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MILK MATTERS
The Impact of Dry Season Livestock Support on Milk Supply and Child Nutrition in Somali Region, Ethiopia

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USAID FROM THE AMERICAN PEOPLE

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Photo credits

Kate Sadler, Emily Mitchard, and Fiona Flintan (for cover photo of children drinking milk)

Contents

LIST OF ACRONYMS

ANOVA	Analysis of Variance
CMAM	Community-based Management of Acute Malnutrition
ETB	Ethiopian Birr
IEHR	International and Refugee Health Branch of the Center for Disease Control
IRB	International Review Board
FEWS NET	Famine Early Warning Systems Network
FGD	Focus Group Discussions
FIC	Feinstein International Center
MUAC	Mid-Upper Arm Circumference
NGO	Non-Governmental Organization
PI	Principal Investigator
PIA	Participatory Impact Assessment
PSNP	Protective Safety Net Programme
RAIN	Revitalizing Agriculture/Pastoral Incomes and New Markets
SAM	Severe Acute Malnutrition
SCUK	Save the Children UK
SCUS	Save the Children USA
UNICEF	United Nations Children's Fund
UNOCHA	United Nations Office for Coordination of Humanitarian Affairs
USD	United States Dollar
WAZ	Weight-for-Age Z Score
WFP	World Food Programme
WHO	World Health Organization

SUMMARY

Children who live in pastoralist areas are increasingly referred to as some of the most nutritionally vulnerable in the world. In Somali Region, Ethiopia, levels of global acute malnutrition among young children are regularly reported to rise above 15 percent, the level defined as a nutritional emergency by the World Health Organization. Yet from work going back many decades in the Region, we know that animal milk, one of the most nutritionally complete foods in the world, plays an extremely important role in the diets of these children. Whilst there is considerable research and early warning literature that highlights the importance of livestock and livestock products for the income and the dietary intake of pastoralists in Somali Region, there is little work that describes use of these products within and amongst households, or that attempts to evaluate the significance of access to milk for the nutritional status of children. Phase I of the Milk Matters study investigated the value and use of milk in these communities (*Milk Matters: The Role and Value of Milk in the Diets of Somali Pastoralist Children in Liben and Shinile, Ethiopia*). Importantly, it established that, when available, milk is prioritized for consumption by young children and that the seasonal lack of access to animals and animal products, exacerbated during periods of drought, is widely perceived by pastoralists as a primary factor behind child malnutrition.

Building off the results of this first phase, the second phase of Milk Matters consisted of two cohort studies designed to assess the impact of community-defined livestock interventions on the nutritional status of young children over the dry season in the Somali Region of Ethiopia. Where the international response to malnutrition has typically been reactionary in these areas, with the provision of a food basket and establishment of selective feeding as acute malnutrition rises, this study aimed to reveal the potential cost savings, both short and long term, economic and social, of a more preventative approach. The results of our work demonstrate that by targeting support to milking animals that stay close to women and children during dry season and/or drought, milk production and consumption among children is improved and their nutritional status benefits.

The main findings include:

- *Milk availability improved in intervention sites*
  - Milk off-take in the intervention sites was significantly greater during the 2011 dry season with the intervention, compared to the 2010 dry season with no intervention
  - Milk off-take was sustained through late lactation periods
  - Participants attributed the increase in milk off-take to the intervention.

- *Milk consumption by young children improved in the intervention sites*
  - By the end of the intervention, a greater proportion of children were consuming milk in the intervention sites as compared to the control sites
  - Those children who received any milk in the intervention sites consumed, on average, more milk than children in the control site.

- *Overall, nutritional status of children receiving milk stabilized over the dry season*
  - There was an overall trend towards stabilized nutritional status among young children over the course of the intervention compared with a steeper decline in status in the control sites
  - Within the intervention sites, those children who continued to consume some milk throughout the intervention time period maintained higher average nutritional status than those who did not receive any milk, a difference that was frequently significant.

- *The cost of the interventions was significantly less than therapeutic feeding programs*
  - Direct costs of the interventions were estimated to be 45 to 75 percent less than those estimated for therapeutic feeding programs (community-based management of acute malnutrition)
  - While difficult to measure, the study also revealed important indirect benefits of this

type of preventive response, e.g., improved maternal well-being that directly impacts the health of young children and protection of critical livestock with important livelihoods benefits
- Challenges in implementation of the interventions that led to higher direct costs suggest important opportunities to reduce costs and improve effectiveness of this type of intervention in the future.

INTRODUCTION

Animal milk has long been recognized as an important component of pastoralist diets across the world (Sadler, Kerven et al. 2010). At the same time, milk is a nutrient-dense food and is known to contribute a high proportion of the nutrients, such as high quality protein and micronutrients, required by the many pastoralist groups that rely on it (Galvin, Coppock et al. 1994; Fratkin, Roth et al. 2004; Barasa, Catley et al. 2008). However, children who live in pastoralist areas of Africa are increasingly referred to as some of the most nutritionally vulnerable in the world, and nutrition surveys in Eastern Ethiopia (SCUK 2007; Ethiopian Health and Nutrition Research Institute, UNICEF et al. 2009) and other pastoralist areas of Africa (Grobler-Tanner 2006; Mason, Cercone et al. 2008) have long identified seasonally high rates of acute malnutrition. Seasonal variation in livestock milk production has also been well described in the literature on pastoralism in Africa, with milk supply falling as the dry season advances (Chell and Chell 1979; Arhem 1985; Catley 1999). This work indicates that the main risk period for child malnutrition is the late dry season in many pastoralist areas. The nutrition and humanitarian literature explains pastoralist child malnutrition by reference to a broad spectrum of direct causes that include the health environment and disease, infant feeding and maternal caring practice, and reduced availability of milk and cereals, but have rarely examined the relative importance of these causes. Whatever the specific causes, the dominant nutrition response from the international aid community to malnutrition in these areas continues to be the delivery of an often limited commodity food basket that rarely includes a protein or fatty acid source suitable for infants and young children. Despite acceptance of the urgent need for risk reduction and drought mitigation, there is still little understanding of which interventions in the medium to long term should be prioritized to improve the health and nutritional status of children in these settings. Moreover, international and national policy guidance on child nutrition in pastoralist areas, especially in Ethiopia, is hindered by a dearth of evidence on how best to address the needs of these widely marginalized and poorly understood pastoral populations.

As part of Save the Children's African Region Pastoral Initiative,[1] the "Milk Matters" project is a joint venture between the Feinstein International Center at Tufts University, Save the Children USA, and Save the Children UK in Ethiopia. The Milk Matters project aims to improve the nutritional status of children in pastoralist/semi pastoralist areas of Ethiopia through demonstrating an explicit link between livestock health, milk availability and access, and child nutrition; the research described in this report was conducted in the Somali Region of Ethiopia (Sadler, Kerven et al. 2009). In common with other pastoralist groups across the world, a substantial portion of the income and the dietary intake of Ethiopian/Somali pastoralists is derived from livestock and livestock products. Various reports estimate that, on average, pastoralists in the Region consume between 20 and 50 percent of their energy requirement as milk and animal products in a normal rain year (Webb and Braun 1994; SCUK and DPPA 2002; SCUK and DPPA 2002; SCUK 2007). Previous work under the Milk Matters project has found that this reliance on milk extends particularly to the diets of young children and that young children are often prioritized for the milk that is available (Sadler and Catley 2009). However, findings also confirmed the work of other research groups on the importance of seasonality for access to milk, with the hungry season falling at the end of the dry season when milk availability is low and animals are in relatively poor condition (Devereux 2006; SCUK 2007; Mason, Chotard et al. 2008). Whilst the Somali pastoralists who participated in this project perceived a direct and important association between reduced milk

[1] The goal of Save the Children's Africa Region Pastoral Initiative is to "deepen and replicate innovative approaches to improve access to basic services and reduce vulnerability to drought in pastoralist populations in order to create positive change for children in this unique and harsh environment."

intake and weight loss among their young children, they also articulated what they felt to be the most effective way to address this: that is, through the maintenance of the health and nutritional status of their livestock. They identified broad areas for possible intervention, including animal health, fodder production, and water supply that, in their opinion, could help to maintain the supply of milk to children during the dry season and drought. The separation of larger stock such as camels from young children during seasonal migrations was also highlighted as an important factor that disrupted children's access to animal milk. It is these areas therefore that formed the basis of the design of interventions tested in this next phase (Phase II) of the work.

Whilst many agencies, including Save the Children, have implemented programs that aim to improve food security and nutritional status at the community level and of children in pastoralist areas (Dejenu 2004; Admassu, Nega et al. 2005; Abebe, Cullis et al. 2008; Bekele and Tsehay 2008; Catley, Abebe et al. 2009; Bekele 2011), work that has specifically aimed to improve milk supply to pastoralist children is scarce. In addition, it is rare that any of these programs have actually documented impact on the final outcome indicator of child nutritional status. This gap limits understanding of the possible benefits of these projects on child nutrition and helps to keep the focus of nutrition programming in these communities on treatment of undernutrition rather than prevention.

This report will begin with a brief summary of the objectives and methods of this study, followed by presentation of the results, and a discussion of the challenges and lessons learned. It concludes with recommendations for future nutrition programming.

OBJECTIVE

The goal of the Milk Matters project is to contribute to improvements in policy and programming for child nutrition in pastoralist regions of Ethiopia. The objective of this study (Phase II of the project) was to evaluate the impact of community-defined livestock interventions on child nutritional status during the dry season. In doing so, the study asked two primary research questions:

1. What is the impact of livestock interventions on children's consumption of animal milk over one calendar year, particularly during the dry season?
2. What is the impact of livestock interventions on children's nutritional status over one calendar year, particularly during the dry season?

In addition, the study sought to compare the costs of an early intervention focusing on livestock health and milk production with an emergency-feeding program for children. This assessment is addressed in the discussion portion of the paper.

