicious foods for the family, can detect early diseases that may threaten the health of the child, strictly adhere to immunization schedules, and know when and why to space pregnancies. Educated women do not engage in stressful activities such as processing of Aloe vera, charcoal burning and selling firewood, and have income to diversify into other activities such as businesses. Some women regretted that they are

suffering more because they did not go to school and do not want the same to happen to their children (girls). This is one reason why women strongly support girls' education.

3.3.2.8 Other causes
Other causes of malnutrition in mothers included the abuse of nutrition programs, while noting that nutrition programs for women are not common. Where they exist, only a few women abuse them, especially drunkards. Another minor cause was violating taboos when pregnant, including restrictions on eating certain foods such as intestines and not touching bones or meat with bones.

3.4 WOMEN'S PERSPECTIVES ON PRACTICES AND PROGRAMMING

This section details women's views of the past and current practices used to minimize malnutrition and, given the current situation, their views on preferred types of assistance from NGOs and the Government. The information was drawn from the initial ethnographic stage of the analysis as well as discussions during the participatory causal analysis.

3.4.1 Past and current use of traditional practices
3.4.1.1 For children

In the past, a milking cow was reserved for each child, especially if the mother did not produce enough breast milk or had closely spaced pregnancies. Milk and ghee/butter alone or in combination with other foods (e.g., groundnuts, melons, sorghum/maize bread, sorghum, sesame, etc.) were common foods for children. In the dry season, children were fed with preserved milk, ghee and/or a nutritious food formulation called *emuna*[24] and other traditional food formulations.[25] Less availability of animal products, especially milk and butter, has now hindered the preservation of milk and *emuna*. Traditional rituals (*ngalakasa* for Ngikarimojong) were performed when twins were born to avoid bad omens. This practice is currently discouraged by the church. NGOs and Government currently restrict the use of animal milk to feed children, citing it as a source of diseases. The alternative is to purchase milk from shops, but prices are prohibitive for families with low incomes.

Nowadays, you can make *emuna* only if you can afford to buy the ingredients from the market. Non-spacing of pregnancies was not a common cause of child malnutrition in the past. This is because people had many animals, so

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[24] Made from sorghum flour, sesame (*simsim*), groundnut paste, silverfish (*omena*), melon seeds and butter. Another type of *emuna* is made from groundnuts, white ants, cucumber seeds and butter.

[25] Other food formulations include: a recipe made of local brew residue, sunflower and butter, which is used to make porridge for children and mothers; a recipe made of maize pounded into small particles and ghee, which is good for making porridge.

access to sufficient milk was guaranteed. NGOs and Government are now advising the use of contraceptive pills, but usage is low due to resistance from husbands and women's fear of side effects. Some spacing of pregnancies was possible in the past because men used to stay away in mobile livestock camps for long periods. Following disarmament and confined livestock management, and the resulting substantial loss of livestock, more men are found in the villages throughout the year.

3.4.1.2 For pregnant and lactating mothers
In the past at birth or in the dry season, the husband slaughtered a ram for the woman; this was common among Ngikarimojong but not among the Pokot. Also, a milking cow was reserved for a breastfeeding or pregnant mother. Foods of animal origin (such as milk, butter, blood and meat) and cereals were generally available. Preserved meat was available for use in difficult times such as the dry season or droughts. Also, malnourished mothers were fed on specific types of vegetables, such as *lomaret kwang, eboo* and *lokamalakwang*, which were readily available. Traditional herbs were used to respond to ailments that could lead to malnutrition in mothers; these herbs included *lokuyen, eteteleit, ekurukwait, esekon, etheperan, etulelo, lokitela, lomooch, nyesal, etemere, nyethiaput* and *nyeliira*. Neighbors, friends and relatives were more supportive in terms of providing food and care. Women strictly adhered to certain taboos that could interfere with the child and mother. These included avoiding certain foods at pregnancy and restricting access to the baby by people with diarrhea, wounds and hearing problems.