A key assumption that underscores question one is that in times of scarcity such as during the dry season, available milk is prioritized towards young children. This assumption has been validated through previous Milk Matters research (Sadler and Catley 2009). Investigating the impact of the livestock interventions on children's consumption of animal milk thus rests on assessing two separate but related outcomes: (1) did milk off-take increase as a result of the interventions, and (2) did children in the intervention sites consume more milk than those in the control site.

The Milk Matters project involved distinct phases, each characterized by specific methodology: (1) site, household, and milking animal selection; (2) implementation of cohort studies; and (3) evaluation. Table 1 summarizes the methods used in each phase.

Table 1: Milk Matters' Phases and Methods

Phase	Methods	Description	Primary Purpose/Activities
Study site, household, and milking animal selection	Proportional piling	Participatory ranking method in which participants distribute stones across defined variables to show proportional impact due to that variable	To compare seasonal milk off-take; to establish proportional influence of certain factors on the reduction in milk off-take (e.g., animal disease, nutrition, and/or birthing patterns); to understand milk use and distribution within households
	Map scoring	Participatory method combining visualization and proportional piling; Participants draw seasonal movements of herds and populations and place stones on the map to reflect the proportional distribution of livestock and children by season	To understand the typical movements of children less than five years of age in the selected communities and identify the livestock species kept at closest proximity to children by season
	Key informant interviews	Semi-structured interviews	To probe around topics of seasonal milk off-take, milk use in the household, seasonal movements of people and animals, and access to basic resources
Cohort studies implementation	Monthly surveillance	Three questionnaires completed monthly for each child: (1) anthropometric measurements; (2) milk consumption; (3) infection status	To provide routine monitoring of nutritional status and confounding factors for all participating children (intervention and control sites)
	Interventions	Supplementary feeding and health care provision for animals in identified intervention sites over the dry season	To test the hypothesis that the nutritional status of children will remain stable or improve if access to and availability of milk is maintained
Evaluation	Participatory impact assessment	Checklists with participatory methods focused on how many/which animals were fed and the milk off-take per species of animal	To assess if there was any change in milk off-take in the intervention sites during the intervention period
	Focus group discussions	Semi-structured interviews	To probe around the reasons for the change seen in milk off-take and consumption by children

Selection of Study Sites, Participant Households, and Milking Animals

Six sites were chosen purposively from amongst communities located in Liben and Shinile Zones of Somali Region, Ethiopia (Figure 1). Both areas are subject to similar environmental patterns, most notably an arid climate and bimodal rainfall pattern with low annual rainfall (Table 2).[2] Certain characteristics common to the pastoral livelihood exist in the communities in these regions, including an element of mobility for at least some members of each household, a livelihood strategy based on livestock production, and a diet that includes relatively large amounts of animal products. It was established previously that during a typical dry season, the men take the majority of the large livestock far from the settlement site in search of pasture and water. The women and children remain at the homestead to protect them from the challenges of travelling long distances. Typically a few goats and cows remain with the women and children during this time, with the specific role of maintaining a minimum level of milk supply.

Figure 1: Targeted Zones for Milk Matters Study

Table 2: Seasons in Somali Region, Ethiopia

Season	Months	Description	Notes
Jilaal	January–March	Dry; no rain	Livestock are cheap because pasture and water are scarce; higher incidence of animal diseases; greater household food insecurity
Gu	April–June	Heavy rain	High livestock prices because pasture and water are abundant; animals calving and producing more milk
Hagaa	July–September	Dry; little/no rain	Animals lose weight, livestock prices fall
Deyr	October–December	Small rain	Rain volume is usually less than in Gu and rains last for shorter periods of time.

[2] Annual rainfall varies by year depending on the occurrence of droughts and by zone within Somali Region. Between 1979 and 2008, average annual rainfall in the northern zone of Shinile, measured in the town of Dire Dawa, was 634 mm and ranged from a low of 357 mm to a high of 956 mm. Over the same period of time in the southern Liben Zone average annual rainfall, measured in the town of Filtu, was 424 mm and ranged from 272 to 592 mm (rainfall data courtesy of the Ethiopian National Meteorology Agency, Addis Ababa, Ethiopia).

The study sites were sampled from within these zones to meet the criteria listed below:

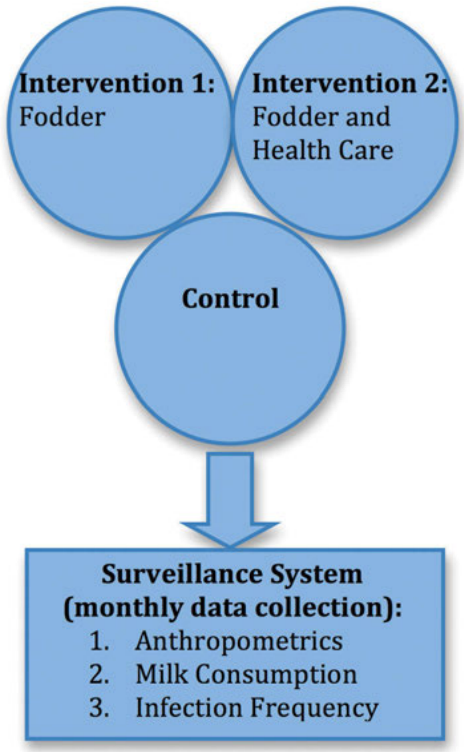
1. A pastoral livelihood;
2. Targeted for assistance under SCUS Protective Safety Net Program (PSNP) and SCUK Revitalizing Agriculture/Pastoral Incomes and New Markets (RAIN) program in Liben and Shinile respectively;
3. Population size greater than 200 households;[3] and
4. Vulnerability to elevated rates of child malnutrition during the dry season, as indicated through regional nutrition assessments (Ethiopian Health and Nutrition Research Institute, UNICEF et al. 2009).

Site selection was completed in December 2009 in consultation with local government officials, SCUS (Liben) and SCUK (Shinile), and local communities. As far as possible, sites with a similar level of access to basic resources such as pasture, water, health care, and education services were selected. Once the sites were determined, the households and primary milking animals that would be targeted for interventions in four of the six sites were selected. Selection of households was also done in consultation with local officials and community members, with a focus on inclusion of all households with children under the age of five years.

Design of the Interventions and the Nutritional Surveillance

Two cohort studies were implemented, one in each targeted zone, Liben and Shinile, of the Somali Region. In each cohort study, children living in designated intervention sites were exposed to livestock interventions over the dry season, while children in the control sites were not. The Milk Matters' surveillance system followed all participating children in intervention and control sites on a monthly basis for one calendar year, June 2010 to June 2011 (See Figure 2). Overall, the surveillance system aimed to follow 940 children, 610 living in intervention sites and 330 living in control sites.

Figure 2. Cohort Study Design



Intervention Design

Based on the results of map scoring during site selection, small ruminants and cows were prioritized as the target species for the livestock

Table 3. Animal Species Targeted per Intervention Site

Animal Species	Liben		Shinile		Total*
	Washaqabar	*Biyoley*	*Ayiliso*	*Waruf*	
Cows	13	112	72	110	307
Goats	352	0	40	0	392

* *Totals do not include the offspring of targeted milking animals, which were also fed during the intervention.*

[3] It was determined that a community with at least 200 households would ensure the desired sample size of 150 children/site.

interventions (Table 3).[4] Households with goats were encouraged to keep three or four goats as the equivalent of one cow, based on estimations of milk off-take by species. The particular milking animals at each household were selected for support according to the following set of criteria: (1) recently lactating; (2) with a normal milking yield; and (3) in overall good health with no problems that could compromise milk production.

Two livestock interventions were designed. In two of the four designated intervention sites (Waruf in Shinile and Biyoley in Liben), the milking animals were given a daily ration of supplementary feed over the dry season. In the other two intervention sites (Ayiliso in Shinile and Washaqabar in Liben), the milking animals were given a daily ration of supplementary feed plus a package of vaccinations and de-worming medications at the outset of the dry season.[5] The two remaining sites were designated as control sites and received no intervention.

Targeted milking animals in all intervention sites continued to receive basic health care provided by trained community animal health workers and supported under PSNP and RAIN projects. Sudan grass was chosen as the feed type because of its high nutritional value and suitability for the environmental conditions of the region. The ration sizes were originally set at six and two kilograms for cows and goats respectively, under the assumption that the feed would supplement natural grazing and browsing; these rations were based on livestock feeding guidelines for drought by the Ethiopian government (Ministry of Agriculture and Rural Development 2008). It was expected that animals would be fed at the locally constructed and managed feeding centers twice daily and were also expected to graze on natural pastures during the rest of the day. The calves and kids of the targeted milking animals were fed half of the ration given to the adult. The package of vaccinations and medications differed also by milking species and is detailed in Table 5 on the next page. The intervention was planned to last 105 days in all intervention sites.

The occurrence of a drought in 2010/11 necessitated changes to the original design of the interventions. First, the interventions in both regions were extended to a total duration of 146 days in Shinile and 135 days in Liben. However, actual animal feeding throughout this period of time was only 70 days in Waruf, 47 days in Ayiliso, and 73 days in each of the two Liben sites. The reasons for the site-specific reduction in actual days of feeding will be discussed below. Secondly, the feed ration of Sudan grass was increased in the Liben sites as a result of the earlier onset of the drought, and the provision of feed was extended in Shinile using a smaller ration of wheat bran due to the prolonged drought conditions (Table 4). Finally, due to unexpected frost during the growing season in Shinile, Rhodes grass was purchased instead of Sudan grass due to its availability on short notice from Sululta, a city just north of Addis Ababa and approximately 500 kilometers from the sites in Shinile.

Table 4. Final Feed Rations (kg/day) for Milking Species

	Liben *Sudan grass*	**Shinile** *Rhodes grass*	**Extended Feeding (Shinile Only)** *Wheat bran*
Adult cow	9	6	3
Adult goat	3	2	1
Calf	3	2	
Kid	2	1	

4 Map scoring established that despite the value placed on camel milk for its availability throughout the dry season, accessibility is the critical concern. During a typical dry season, camels generally accompany the lead herd while goats and cows remain closer to the settlement, thus becoming the primary sources of milk for children over the dry season.

5 Animal feed was provided in all sites based on the fact that animal health care alone would do little to improve milk off-take if the animal remained malnourished, but that extra health provisions in addition to feed may improve milk off-take compared to animals receiving only feed.

A. Feed procurement and delivery

Due to the large quantity of feed required and the sensitivity of the intervention timeline, the selected feed/hay providers were required to have irrigation capacity. In Liben Zone, agricultural cooperatives were contracted to grow and deliver the entire quantity of feed for the duration of the intervention. In Shinile, the original contract was awarded to a private grower and two small farmer cooperatives near Jijiga, but was later re-awarded to a private contractor in Sululta for Rhodes grass as a result of unanticipated frost in the Jijiga area during the growing season (see discussion). The care and shelter of the grass hay upon delivery to the sites was tasked to community members in each intervention site. Both SCUS and SCUK provided assistance in building the shelters for the hay. Participating households were responsible for providing the milking animals with sufficient water.

B. Medications procurement

An advisory team of veterinary experts, in consultation with community members, created the package of health interventions. Private vendors of veterinary drugs were contracted to maintain a consistent supply of the designated prophylactic drugs throughout the dry season. Incorporating the operational voucher system established by SCUS and SCUK in the respective regions, trained community animal health workers used vouchers to purchase the medication. The Ethiopian Government Bureau of Livestock, Crop and Rural Development provided the vaccinations.

Weighing bundles of Sudan grass in Liben Zone

Surveillance System

Approximately 940 children aged 6 to 59 months participated in the 13-month surveillance system. The data from the first two months was discarded from the final analysis as data collectors were effectively still undergoing training in administering the questionnaires and collecting anthropometric measurements.

A. Selection and training of data collectors

A key feature of the pastoral livelihood, mobility,

Table 5. Vaccinations and Medications for Milking Species

Care Type	Cattle	Goats
Vaccination	Anthrax, blackleg, contagious bovine pleuro-pneumonia (CBPP), Lumpy Skin Disease (LSD)	Contagious caprine pleuro-pneumonia (CCPP), capri pox, peste des petites ruminants (PPR)
Prophylactic treatment	Ivermectin (internal and external parasites)	Ivermectin (internal and external parasites)
Other curative treatment	Treatment provided with diagnosis throughout the dry season	Treatment provided with diagnosis throughout the dry season

allows families to move as necessary to areas with adequate pasture and water. These seasonal movements are well known amongst the community, and fellow pastoralists are the most reliable source of knowledge on the whereabouts of other community members. It was thus determined that community members would be best positioned to collect data from children on a monthly basis. Five data collectors were nominated per intervention site, six in each control site, based on a demonstrated ability to read and write. Of the 32 total data collectors, two were women and 30 were men. Each data collector was assigned approximately 25 to 30 children to follow, where possible, on a monthly basis for the duration of the intervention.

In May 2010, a three-day training was conducted in which the data collectors were trained in the standardized collection[6] of anthropometric measurements using hanging weight scales and mid-upper arm circumference (MUAC) bands. They were also instructed on how to assess children for signs of severe acute malnutrition (SAM) and the appropriate referral mechanisms for treatment, how to use graduated cylinders for measuring milk consumption, and how to administer the three household questionnaires, described below. Finally, they were provided with and instructed to read a verbal consent script to each participating family.[7] Data collection did not begin until signatures from all households were obtained. Data collection was closely supervised for the duration of the surveillance by field staff located in Dollo Ado and Dire Dawa.

B. Data collection on child health and diet

Three questionnaires were used to collect data on child health and diet: anthropometrics, milk consumption, and infection status (see appendices 1–3). The design of the questionnaires was based on extensive formative research conducted during Phase I of the Milk Matters project (Sadler and Catley 2009). Approximate ages (in months) of the children were established in the first round of data collection by reference to the local definitions of the seasons (see Table 2) and through use of community-established "landmark events" to determine the year. In addition to the anthropometric measurements of weight and MUAC, mothers were asked each month if the child was breast-feeding, if the child had experienced any episodes of fever, coughing, or diarrhea in the past two weeks and if so, how many times,[8] and how much milk the child had consumed yesterday. Milk consumption was broken down into plain milk, family tea, "special tea," milk with cereal, and "other" milk products.[9] For consumption of plain milk, family tea, and special tea, mothers were asked to state each episode of milk consumption by time of day, the type of milk (cow, goat, or camel), and the approximate quantity consumed. The total quantity of liquid consumed was estimated using water and a graduated cylinder and the proportion of milk was later calculated using established ratios of milk to tea (Table 6). For milk with cereal and other milk products, amount consumed was recorded simply as the total number of episodes during the whole day. The consumption

Table 6: Milk Consumption Measurement Methodology

Milk Type	Measurement Technique	Estimated Proportion of Milk
Plain milk	Graduated cylinder	100%
Family tea	Graduated cylinder	20%
Special tea	Graduated cylinder	75%
Milk with cereal	Number of times consumed	--
Other milk products	Number of times consumed	--

[6] MUAC and weight measurements were standardized, using the methods laid out by Habicht, for all data collectors against a "gold standard" trainer to improve accuracy and precision. Habicht, J. P. (1974). "Standardization of quantitative epidemiological methods in the field." Boletin de la Oficina Sanitaria Panamericana. Pan American Sanitary Bureau 76(5): 375-384.

[7] The study received ethical approval from the Tufts University Institutional Review Board (IRB).

[8] In previous Milk Matters research, communities identified diarrhea, fever, and cough as the top three diseases affecting children.

[9] Again, previous Milk Matters research revealed that, when available, milk is added to most complementary foods given to children, and processed into cheese, butter/ghee, and yoghurt, which are also fed to children.

questionnaire employed a 24-hour recall period, and the infection questionnaire used a two-week recall period.

C. Surveillance procedures

The surveillance system was designed to follow set procedures each month. At the beginning of the month, the data collectors received new questionnaires, one set of three for each child under his/her surveillance. The data collectors then spent between 10 and 15 days visiting the households of the participating children and administering the questionnaires. A supervisor and data entry clerk per region were responsible for cross-checking the collected data for errors and entering the data in the software program, Epi Data, prior to the twenty-fifth day of the month. In the last week, the data was sent to the project coordinator in Addis Ababa and on to the principal investigator (PI).

Baseline Characteristics of Study Participants

The following baseline data was collected on characteristics such as sex, age distribution, and

Table 7. Baseline Data—August and September 2010

	Liben			**Shinile**		
	Washaqabar	*Biyoley*	*Makinajab (control)*	*Ayiliso*	*Waruf*	*Fadhato (control)*
Total sample size (N):	144	145	170	163	176	189
Sex: male (%)	48.6	53.8	45.3	53.4	51.1	51.6
Breast-feeding: (% of 6–24 mo.)	54	64	77.5	53.8	47.4	50.0
Sample size by age groups: 6–24 mo. (% of total N)	50 (34.7)	50 (34.5)	40 (23.5)	30 (23.9)	38 (21.6)	40 (21.2)
25–36 mo. (% of total N)	37 (25.7)	35 (24.1)	37 (21.8)	37 (22.7)	38 (21.6)	29 (15.3)
37–48 mo. (% of total N)	40 (27.8)	43 (29.7)	41 (24.1)	49 (30.1)	53 (30.1)	60 (31.7)
49–59 mo. (% of total N)	17 (11.8)	17 (11.7)	52 (30.6)	38 (23.3)	47 (26.7)	60 (31.7)
Mean WAZ in Sept. (SD)	–0.843 (1.23)⋆	–1.529 (1.23)	-1.133 (1.13)	–0.891 (0.97)	–0.687 (1.07)	–0.965 (0.95)
Proportion of children receiving any animal milk (%)	72	55	45	85	85	38
Mean Daily Milk Consumed	831.6	843.44	631	885.1	698.25	511.98
(mL) in Sept. (SD)	(426.13)⋆⋆	(275.79)⋆⋆	(266.19)	(311.59)⋆⋆	(321.69)⋆⋆	(197.98)

+ Mean milk consumption estimates are for children who received any milk.
⋆ P <0.05 comparing intervention site with control site.
⋆⋆ P <0.001 comparing intervention site with control site.

PIA: discussing milk off-take with and without intervention

breast-feeding status, as well as mean weight-for-age z scores by site (Table 7). For average WAZ, the difference at baseline was statistically significant in only one site, Washaqabar versus Makinajab (the control). Average daily milk consumption at baseline, on the other hand, was statistically different in all intervention sites compared to the control site. The trends over the year-long surveillance will be discussed in the results section.

Fluctuations in monthly sample size from a total of 852 children to 1001 over the 11 months of surveillance, detailed in Table 8 below, were the result of several factors: (1) children traveled too far away for data collectors to follow on a monthly basis; (2) children were added at six months of age or graduated from the surveillance at five years of age; (3) parents refused to participate with their children; and (4) a child died. In total, four children died during the course of the surveillance, one from snakebite, one from serious complications after medical treatment for SAM, and two from conditions un-related to malnutrition. The vast majority of fluctuations were the result of movement by families and children.

Evaluation

Participatory Impact Assessments

Participatory impact assessments (PIAs) were conducted in all sites between June and August 2011. The primary objective was to assess if there was any change in milk off-take in the intervention sites during the intervention period, and the reasons for the change. These questions

Table 8. Sample Sizes per Site for 11 Months of the Surveillance, 2010–2011

Month	Liben			Shinile			Total
	Washaqabar	*Biyoley*	*Makinajab*	*Ayiliso*	*Waruf*	*Fadhato*	
Aug	144	145	170	163	176	189	987
Sep	153	157	174	163	174	180	1001
Oct	149	153	172	157	170	181	982
Nov	150	147	175	152	169	159	952
Dec	152	147	171	142	167	165	944
Jan	159	163	166	134	160	154	936
Feb	152	162	168	138	161	151	932
Mar	147	162	167	136	153	151	916
Apr	154	166	168	134	148	145	915
May	152	170	168	137	137	148	912
Jun	149	169	161	114	133	126	852

were investigated through the use of a checklist accompanied by participatory methods and focus group discussions (FGDs) (see Table 1). Interviews were conducted in all six sites, intervention and control. Given the dispersion of households and limited timeline for the PIA, households were interviewed as encountered. In total, between 31 and 48 households were interviewed in each of the six sites.