The practices above are now undermined in various ways by irresponsible husbands, frequent droughts and other factors that have reduced the livestock population. The practices are also undermined by reduction in crop yields, reduction in wild vegetables and fruit trees, and less support from friends and relatives. However, in pastoralist areas, support from husbands (e.g., selling an animal to buy food), relatives and friends (who bring gifts at birth or intervene when problems occur during lactation) was reported to be still high. The problem of irresponsible husbands was reported more in agro-pastoralists areas and was attributed to alcoholism. Charcoal burning and sale of firewood has led to fewer trees where practiced, i.e., common among the agro-pastoralists and restricted in pastoralist areas. The most affected trees include *ekorete, ekaale, epeduru, ebobore, edurukoit, ekapelimen, etirir, erege, ekapakiteng, ekaduelae, ekadeli, engomo* and *epodo*.

A recipe made of wild fruits (such as *nyaperu, ngimongo* and *ngamalera*) and water, with or without milk or porridge, was given to lactating mothers to stimulate or increase milk let-down. Pregnant women used to gather these types of fruits before childbirth. However, nowadays, these fruits are scarce due to frequent droughts and

charcoal burning. Lactating mothers have resorted to local brew (*ebutiya*). *Ebutiya* is also taken by mothers during pregnancy and has been associated with delivery of clean and strong children, literally, *"Ebutiya washes the child well when in the womb."*

3.4.2 External interventions on nutrition
Women noted that nutrition programs were being provided by various NGOs and through Government health centers. They described nutrition interventions as follows:

For children:

- Distribution of Plumpy'nut (Moroto—*odi*; Kotido—*nyedi*), soya flour, sugar, oil and super cereals (Kotido—*ngakiria*).

- Training of village health teams (VHTs)/peer mothers/traditional birth attendants (TBAs) on detecting malnutrition and monitor progress using an arm circumference tape.

- Hospitalization of severe cases of malnutrition for close feeding and monitoring.

For mothers:

- Distribution of super cereals (Kotido—*ngakiria*), yellow posho, plus oil, lentils, cowpeas and maize for lactating mothers; distribution of sorghum and soya flour for porridge for lactating mothers.

- Distribution of hygiene kits. Include soaps, bed sheets, basins, sugar, tea leaves, Vaseline oil and underwear.

- Training of VHTs/peer mothers/ TBAs to raise awareness on or perform the following: hygiene and sanitation—body hygiene, how to keep the house and cooking place clean, building a rack for utensils, digging pit latrines; spacing of children (family planning); frequent breastfeeding of children; how to feed children well on a variety of well-cooked foods; delivery of baby in the hospital; antenatal care; use of malaria kits at village level for detection of malaria.

- Establishment of kitchen gardens for family nutrition. Grow cabbages, tomatoes, eggplants, onions, peas, cassava, etc. Also distribute tools such as jerrycans, watering cans and fencing wire for the gardens; establish group farms/demonstration gardens.

- Distribution of seeds and tools for nutrition—beans, groundnuts (Ngijie—*epuli*), maize (Ngijie—*eburet*).

When assessing the value of these interventions for reducing malnutrition, women described problems with nutrition kits, abuse of nutrition programs, weaknesses in supportive medical services, weaknesses in training and barriers to implementing external advice, as outlined below:

- Weaknesses of the nutrition kits—cases of diarrhea when children were fed on soya flour alone; expired soya flour and super cereals are distributed, with maggots and weevils, and with a sour, bitter taste. As these cause diarrhea, it is commonly diverted to make local brew; delay in distribution of kits.

- Abuse of nutrition programs—selling of nutrition kits to raise money for alcohol or to pay debts; relatives or neighbors rotate one malnourished child to get nutrition kits; children are poorly fed so to attract nutrition kits.

- Weaknesses in supportive medical services— inadequate medicines and personnel; high cost of services at church health centers.

- Weaknesses in distribution of seeds and tools for nutrition—wrong targeting of beneficiaries; most beneficiaries are the well-off, which is encouraged by the cost recovery approach and use of biased community entry points such as political leaders; inadequate seeds and tools; the poor sell their vouchers to the rich people; distribution of ineffective grain storage equipment such gunny bags, which allow weevils to attack the grain.

- Weaknesses in training related to nutrition— insufficient training on kitchen gardening; peer mothers are poorly incentivized.