The checklist designed for the intervention sites included questions on the number and species of animals fed during the intervention, amount of feed received, whether feed was independently purchased, and household uses of milk from targeted animals. Average daily milk off-take was measured using graduated cylinders: participants were asked to fill the graduated cylinder with water to reflect daily milk off-take for an identified species at the beginning, middle, and end of this dry season, and then to repeat the exercise to reflect average daily off-take seen last dry season for the same species when there was no intervention. In the control sites, the questionnaire asked households if and how many animals were kept at the homestead during the dry season months and whether feed was independently purchased. No milk off-take measurements were taken in the control sites.

The FGDs in the control sites focused primarily on exploring external factors that may have influenced milk production. In the intervention sites, the FGDs probed community perceptions around the implementation and effectiveness of the intervention, in addition to the external factors influencing milk off-take results.

Data Analysis

Monthly data from the surveillance system were entered in the field using the software EpiData

Table 9. Summary of Key Variables Measured in Study Sites

Variable	**Liben**			**Shinile**		
	Washaqabar	*Biyoley*	*Makinajab (control)*	*Ayiliso*	*Waruf*	*Fadhato (control)*
Livestock milk supply -Milk off-take	Goat milk previous dry season (3 months) and dry season during intervention (3 months)	Cow milk previous dry season (3 months) and during dry season during intervention (3 months)	Not measured	Cow milk previous dry season (3 months) and during dry season during intervention (3 months)	Cow milk previous dry season (3 months) and during dry season during intervention (3 months)	Not measured
Child milk consumption -Proportion (%) of children receiving milk -Amount of milk consumed by children	5 months pre-intervention followed by 5 months during intervention					
Child nutritional status -WAZ						

and then analyzed in SPSS software version 19. The data was cleaned and weight-for-age z-scores (WAZ) were calculated using the combined software EpiInfo/ENA (Emergency Nutrition Assessment) provided by the Center for Disease Control International and Refugee Health (IEHR) Branch. Final data analysis involved interpretation of trends over time using charts and graphs created with Excel and SPSS, and assessment of statistical significance between intervention and control sites using independent samples t-tests and ANOVA. Qualitative methods using proportional piling were converted into quantitative measures and results were analyzed in Excel. Table 9 summarizes the key variables assessed over the duration of the study.

The results of the Milk Matters study are presented below in four sections by intervention site. Each of these four sections is further sub-divided into three parts:

- Milk off-take—focuses on the impact of the interventions on milk off-take in the intervention sites
- Milk availability—presents the results of the intervention on milk consumption
- Nutritional status—assesses the impact of the intervention on nutritional status of young children.

Note that the "dry season" is hitherto interchangeable with "intervention period," and that all months leading up to dry season are referred to as the "pre-intervention period." The intervention period in Shinile extends over the months of February through June with the provision of Rhodes grass (in July, animals were fed a smaller ration of wheat bran due to ongoing drought conditions). In Liben it extends from January through May with animals receiving a ration of Sudan grass (refer to Table 4). Importantly, while the intervention period was designed to correlate with the dry season, the occurrence during 2010/2011 of a drought in both intervention areas meant that the dry season began earlier, was more intense, and lasted much longer than normal, with crucial implications for the impact of the interventions.

Washaqabar, Liben Zone

Key Findings:

- Livestock milk off-take in Washaqabar was significantly greater during the dry season/drought in 2011 with the intervention, compared to the previous year dry season in 2010 with no intervention.
- Milk was more available to young children in Washaqabar compared with the control site, with 94 percent of children receiving milk compared to 56 percent in the control, and each child consuming on average 366 more mL of milk per day than in the control.
- The nutritional status of children in Washaqabar remained relatively stable during the intervention, compared with declining nutritional status among children in the control site.

Milk Off-take

Goats were the most commonly owned milking animals in Washaqabar; 90 percent of the households preferred that we support goats and not a cow for the intervention. Three to four goats were targeted for each household. Table 10 presents the average reported daily milk off-take per goat during the intervention compared to average daily milk off-take in the previous dry season. There was a significant improvement with the intervention, with off-take increasing by, on average, 2000 percent compared to the previous year. In the PIA and FGD, the general consensus among participants was that the increase in milk off-take was attributable to the project.

Other results from the PIA interviews include the following: (1) 67 percent of households interviewed said that they independently purchased feed for animals to supplement that provided by the intervention;[10] and (2) participants acknowledged water shortages throughout the intervention period, stating that animals had to travel on average ten kilometers to reach water.

The most likely non-project factor that could have resulted in better milk off-take in the intervention year would have been better

[10] In three of four intervention sites, as well as one of the control sites, over half of the households independently purchased feed for their cattle, a notably positive trend. It is recommended that future work explore intra-household decision-making processes around feed purchases and how best to support this trend.

Table 10. Milk Off-take in Washaqabar

Livestock Type	Stage of Lactation	Mean Daily Milk Off-take (mL) *Dry season, 2010, no intervention (95% CI)*	*Dry season,[b] 2011, with intervention (95% CI)*	Percent Change
Goat[a]	Early	224 (190.5, 257.6)	628 (473.8, 782.9)	280[c]
	Middle	54 (24.5, 84.2)	567 (428.3, 706.6)	1050[c]
	Late	8 (0.0, 20.2)	382 (317.6, 446.6)	4775[c]

a Because a goat yields less milk than a cow, three goats were considered equivalent to one cow during the intervention. The above yield estimates are for one goat.
b The 2011 dry season became a drought (see Table 11).
c Significant at the 95% confidence level.

rainfall, leading to better browse and water. It follows that a comparison of rainfall in 2009/10 and 2010/11 in or around the project sites would be useful. Table 11 presents average monthly rainfall for the town of Dollo Ado, located very near to the study sites, and indicates drought conditions between January and March 2011, with much less rainfall than in the previous year. While official rainfall data was unavailable for the 2010 Deyr season (October through December), other sources, including the United Nations Office for Coordination of Humanitarian Affairs (UNOCHA) weekly Humanitarian Bulletins, indicated a general failure of the 2010 Deyr rains in many parts of the Somali Region, including Liben Zone (UNOCHA-Ethiopia 2010-11). With the failure of the Deyr rains compounded by the clear drought in Jilaal in 2011, we observed that very little browse and pasture was available for animals during the intervention relative to the previous dry season.

Table 11. Average Monthly Rainfall in Dollo Ado*

Season	Months	2010 Average Monthly Rainfall (mm)	2011 Average Monthly Rainfall (mm)
Jilaal	Jan	0.00	0.00
	Feb	85.2	0.00
	Mar	164.5	0.00
Gu	Apr	64.3	55.5
	May	26.1	29.1
	Jun	0.00	[missing]
Hagaa	Jul	[missing]	[missing]
	Aug	[missing]	[missing]
	Sep	[missing]	[missing]
Deyr	Oct	[missing]	[missing]
	Nov	[missing]	[missing]
	Dec	[missing]	[missing]

*Rainfall data provided courtesy of the Ethiopian National Meteorology Agency, Addis Ababa, Ethiopia.

Milk Availability

Milk availability for children in each site is measured as a function of both the percent of children receiving milk and the average daily amount of milk consumed by those children receiving milk. Overall, milk availability in the intervention site in Washaqabar was better than in the control site in Makinajab, with more children receiving milk and each child on average consuming greater quantities of milk per day through the dry season (January through May). As seen in Figure 3, both sites experience a decline in percentage of children receiving milk (denoted by the shaded regions), as well as in the average amount of milk consumed (solid lines) during the pre-intervention period. The comparative trend between the two sites begins to diverge at the beginning of the intervention in January. In Washaqabar, the percent of children receiving milk climbs by 31 percent, from 63.2 percent in December to 94.1 percent in May. By contrast, in Makinajab, the percentage receiving milk initially declines before rising to 56 percent in May, a total change of about 20 percent. The average amount of milk consumed by children receiving milk in Washaqabar also improves from 793 mL/day to 1034 mL/day in May, contrasting with the gradual decline seen in Makinajab. In summary, over the intervention period, more milk was available and was thus distributed to a greater number of children in Washaqabar. This allowed each child to receive more on average than children in the control site. The small peak in percentage of children receiving milk in November seen in both sites is likely the result of intermittent rainfall in these areas in October 2010.

Disaggregating the data by age groups for both sites over the intervention months confirms the assumption that milk is prioritized towards young children (Figure 4). In both the intervention site and the control site, a greater proportion of children under the age of three years old continue to receive milk compared to older children.

Table 12 presents the average daily milk off-take per household from the PIA data, the average amount that was recorded as consumed by each child from the surveillance data, and the average proportion of children receiving milk in targeted households over the five months of the intervention according to the surveillance data.

Figure 3: Milk Availability in Washaqabar vs. Makinajab (control)

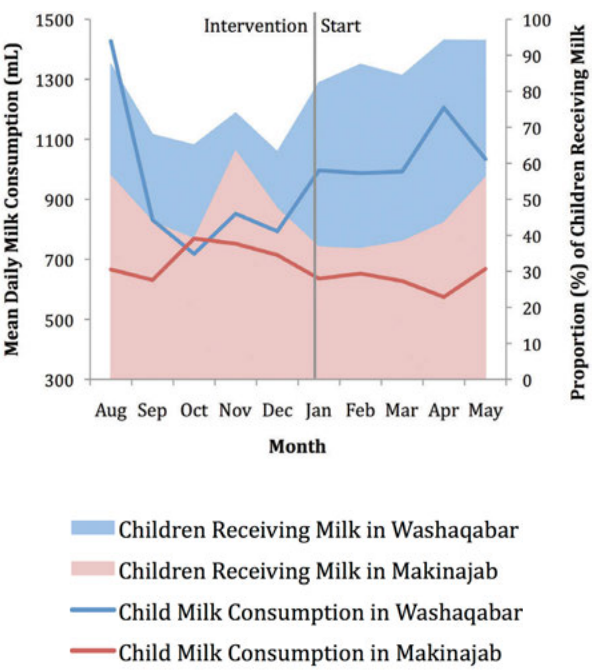


Figure 4: Average Percent of Children Receiving Milk during the Intervention Period by Age Group: Washaqabar vs. Makinajab (control)

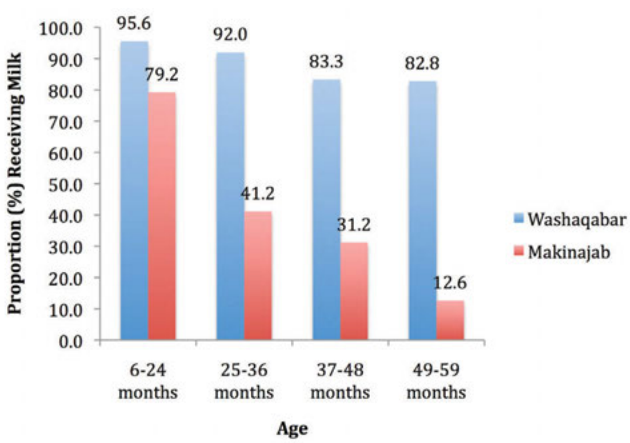


Table 12: Comparison of Milk Off-take and Milk Consumption Results, Washaqabar

Milk off-take/household/day (mL)	1577*
Milk consumed/child/day (mL)	1043
% children receiving milk	89

*Average of 394 to 525 mL per goat and households kept three to four goats.

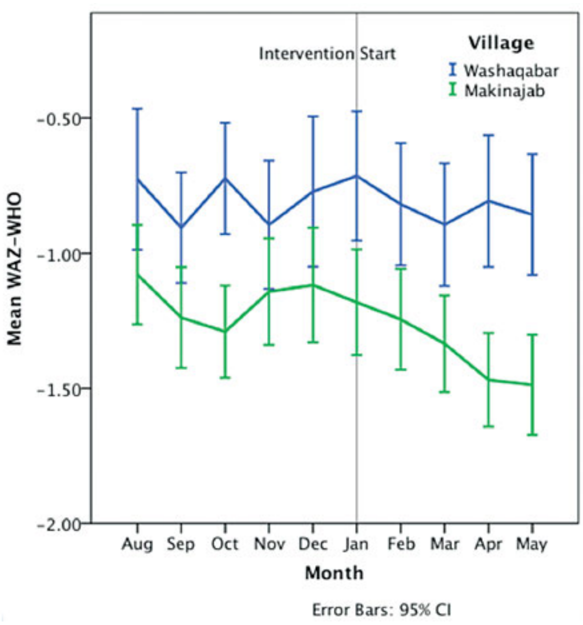
Under the assumption that there was an average of two children per household and that all available milk was given to children under five years of age, each child in a household in Washaqabar should have received roughly 790 mL of milk per day [1577 mL/2], according to the PIA milk off-take data. The surveillance data confirms that a high proportion of the children targeted did in fact receive milk and that each child received 1043 mL/day. Whilst this is not an exact "match," when the error around each measure is taken into account, the two estimates are within a reasonable range of each other.

Nutritional Status

Pre-intervention nutritional status was relatively stable in both the intervention and the control site (Figure 5). However, with the start of the dry season in January 2011, the average weight for age z-score (WAZ) of children in the Makinajab control site started to decline, with an overall decrease of 0.31 points between January and May. In contrast, the average z-score fell by only 0.07 points from January to May in the Washaqabar intervention site.

Whilst the average WAZ of children was significantly lower in the control site for 10 of the 11 months of surveillance, the difference in mean WAZ between the two sites grew to over 0.6 points during the intervention period compared to 0.4 point difference on average during the pre-intervention months (Figure 5).

Figure 5. Nutritional Status of Children in Washaqabar vs. Makinajab (control)



Biyoley, Liben Zone

Key Findings:

- Cow milk off-take in Biyoley was significantly greater during the dry season/ drought in 2011 with the intervention, compared to the previous year dry season in 2010 with no intervention.
- Milk availability for children improved more in Biyoley during the intervention months than in the Makinajab control site, with significantly more milk allocated to each child (433 mL more milk per child per day) by the end of the intervention.
- In both Washaqabar and Biyoley, the nutritional status of children who received milk was significantly greater than those who did not receive milk for all of the intervention months.

Milk Off-take

All households in Biyoley chose to keep a cow to be fed by the project for the duration of the intervention. Table 13 presents the average daily milk off-take per cow during the intervention compared to the previous dry season. There was a significant improvement with the intervention, with milk off-take increasing by on average 994 percent compared to the previous year. During FGDs, participants from Biyoley widely attributed this improvement to the project feed. Additional results from the interviews include: (1) 64 percent of households purchased feed independently; (2) because households were widely dispersed and had to travel lengthy distances to the feeding center, participants had a difficult time keeping calves from sucking on the journey home; (3) the region was affected by serious water shortages aggravated by the distances to the feeding sites; and (4) many project households shared milk with households not targeted by this intervention. The implications of these results will be discussed in greater detail below.

Referring back to the rainfall data presented in Table 11, we can attribute the increases in milk off-take in the Liben Zone sites to the project interventions and not to any improved pasture and water availability.

Milk Availability

During the pre-intervention months, the overall trend in milk availability in both Biyoley (intervention site) and Makinajab (control site) was that of decline (Figure 6). Over the intervention months in the control site milk availability increased only modestly: the proportion of children receiving milk increased by 20 percent from December to May, but the average amount of milk consumed by each child declined by nearly 7 percent over the same months. In contrast, the daily amount of milk consumed by children in Biyoley during the intervention period increased by 100 percent, from 525 mL/day in December to 1100 mL/day in May. The proportion of children who received milk also increased from 1.4 percent to 46 percent; this was a substantial increase (44.6 percent) considering that drought periods are usually associated with low or no milk supply to

Table 13. Milk Off-take in Biyoley

Livestock Type	Stage of Lactation	Mean Daily Milk Off-take (mL) *Dry season, 2010, no intervention (95% CI)*	*Dry season,[a] 2011, with intervention (95% CI)*	Percent Change
Cattle	Early	638 (483.8, 792.0)	2197 (1954.8, 2439.4)	344[b]
	Middle	293 (161.5, 424.6)	2251 (1923.4, 2577.9)	768[b]
	Late	46 (0.0, 135.7)	860 (688.6, 1032.3)	1870[b]

a The 2011 dry season became a drought (see Table 11).
b Significant at the 95% confidence level.

Figure 6: Milk Availability in Biyoley vs. Makinajab (control)

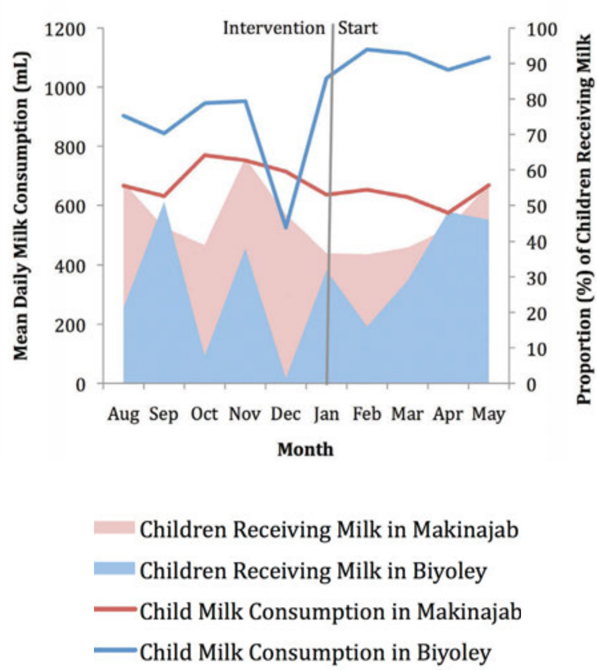
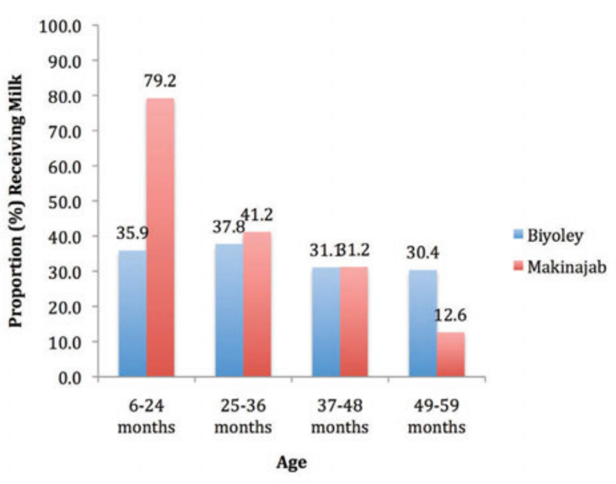


Figure 7: Average Percent of Children Receiving Milk during the Intervention Period by Age Group: Biyoley vs. Makinajab (control)



children. The overall proportions of children receiving milk and the erratic pattern seen in Biyoley, in which the percent of children receiving any milk varies widely from month to month, is presumed to reflect sharing of limited milk with children not participating in the project. This will be discussed at greater length in the following section. In both sites, the peak in November is likely the result of intermittent rainfall in October 2010.

The pattern of prioritizing milk by age group over the duration of the intervention can be seen in Biyoley, although less dramatically than in the control site (Figure 7). Again, sharing of milk with non-project households may have affected these results.

Under the assumption that there was an average of two children per household and that all available milk was given to children under five years of age, each child in a household in Biyoley should have received roughly 885 mL of milk per day [1770 mL/2], according to the milk off-take data. However, according to the surveillance data, each child consuming milk received 1085 mL/day (Table 14). The PIA interviews in Biyoley revealed that milk was also shared widely with households not targeted by this project. If this finding is true, it is possible that at least one child (perhaps the younger of two) was receiving around 60 percent (1085mL) of the milk produced in each household and the remaining milk was shared with young children in those households outside the intervention.