- Difficulties in implementing some of the hygiene and sanitation practices:

  o Washing hands after visiting the toilet or using water for body hygiene are difficult when water is scarce.

  o Using soap for hygiene is difficult where markets are lacking or incomes are limited.

- Eating a variety of foods is difficult where markets are lacking or incomes are limited, or where men are irresponsible, e.g., they sell animals for alcohol or abandon the wife once pregnant or just after giving birth.

- Exclusive breastfeeding is difficult due to poor women's diet and non-spaced pregnancies that reduce breast milk; women are compelled to wean the child early.

- Difficulty of having toilets—difficult to dig a toilet in places with hard ground; toilets attract flies.

- Nutrition kits for malnourished children only are not practical because of food scarcity; have to share with other family members and neighbors.

- Low use of birth control pills to control pregnancies because men do not allow it; the pills also have side effects

- Lack of awareness on nutrition—men not targeted in awareness campaigns.

In addition to these challenges with nutrition interventions was the more fundamental issue that none of the interventions addressed the root causes of malnutrition, as illustrated in Figures 3 to 6. For women, good nutrition is mainly a matter of access to cows and milk, and a better balance of responsibilities between women and men in terms of providing food and income.

3.4.3 Programming ideas
Women's priorities for nutrition-related programming are summarized in Table 13. Six main types of interventions stand out, viz., direct support with relief food during drought, restocking, support to income generation, children's education and health, and stopping "gin whiskey" production. When interpreting these preferences, it is likely that women will refer to their experiences or observations of past or ongoing programs rather than propose novel interventions.

Relief food—current nutrition kits and food supply to malnourished children would fall under this type of support, but taking the weaknesses mentioned by women above into account. However, it also includes more general food relief during drought. At a general level, this preference reflects women's views that insufficient food causes malnutrition.

Restocking—including the notion of assisting traditional restocking systems. This suggestion relates very directly to the causal diagrams (Figures 3 to 6) and low livestock ownership being a root cause of malnutrition.

Support income generation—this preference relates directly to the problem of "more reliance on non-livestock food and income" in the causal diagrams (Figure 3 to 6)

Table 13. Women's preferences for nutrition-related interventions

Type of support	Proportional score (%)	
	Agro-pastoralist areas (n = 16 groups)	**Pastoralist areas (n = 8 groups)**
Distribution of food relief at difficult times—drought	21	7
Restocking by NGOs or Government, or on their own through bridewealth/friends/relatives— *"This will make men busy"*	15	16
Support income generation and businesses for women, including credit services and training in business skills	12	25
Take all children to school	10	12
Health care, hygiene and sanitation	10	18
Sensitize/talk to men to support women	7	4
Cash/food for work for both men and women—clearing roads	7	0
Stop gin whisky production	7	7
Distribute seeds and tools (ox-ploughs)—to grow enough food	5	2
Vocational training for women	2	0
Specific production for men	2	0
Birth control pills, including talking to men and sensitizing women to spacing pregnancies	1	6

Note

Figures in the table are derived from the total (summated) scores assigned to each type of support, expressed as proportions. Very low and infrequent scores were assigned to other types of support, such as maintaining peace and market access.

and women's frequent engagement in activities that produce limited income but take considerable time and effort. An important aspect of this approach is the idea that women could make choices on specific, more high-value income activities. Part of the decision-making relates to childcare, i.e., some activities enable childcare better than others. This preference also relates to the problem that poorer households with few livestock struggle to afford purchased foods, especially animal-derived foods.

Education—a range of issues were mentioned, including the specific need to improve education for girls, making education free of charge, talking to men to accept the idea of girls going to school, scholarships for girls, constructing schools closer to communities and taking girls to school when still young. This preference relates to women's recognition of the behaviors and opportunities seen in educated girls and women (see section 3.3.2.7).

Healthcare—women specifically mentioned mosquito nets, equipping health centers and establishing health centers at community level.

Relative to the causal diagrams, a greater preference for more direct gender programming might have been expected, and to some extent this is captured in the need to sensitize men to support women (Table 13). The modest scoring of this activity probably relates to the absence of high-profile or large-scale programs in Karamoja of this kind, and so women have limited knowledge on the activity or its impacts. Notably, an important aspect of the preference for restocking was that it is seen as a way of occupying men.

4. DISCUSSION

4.1 USING PARTICIPATORY EPIDEMIOLOGY TO ANALYZE MALNUTRITION

4.1.1 Reliability and validity of monthly calendars

For readers who are unfamiliar with PE, this section discusses the reliability and validity of the PE methods, with emphasis on the monthly calendar method (section 2.2.1, Figures 1 and 2).

Each monthly calendar used 12 months and 10 indicators, with each indicator "scored" across the months using 100 stones. In each case, this leads to a diagram comprising 1,000 stones (for an example, see Plate 1). Despite this complexity, women were able to construct the diagrams, score the indicators, explain the monthly variation in each indicator and explain relationships between indicators. The reproducibility of the method was assessed by measuring the level of agreement between the groups of women, with significant agreement between the independent groups for 9/10 indicators scored by agro-pastoralist women and 8/10 indicators scored by pastoralist women (Table 8). When scoring the monthly availability of goat milk, there was weak agreement between groups in all locations, but this was explained by different management of goats by some locations (section 3.2.3.2). In pastoralist areas, there was weak agreement over women's other work, but this was explained again by location-specific differences in the types of other work that women were involved in. Overall, the method showed good reproducibility.

The validity of the monthly calendar method is assessed by comparing results with secondary data and literature, and for some indicators, by assessing technical plausibility. This involves not only examining the monthly patterns of the indicators but also assessing the explanations provided by the informants. Further details are as follows.

Rainfall—results agree with rainfall as detailed in meteorological records and secondary literature. For example, an analysis of rainfall in Karamoja over 35 years concluded that the *"first phase starts in late March, with rainfall peaking in early May and then declining to a relative low in late June; second phase starts in early July, with rainfall peaking later in the month and then declining (with noticeable fluctuations) to early November."*[26]

Availability of cow milk for children—in dry, pastoralist areas, milk production in cows typically depends on the availability of water and pasture; a close correlation between rainfall and cow milk availability is expected and technically plausible.

Availability of goat milk for children—the monthly patterns shown in Figures 1c and 2c were unexpected, as we assumed that goat milk would follow a similar pattern to cow milk. However, the explanations for the pattern of goat milk availability provided by the women (section 3.2.3.2) are technically plausible, e.g., the use of supplementary feeds to ensure milk production in relatively drier months.

Availability of own sorghum (agro-pastoralist areas) or own maize (pastoralist areas)—patterns of sorghum and maize availability are consistent with the basic principles of rain-fed crop production, as well as specific descriptions of crop production in Karamoja in the literature.[27]

Women's work in their own gardens—the monthly patterns in Figures 1d and 2d are consistent the patterns of sorghum and maize availability, and the examples of agricultural tasks and time spent shown in Table 6.

Women's other work, especially work for income—the indicator is difficult to verify against secondary literature because it is a composite indicator, comprising different types of work. (e.g., see Table 7).

Occurrence of child malaria and diarrhea—in dryland areas, the incidence of malaria and diarrhea are associated with mosquito populations and exposure to contaminated water and related pathogens, respectively; the correlations shown in Figures 1a and 2a are technically plausible.

Occurrence of human births—human pregnancies and births show seasonality in both low-income and industrialized countries;[28] the birth pattern shown in Figures 1b and 2b is consistent with research on birth seasonality in neighboring Turkana, Kenya.[29] A level of biological adaptation is expected in pastoralist populations that rely heavily on livestock milk and where human births coincide with rainfall and therefore, with peaks in milk production.

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[26] Chaplin et al., 2017.

[27] Robinson and Zappacosta, 2014.

[28] For example, see Dorelién, 2013.

[29] Leslie and Fry, 1989.