Table 14. Comparison of Milk Off-take and Milk Consumption Results, Biyoley

Milk produced/household/day (mL)	1770
Milk consumed/child/day (mL)	1085
% children receiving milk	34

Nutritional Status

For the entire duration of the surveillance, the average WAZ of children in the intervention site, Biyoley, was lower than that of children in the control site, Makinajab (Figure 8). For three of the five pre-intervention months and three of the five intervention months, the difference in mean WAZ between the two sites was statistically significant. During the pre-intervention period, nutritional status in Biyoley remained stable, before beginning to decline during the intervention period at approximately the same rate as seen in the control. The lack of improvement or stabilization in the intervention site is likely to be the result of the fact that on average only 34 percent of the children targeted by the project in Biyoley received any milk at all during the intervention months (see Figure 6). In the control, over 42 percent of children consumed milk, albeit at lower quantities.

Given the low percentages of children who received milk in the intervention site of Biyoley, we looked at the difference in nutritional status between those children who received milk and those who did not in both intervention sites in Liben Zone, Washaqabar and Biyoley. Average WAZ scores for those receiving milk were consistently higher than for those who did not receive milk and significantly so for all five months of the intervention (Figure 9).

Figure 8. Nutritional Status of Children in Biyoley vs. Makinajab (control)

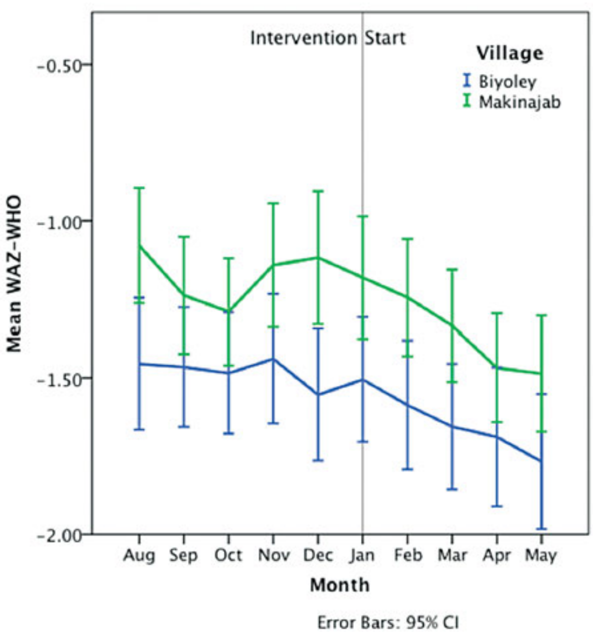
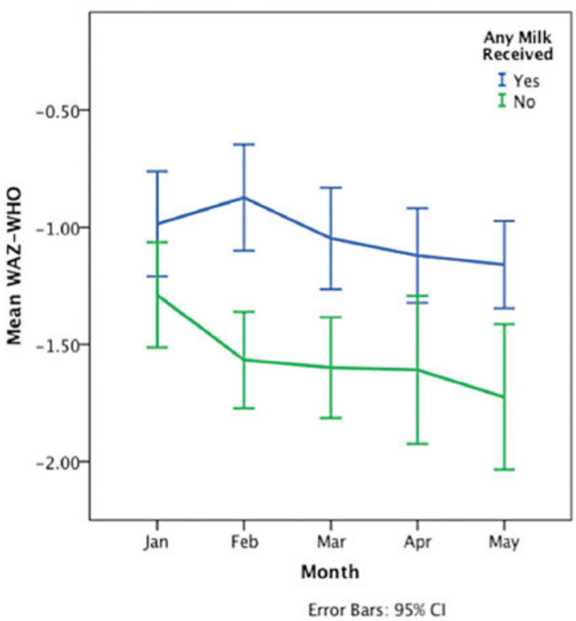


Figure 9. Nutritional Status of Children Who Received Milk vs. Those Who Did Not in Washaqabar and Biyoley



Ayiliso, Shinile Zone

Key Findings:

- Milk off-take from cows was significantly higher during the mid- and late dry season in 2011 with the intervention, compared to the dry season in 2010 with no intervention.
- Milk availability for young children in Ayiliso increased relative to the control site in Fadhato, especially in children less than three years old; by the end of the intervention, the average daily amount consumed by children was significantly higher in Ayiliso compared to Fadhato.
- While nutritional status of children declined in both villages during the drought in 2011, WAZ scores declined less during the intervention months in Ayiliso compared to Fadhato.

Milk Off-take

Cows were the most commonly-held milking animals in Ayiliso; 85 percent of the households preferred that we supported one cow with this intervention and not goats. Table 15 presents the average milk off-take in Ayiliso, and shows significant increases in off-take during the middle and late dry season in 2011, with the intervention. Participants in FGDs also attributed the increase in off-take to the intervention. During the PIA, participants revealed that some households took feed away from the feeding center, meaning animals were fed at home without oversight from the project staff. This may have contributed to lower production as feed was shared with other animals.

Additional results generated from the PIA interviews include the following: (1) 66 percent of households interviewed said that they had independently purchased feed for animals to supplement the feed provided by the intervention; (2) water shortages and cattle migration were major issues that disrupted the intervention; (3) feed distribution was interrupted in the Shinile Zone for a total of 20 days; and (4) hay delivered early in the project was of poor quality.

In the control site Fadhato, the PIA revealed that 81 percent of households purchased feed independently. This is the largest proportion of households that purchased feed independently of all sites. Moreover, participants in the control site, Fadhato, revealed that vouchers given by SCUK as part of the PSNP were used to buy additional livestock feed during the dry season. The suspected outcome is that milk off-take was likely improved in the control site above and beyond that seen in a typical dry season, with important consequences for the study. This will be discussed at length in the discussion section, and indicates the practical difficulty of a research project controlling events in a control site.

As discussed for Liben Zone, rainfall leading to better browse and pasture is the most likely non-project factor that could have resulted in better milk off-take during the intervention period. Monthly average rainfall data in the Shinile Zone was available for Dire Dawa, a

Table 15. Milk Off-take in Ayiliso

		Mean Daily Milk Off-take (mL)		
Livestock Type	**Stage of Lactation**	***Dry season, 2010, no intervention (95% CI)***	***Dry season,[a] 2011, with intervention (95% CI)***	**Percent Change**
Cattle	Early	649 (384.1, 914.0)	1060 (809.3, 1311.4)	163
	Middle	409 (255.8, 561.7)	801 (614.8, 988.0)	196[b]
	Late	251 (158.3, 344.5)	540 (404.3, 675.9)	215[b]

a The 2011 dry season became a drought (see Table 16).
b Significant at the 95% confidence level.

town located approximately 80 to 100 kilometers from the three study sites (Table 16). As in Liben, very little rain was recorded during the dry season months corresponding to the intervention in 2011 and much less than that seen during the dry season the previous year. The January 2011 Ethiopia Food Security Outlook Report from the Famine Early Warning Systems Network (FEWS NET) reported poor water availability during the 2010 Deyr season, suggesting that pasture was likely scarce and fast depleting by the 2011 dry season. Thus it is very unlikely that rainfall leading to better pasture and grazing was the cause of the improved production seen here.

Milk Availability

During the intervention months, the change in the proportion of children receiving milk from February to June was higher in Ayiliso (4.6 percent compared to 0.8 percent in Fadhato), as was the amount of milk consumed by children (an increase of 226 mL/day in Ayiliso compared to no change in Fadhato) (Figure 10). As mentioned previously, the purchase of feed in Fadhato likely increased available milk in this control site, while such factors as the sharing of feed with non-project animals, some sharing of milk with non-project households, and migration of cattle affecting milk off-take likely reduced overall milk availability in Ayiliso. In both sites, but particularly in Ayiliso, there was strong prioritization of milk towards younger children in Ayiliso, possibly as a result of this reduced availability of milk (Figure 11).

Table 17 on the next page reflects the average daily milk off-take per household over the 2011 dry season with the intervention, the average daily amount of milk consumed per child receiving milk in Ayiliso, and the average proportion of children receiving milk over the course of the intervention. Under the assumption that there was an average of two children per household and that all available milk was given to children under five years of age, each child in a household in Ayiliso should have received roughly 400 mL/day of milk, according to the milk off-take data. Our data suggests that it was the younger children in each household who were prioritized to receive milk (see Figure 11 on the next page).

Nutritional Status

In the pre-intervention months, the average WAZ in Ayiliso and Fadhato remained relatively stable (Figure 12). During the intervention period, average WAZ in both sites declined, but at a faster rate in the control. In Ayiliso the average WAZ scores fell by 0.19 points between February and June, while in Fadhato the average fell by 0.33 points. Moreover, the difference in mean WAZ scores between the two sites became greater in the months towards the end of the

Table 16. Average Monthly Rainfall Data for Dire Dawa*

Season	Months	2010 Average Monthly Rainfall (mm)	2011 Average Monthly Rainfall (mm)
Jilaal	Jan	0.00	0.00
	Feb	89.7	0.00
	Mar	167.8	11.8
Gu	Apr	122.8	43.5
	May	75.4	[missing]
	Jun	16.1	14.1
Hagaa	Jul	119.3	67.7
	Aug	194.2	161.4
	Sep	151.8	83.9
Deyr	Oct	10.7	0.00
	Nov	[missing]	0.5
	Dec	[missing]	0.00

*Rainfall data provided courtesy of the Ethiopian National Meteorology Agency, Addis Ababa, Ethiopia.