Occurrence of child malnutrition—the source of information on child malnutrition in Karamoja is the biannual FSNA surveys. Since 2010, the reports have reported lower point prevalence of GAM in May/June relative to November/December. This is broadly consistent with the levels of child malnutrition in these months shown in Figures 1 and 2. Note that the figures have no y-axis scale, and the lowest level of malnutrition (or any other indicator) shown does not necessarily mean a level of zero. The peak of child malnutrition at the end of the dry season in January–February is consistent with other pastoralist areas of East Africa[30] and shows a clear technical plausibility given the reliance on livestock milk. In agro-pastoralist areas (Figure 1), the extended period of malnutrition (December to June) relative to pastoralist areas (December to April) (Figure 2) relates to a higher reliance on crops in agro-pastoralist areas but low crop production, due to the small areas of land cultivated and frequent drought.[31] The patterns of child malnutrition are also supported by women's explanations of these patterns by reference to food availability (section 3.2.3) and the difference in diets between healthy and malnourished children and mothers (Tables 10 and 11).

4.1.2 Hidden peaks and sequencing

In general, the findings from the monthly calendars show strong technical plausibility but also show at least three patterns and relationships that have not been previously reported in Karamoja to our knowledge.

Peak in malnutrition—overall, the monthly calendar method complements the FSNA surveys by showing malnutrition and related indicators throughout a year but critically, the results show a peak in malnutrition in January–February that is not currently detected by the surveys. If the FSNA surveys aim to detect the highest and lowest levels of malnutrition in agro-pastoralist and pastoralist areas of Karamoja, the surveys would need to take place in January–February and again in October–November.

Birth patterns—the pattern of births in Karamoja is highly seasonal, with births corresponding closely to rainfall and the availability of cow milk (Figures 1c and 2c). This adaptation has probably evolved in response to the rainfall pattern and the high reliance on livestock milk, and so has a clear biological logic. However, the problem of persistent malnutrition in Karamoja can be explained at least in part by the persistence of this birth pattern as livestock ownership has declined. Instead of children now

being born into a time of milk abundance, they are born into a time of milk scarcity. The "peak" in cow milk availability is only a peak for those with enough cows or other access to cow milk. Also, children are born into a period when milk is limited, but also when grain stores are low and grain prices are relatively high; for children reaching weaning age in the dry season, this coincides with low availability of milk and own cereals. At present, women have limited control over birth spacing.

Disease and malnutrition—the peak of child malnutrition at the end of the dry season does not coincide with peaks in diarrhea or malaria, which are most prevalent in the wet season (Figures 1a and 2a. Furthermore, in agro-pastoralist areas, a decline in malnutrition between March and May coincides with rising incidence of diarrhea and malaria. This timing of events indicates that these health problems are not root causes of malnutrition. From a clinical perspective, cases of malnutrition would be exacerbated by malaria or diarrhea and vice versa, and diarrhea and malaria are important health problems irrespective of malnutrition. This indicates the need for public health and sanitation, not least because access to health and clean water are basic rights. It also indicates that a health-focused approach to malnutrition might have marginal impact.

4.2 CAUSES OF MALNUTRITION AND PROGRAMMING IMPLICATIONS

The causal diagrams show that women explain malnutrition mainly from the perspective of the limited availability of livestock and milk, and social norms that make them overburdened with the work of childcare and finding food for the family (Figures 3 to 6). These two root causes of malnutrition are interlinked and cascade down into various other issues and problems. In particular, the limited livestock ownership has a direct impact on food availability because milk supply is insufficient and also forces households towards more non-livestock sources of food and income, which traditionally are the domain of women. These non-livestock activities include crop production, but on small plots and with high risk of rain failure,[32] and a range of other activities that often involve considerable effort for limited reward[33]—and which often hinder childcare. This situation then creates another layer of nutritional risk for unweaned children, because while their mothers are away working, they are cared for by siblings or other relatives. For these children, cow or goat milk would be an important replacement for breast milk

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[30] Sadler et al., 2009; Young and Marshak, 2018a.

[31] Cullis, 2018.

[32] Cullis, 2018.

[33] For example, see Iyer and Mosebo, 2017, for accounts of very low wage rates for casual and unskilled labor in Karamoja.

during these periods of separation, but livestock holdings are few and milk is absent or in short supply. As indicated in section 3.3.1.2, women might be separated from their children for up to two days. Further problems have their roots in livestock-gender issues such as loss of cattle affecting men's self-identity and sense of purpose, men spending more time in villages than in the past and more consumption of local brew and hard liquor.[34] In turn, this leads to even more violence towards wives and a continued non-spacing of pregnancies. For women, increasing workloads, the stress associated with finding food and income, and the risk of violence from husbands also leads to alcohol abuse.

Looking specifically at livestock ownership, a recent KRSU study estimated a livestock threshold for agro-pastoralist households in Karamoja; the threshold is the minimum level of livestock ownership per person needed to sustain the household with food and income independently of external support or non-livestock/crop activities.[35] For the estimated livestock threshold of 3.3 Tropical Livestock Units (TLU) per person:

- 56.5% of households in agro-pastoralist and pastoralist areas of Karamoja owned less than the threshold and so could be categorized as "livestock poor."

- The analysis showed a skewed ownership of livestock towards wealthier households. For example, the wealthiest 30% of households owned 69.3% of livestock in terms of TLU. This pattern of ownership is similar to some pastoralist areas of Ethiopia and Kenya, where comparable data are available.

- Among poorer households, below the 3.3 TLU/capita livestock threshold, livestock ownership was skewed away from the threshold. For example, 47% of these households owned only 1.2 TLU/capita or less.

- 13% of households owned no livestock at all.

The findings in the causal analysis of malnourished children and mothers (Figures 3 to 6) are broadly consistent with the livestock threshold analysis. While the low and skewed livestock ownership reported in the latter was discussed in terms of poverty traps affecting households with insufficient livestock assets, the concept of

a "malnutrition trap" might also apply to these households. Pressures on agro-pastoralism in Karamoja have been reported for decades[36] and include the long-term studies on human adaptation and changing diets and decline in milk,[37] and conflict-livelihoods research that also includes descriptions of changing diets and limited milk availability.[38]

Women's suggestions for programs to support nutrition reflect their causal analysis of malnutrition. They emphasize food, livestock assets and income generation, followed by health and education, and reducing alcohol consumption (Table 13). While women also mentioned activities to sensitize men, the relatively low preference for this activity might relate to its limited presence in Karamoja to date; women have not observed a large-scale men's sensitization program around gender issues nor are they familiar with the potential impacts of such a program. For agencies currently implementing nutrition programs in Karamoja, the analysis raises the question of consistency between women's preferences for nutrition-related support and what the current programs actually provide. The analysis also raises the question of the impact of nutrition programs and to some degree explains the persistence of GAM in Karamoja despite substantial investments in nutrition. An understanding of the seasonality of livelihoods and nutrition, and the interplay between livestock ownership, milk, and gender and work explains the persistence of "malnutrition traps" in Karamoja. It indicates the need for an area-wide nutrition strategy that places greater emphasis on the root causes of malnutrition and far greater participation of women in the analysis of malnutrition and program design.

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[34] Iyer et al., 2018.

[35] Catley and Ayele, 2018.

[36] For example, Muzaale, 1987; Sandford, 1988.

[37] Gray and Sundal, 2017.

[38] Stites and Mitchard, 2011.

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ANNEX I. LOCATIONS

LOCATIONS OF FOCUS GROUP DISCUSSIONS

Agro-pastoralist areas, language Ngikarimojong:

Moroto District

- Natedewoi village, Rupa Sub-county—2 FGDs
- Nawanatau village, Nadunget Sub-county—2 FGDs

Kaabong District

- Nasinyonoit and Mogos villages in Kapedo Sub-county—3 FGDs
- Wusaki village in Kalapata Sub-county—3 FGDs

Kotido District

- Rikitae village in Panyangara Sub-county—3 FGDs
- Losilang village in Kotido Municipality—3 FGDs

Pastoralist areas, language Pokot:

Amudat District

- Anguruma village, Loroo Sub-county—2 FGDs
- Lityei village, Amudat Sub-county—2 FGDs
- Akuule village, Amudat Sub-county—2 FGDs

LOCATIONS FOR PE METHODS

Agro-pastoralist areas, language Ngikarimojong (n = 16 women's groups):