Figure 10. Milk Availability in Ayiliso vs. Fadhato (control)

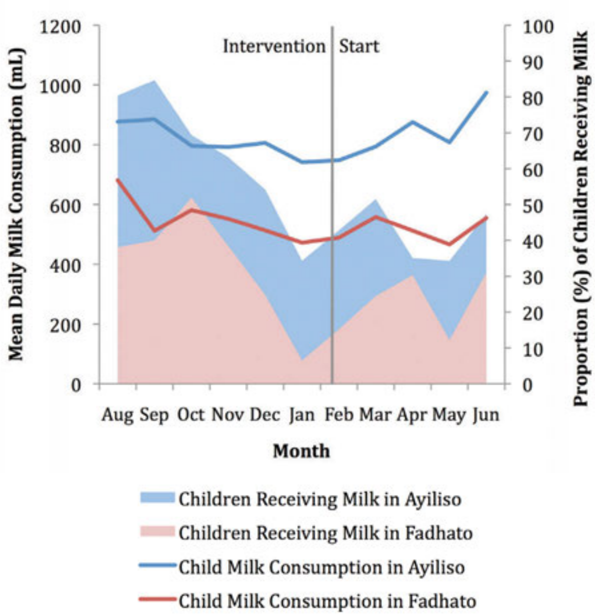


Figure 11. Average Percent of Children Receiving Milk during the Intervention Period by Age Group: Ayiliso vs. Fadhato (control)

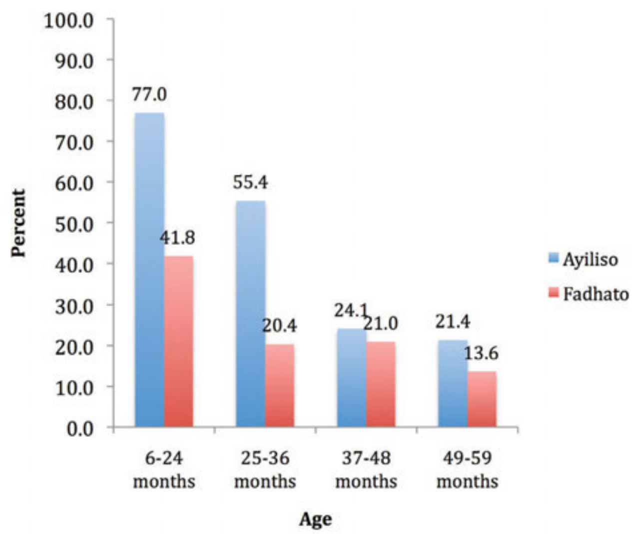


Table 17. Comparison of Milk Off-take and Milk Consumption Results, Ayiliso

Milk produced/household/day (mL)	800
Milk consumed/child/day (mL)	840
% children receiving milk	42

intervention, and significantly different for May (mean difference = 0.256; p = 0.020) and for June (mean difference = 0.280; p = 0.027).

As milk was clearly prioritized towards younger children (see Figure 13), it is interesting to note that the average WAZ score among under two year olds reveals modestly higher scores across the intervention compared with the rest of the older children.

Figure 12. Nutritional Status of Children in Ayiliso vs. Fadhato (control)

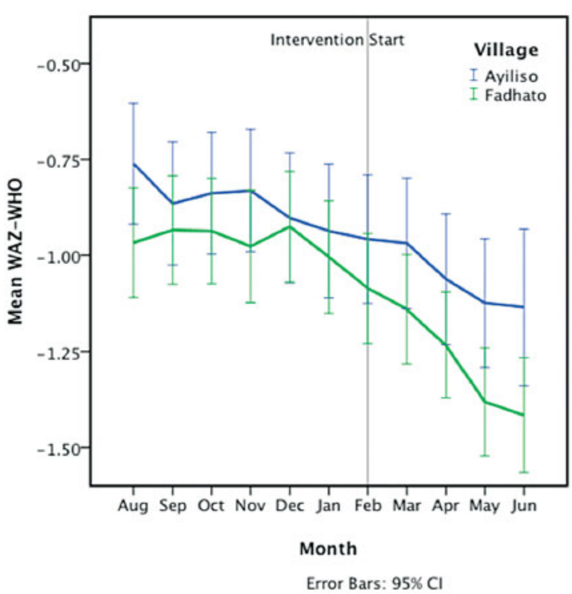
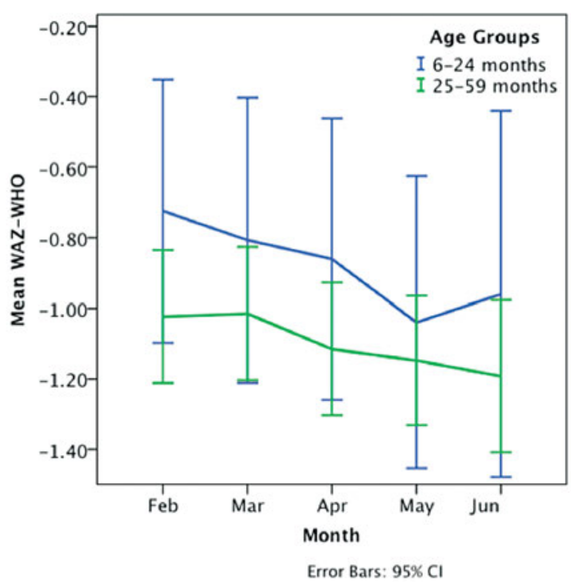


Figure 13. Nutritional Status of Children 6–24 Mo. in Ayiliso vs. Children 25–59 Mo.



Waruf, Shinile Zone

Key Findings:

- Cow milk off-take in Waruf increased significantly in the 2011 dry season with the intervention, compared to 2010 dry season without the intervention.
- More milk was available for young children during the intervention months in Waruf compared to the control site in Fadhato—86.5 percent of children were consuming milk in Waruf by the end of the intervention compared to 31 percent in Fadhato.
- Child nutritional status in Waruf remained relatively stable during the intervention months compared to a rapid decline in Fadhato.

Milk Off-take

All households in Waruf chose to keep a cow during the intervention. Households reported a significantly higher average milk off-take than last dry season in the absence of an intervention (Table 18); participants in FGDs attributed the results to the project inputs.

Other notable results from the PIA interview include: (1) 22 percent of households purchased feed independently; (2) there was an outbreak of a disease causing diarrhea in small ruminants late in the intervention; and (3) feed distribution was interrupted for a total of 20 days during the intervention period.

Referring to Table 16, which provides monthly average rainfall for the town of Dire Dawa, as well as to the reports of poor conditions during the 2010 Deyr season, we can again confidently state that the increase in milk off-take over the 2011 dry season was attributable to the project and not to improved rainfall and pasture.

Milk Availability

During the pre-intervention months of August through January, available milk declined in Waruf and Fadhato, both in terms of numbers of children receiving it and in amounts consumed (Figure 14). During the intervention months (February through June), available milk increased substantially in Waruf as compared to Fadhato, particularly in terms of the proportion of children receiving it. By the end of the intervention, 90 percent of the children in Waruf, compared to only 31 percent in Fadhato, were given milk. Average child milk consumption in Waruf rose quickly during the first few months of the intervention, stabilizing at approximately 590 mL/day compared to an average of 510 mL/day in Fadhato.

Milk was prioritized towards younger children in both Waruf and Fadhato, as can be seen in Figure 15. However, the trend of prioritization is less pronounced in Waruf compared to sites with less available milk, since over 90 percent of children in Waruf were receiving some milk.

According to the milk off-take data, the daily average milk off-take was 1280 mL per

Table 18. Milk Off-take in Waruf

Livestock Type	Stage of Lactation	Mean Daily Milk Off-take (mL): *Dry season, 2010, no intervention (95% CI)*	Mean Daily Milk Off-take (mL): *Dry season,[a] 2011, with intervention (95% CI)*	Percent Change
Cattle	Early	237 (104.5, 369.9)	1698 (1503.4, 1893.3)	716[b]
	Middle	151 (63.5, 238.5)	1235 (1072.2, 1398.1)	818[b]
	Late	71 (22.4, 119.2)	899 (744.3, 1054.6)	1266[b]

a The 2011 dry season became a drought (see Table 16).
b Significant at the 95% confidence level.

Figure 14. Milk Availability in Waruf vs. Fadhato (control)

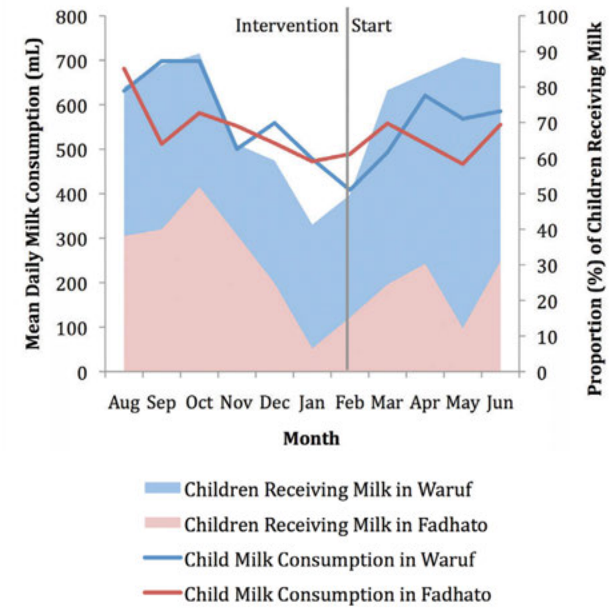
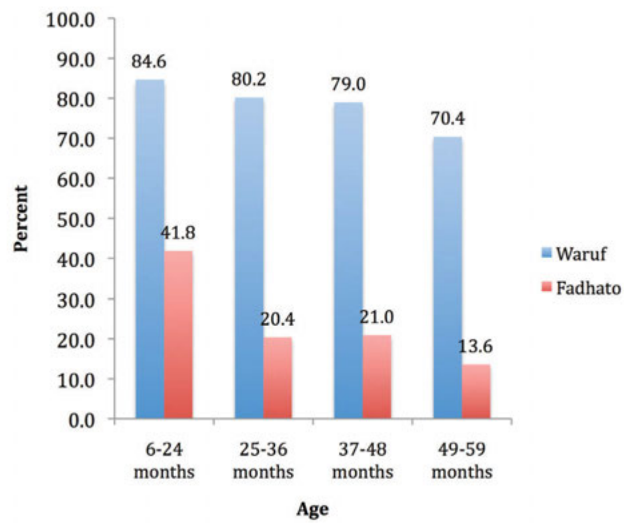


Figure 15. Average Percent of Children Receiving Milk during the Intervention Period by Age Group: Waruf vs. Fadhato



household, which would equate to 640 mL per child per day under the assumptions stated above. This amount approximates the amount recorded through the consumption data of a daily average of 535 mL per child and reflects the high proportion of children that continued to receive milk throughout the intervention (Table 19).