Moroto District

- Naachuka village, Nadunget Sub-county
- Loowoi village, Rupa Sub-county
- Toreikinae/Napetaregae village, Tapac Sub-county
- Atedru village, Nadunget Sub-county
- Nangorikipi village, Nadunget Sub-county
- Kadilakeny village, Rupa Sub-county
- Rata village, Katikekile Sub-county
- Lomuria Ke Ekor, Moroto Town Council

Kotido District

- Nariwokitoe village, Kotido Municipality
- Kalokori village, Nakapelmoru Sub-county
- Adome village, Panyangara Sub-county
- Kotopae village, Kacheri Sub-county
- Gelangole village, Rengen Sub-county
- Nakongumutu Central, Napumpum, Panyangara Sub-county
- Lodera village, Kotido Municipality
- Kongesia village, Panyangara Sub-county

Pastoralist areas, language Pokot (n = 8 women's groups):

Amudat District

- Cheiwak village, Amudat Sub-county
- Dingidinga village, Karita Sub-county
- Motany village, Amudat Sub-County
- Kaaron village, Amudat Sub-county
- Katabok village, Amudat Sub-county
- Kaichom village, Karita Sub-county
- Nakiwangaret village, Loroo Sub-county
- Namosing village, Loroo Sub-county

ANNEX 2. FIELD GUIDE FOR MONTHLY CALENDAR

1. **Preparation**
   Before going to the field,
   a. Collect information on local terminology for months, and be ready to use this terminology.

   b. Prepare diagrams to represent each month, and be ready to explain these diagrams to the informants.

   c. Prepare diagrams to represent the indicators for the seasonal calendars, or use objects to represent the indicators. Be ready to explain the meaning of each diagram or indicator.

   d. Have several bags of counters ready, with bag containing 100 counters (e.g. 100 stones).

Key point – most or all informants will be illiterate. Use diagrams and verbal dialogue; do not use any written words.

2. **Make a 1-year line by month**
   The method is done on the ground. Make a long line on the ground to represent a "Normal year". Place the diagrams for each month along the line, and:
   a. Explain the meaning of the line and the diagrams to the informants

   b. Check their understanding e.g. point to a diagram and ask *"Which month is this?"*

   c. If there is any misunderstandings, explain the diagrams again, and until there is a good understanding of the diagrams/months.

3. **Scoring of Rainfall – the first indicator**
   a. Select "Rainfall" as the first indicator.

   b. Place the Rainfall diagram on the left side of the months, and explain the meaning of the diagram.

   c. Select a bag of 100 counters. Ask the group to distribute the counters to show the pattern of rainfall by month. A month with a lot of rain should be given a lot of counters, whereas a month with no rain would have no counters. The group should use all 100 counters.

   d. Leave the group for about 5-10 minutes to distribute the counters. Only intervene if the group need clarification of the method.

e. During the scoring there will be a lot of discussion among the group. Listen carefully to the discussion, but do not interfere. Key issues should be recorded.

f. When the group has finished the scoring, ask further questions to check that scores are clear. Follow up any interesting score or relationships with open and probing questions.

Note – the seasonal calendar is a visual method. Do not ask the group to count the counters when distributing them across the months. Instead, ask them to use the counters to show the "pattern" of how the indicator varies by month.

4. **Scoring other indicators**
   a. Leave the counters for Rainfall in place – do not remove them.

   b. Select another indicator, and explain the diagram for this indicator. Check that the informants understand the meaning.

   c. Take another bag of counters and ask the group to distribute the counters against the months for the indicator.

   d. Again, give them enough time to distribute the counters and don't interfere. Listen to their discussion as they do the scoring, and record any key points.

   e. When the scoring has finished, ask questions to check the scores, and explain the reasoning behind the scores.

Repeat this process for each of the following indicators:

Indicator	Explanation	Examples of key questions
1. Rainfall	Pattern of rainfall by month	No key questions.
2. Availability of cow milk for children	This indicator is self explanatory, and aims to show the variation in milk supply during the year.	What happens for poor households with no cows, or very few cows?
3. Availability of goat milk for children	This indicator is self explanatory, and aims to show the variation in milk supply during the year.	What happens for poor households with no goat, or very few goats?
4. Availability of own sorghum (Karamoja) or maize (Pokot)	This relates to own production of cereals, and the availability of these cereals for home consumption.	Is all of the sorghum/maize grown in the gardens eaten at home? Is any of the sorghum/maize sold? Is any of the sorghum used for brewing?
5. Women's work in own gardens	To include land preparation, planting, weeding, harvest etc.	For months when workload is very high, how many hours/day do women spend in the gardens? For women who are breast feeding, how do they manage the child at this time?
6. Women's other work	This covers activities related to income generation, other farming activities and so on.	Same or similar to above.
7. Occurrence of child malnutrition	This indicator should show when most cases of child malnutrition are seen	Why does child malnutrition have this pattern across the months?
8. Occurrence of child diseases – malaria	This indicator should show when most cases of child malaria are seen.	Why does child malaria have this pattern across the months?
9. Occurrence of child diarrhea	This indicator should show when most cases of child diarrhea are seen.	Why does child diarrhea have this pattern across the months?
10. Births	This indicator should show when most births occur during the year. Are births distributed evenly across the months, or, are there certain months with more births?	Why do most births happen during these months? Look carefully at the pattern of births against the availability of foods, and women's labor demands. Does the timings of births match good availability of food, especially milk? Does it match low labor demands? If not, discuss and probe these issues. *What is the ideal time to give birth relative to the availability of milk and labor demands?*

Note – the examples of key questions are mostly open questions. They use words such as *"Why?", "How?"* to open up discussion.

Supplementary proportional piling

Related to indicators 2, 3 and 4 in the seasonal calendar, a quick proportional piling can be used to gather further information.

Indicators 2 and 3, about animal milk: *"In the last year, what was the pattern of households with enough access to milk vs. households with insufficient access to milk?"*

Indicator 4, about sorghum/maize: *"In the last year and among poorer households, what was the pattern of sorghum that was consumed vs. sold vs. used for brewing?"* Adjust the question for Pokot as needed.

See the guideline on proportional piling for more information in this method.

5. **Repeating the method**
    In the malnutrition study, the seasonal calendar will be repeated with different groups of women in different locations.
    a. When repeating the method, it is important that:

        •   the same diagrams are used each time to show the months and the indicators

        •   the same indicators are used

        •   the same numbers of counters are used.

    b. When asking questions to check the information in the seasonal calendar, these questions can vary from place to place.

6. **Recording the information**
    Three types of information need to be recorded:
    a. When the group is scoring each item, listen to their discussion and record any key or interesting points e.g. their reasons for placing the counters in a particular way.

    b. Record all of the scores against the indicators and months.

    c. With the follow up questions, record the questions asked and the responses.

7. **Options for triangulation**
    Rainfall (indicator 1) – the scores can be compared with actual monthly rainfall data for a "normal year".

    Child malnutrition (indicator 7) – compare the scores with data monthly demand for nutrition kits, monthly distribution of kits, or health records on cases of child malnutrition.

    Births (indicator 10) – use local health records to compile frequencies of antenatal visits by month, or similar data.

ANNEX 3. LOCAL NAMES FOR MONTHS

English name	Local name version 1 Ngikarimojong	Local name version 2 Ngikarimojong	Local name Pokot
January	*Lokwang*	*Lokwang*	*Muu*
February	*Lodunge*	*Lodunge*	*Tirtir*
March	*Lomaruk*	*Lomaruk*	*Popokugho*
April	*Titima*	*Lochoto*	*Rikisa*
May	*Yeliyel*	*Titima*	*Porowo*
June	*Lomodokogech*	*Yeliyel*	*Melwon*
July	*Losuban*	*Lomodokogech*	*Sikuku*
August	*Lotiak*	*Lopoo*	*Mikeyon*
September	*Lolobai*	*Losuban*	*Tapach*
October	*Lopoo*	*Lotiak*	*Kipsich*
November	*Lorara*	*Lorara*	*Kokelian*
December	*Lomuk*	*Lomuk*	*Kweghe*