Nutritional Status

During the pre-intervention months, the nutritional status of children in Waruf and Fadhato was relatively stable, although the mean WAZ was significantly higher in the intervention site compared to the control for four of the five months (Figure 16). From December through March, the mean WAZ scores declined in parallel and were not significantly different. In April, the difference began to grow as the mean WAZ continued to fall in the control while stabilizing in the intervention: the difference became statistically significant for May (mean

Figure 16. Nutritional Status of Children in Waruf vs. Fadhato (control)

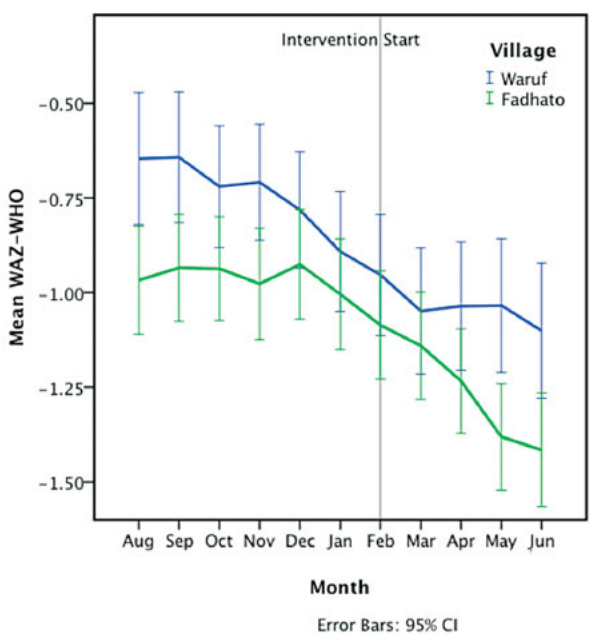


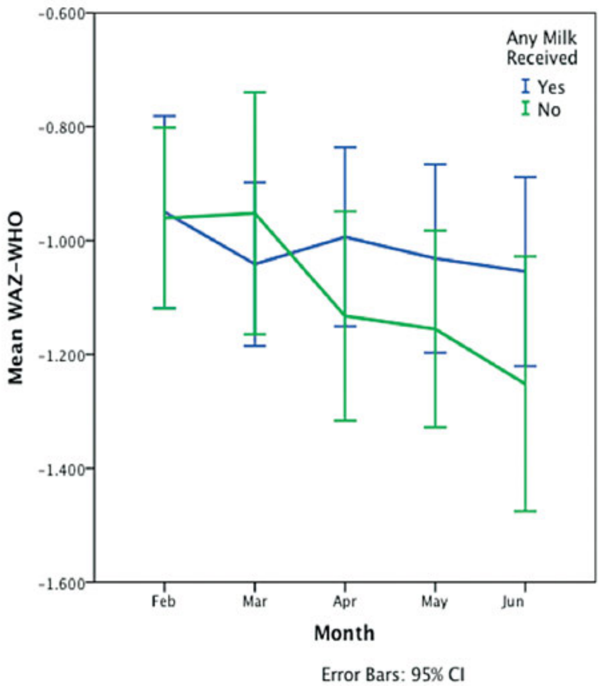
Table 19. Comparison of Milk Off-take and Milk Consumption Results, Waruf

Milk produced/household/day (mL)	1280
Milk consumed/child/day (mL)	535
% children receiving milk	77

difference = 0.347, p = 0.003) and for June (mean difference = 0.315, p = 0.008). Moreover, during the intervention period, the average WAZ scores largely stabilized in Waruf, falling by only 0.10 points compared to the rapid decline in the control site (0.33 points from February to June).

Looking at the nutritional status of children in just the intervention sites of Ayiliso and Waruf, the difference in average WAZ scores between those children who received any milk and those who did not reveals an interesting pattern. Over the course of the intervention, the average WAZ for those who continued to receive milk stabilized at -1.00 while the average WAZ continued to decline for those who did not receive milk (Figure 17). The mean difference in WAZ per month, however, is not statistically significant for any of the intervention months.

Figure 17: Nutrition Status of Children Receiving Milk vs. Those Who Did Not in Ayiliso and Waruf



"These interventions protected our livelihood base and prevented our children from becoming malnourished."
— Female participant, Washaqabar

In many pastoralist areas of Africa, child malnutrition in years with normal rainfall peaks during the end of the long dry season as livestock milk supply dries up. This study aimed to examine the impact of livestock interventions on pastoralist children's consumption of animal milk and their nutritional status during the late dry season. As we describe earlier, the livestock interventions were used during the dry season in 2011, but this period became categorized as drought rather than a normal dry season. Our experience shows the difficulty of implementing applied field research in remote pastoralist areas, where external factors cannot easily be controlled. Similarly, external interventions in at least one of the two control sites, Fadhato, illustrated how events in control locations cannot be controlled by a research project. In this site, vouchers provided by another project enabled households to purchase livestock feed independently. Various other implementation issues arose during the research, such as the failure of one contractor to supply livestock feed, interruptions in feed provision locally, and variations in the feeding approach used. Partly for these reasons and site-specific variations in implementation, we opted to present the results by site and where possible, describe implementation issues in each site so that the results could be interpreted accordingly. We also discuss implementation experiences more fully below.

Overall, the results demonstrate that targeted livestock support can significantly increase daily livestock milk off-take during very dry periods, at times by more than 4000 percent (Table 10), and can sustain milk production through late lactation. Whilst improved milk production in animals that receive supplementary feeding has been documented elsewhere (e.g., Aklilu and Wekesa 2002; Degen 2007; Bekele and Tsehay 2008), it has not been tested in the particular programmatic setting used here, whereby households and animals were targeted with explicit child nutrition benefits in mind. It was also notable that the high levels of milk off-take in supplemented goats and cows were achieved in local Somali indigenous breeds located in pastoralist areas. This result indicates the potential to enhance production in these local breeds, which are well adapted to harsh environmental conditions and disease risks in pastoralist areas.

This increase in milk production had very positive benefits for children, even though only a small number of milking animals remained close to the homestead over the dry season. Results show that, in three out of four sites, children in intervention areas consumed more milk compared to children in control areas. To our knowledge, this is the first study that presents quantitative data demonstrating the impact of livestock interventions on nutrient intake in young children in pastoralist areas. There were several factors, however, that affected the relationship between off-take and consumption during this study that have important implications for how future programs are implemented. First, implementation challenges with the intervention itself affected the amount and quality of feed available for animals, which in turn probably reduced the amounts of milk available to households in some sites. Critical events encountered during the intervention period are described above and below, with recommendation for future implementation strategies. Second, where intervention coverage was lower (i.e., fewer households from the total number of households in a village targeted), there existed higher levels of sharing of milk between project and non-project households. The result was that fewer of the project children received milk in those villages, and there was a pronounced prioritization of milk towards younger children (less than three years). The latter result confirms previous work under the Milk Matters project that has described how milk is prioritized for young children in these areas of Somali Region (Sadler and Catley 2009) and elsewhere (Sadler, Kerven et al. 2010; Stites and Mitchard 2011). This suggests that, to achieve maximum impact on child nutrition, interventions such as those implemented here must be designed to benefit all households in a community to prevent dilution of impact, particularly those households that contain children less than three years of age.

Where the intervention worked well and intervention coverage of households was high, such as in Washaqabar, the increase in milk consumption seen (1050 mL/day compared to 650mL/day in the control site) translates into an *additional* 264kcal, 12.8g of protein, and considerably higher intakes of essential fatty acids, vitamins, and minerals per child each day. For a young child of two years old, this increase in nutrient intake would meet *circa* 26 percent of energy and 98 percent of protein requirements.

The relationship between nutrient intake and weight gain is complex and can be impacted by a multitude of factors, including health status, activity levels, and baseline nutritional status. Whilst we don't see a dramatic improvement in nutritional status among intervention children, we do see an overall pattern of stabilized WAZ among these children compared with a general decline in children in control sites over the intervention period. Moreover, we see a pattern of stable nutritional status among children receiving any milk over the intervention period as compared with children who did not receive any milk in the same sites (see Figures 7 and 14). Together, these impacts indicate that interventions such as those tested here hold potential to maintain weights of young children in times of drought and to prevent a deterioration into acute malnutrition that would require treatment by a program such as community-based management of acute malnutrition (CMAM) (WHO, WFP et al. 2007). It is well documented in the scientific literature that preventing a child's decline into episodes of severe acute malnutrition (SAM) is crucially important for a child's survival and overall mental and physical development (Bhutta 2009).

In addition to the impacts seen on milk consumption and nutritional status in young children, the interventions had several positive livelihood outcomes for participating households, all of which were considered important by participants during the final PIAs. First, women reported having more free time as a result of reduced workload: during a typical dry season women usually spend extensive amounts of time searching for adequate pastures for the small number of milking animals in their care and/or gathering food needed to fill the gap left by milk for their own children. Considering the links between maternal health and wellbeing and optimal infant and young child feeding practices (such as perceived ability to exclusively breastfeed) in these areas (Shell-Duncan and Yung 2004; Nyaruhucha, Msuya et al. 2006; SCUK 2007), this is an important finding for child nutrition. Secondly, the intervention positively impacted pastoralist livelihoods by protecting their critical assets during drought conditions: many households reported a high

> *"It gave us great advantages not only to children but also to households and communities. It saved the money that we usually spend on feeding animals during the dry season and eased the hard work for women of collecting feed for animals. This intervention protected the livestock, particularly the milking cows, from the negative consequence of the drought."*
>
> — Female participant, Waruf

survival rate of dams and suckling calves and perceived improved rates of reproduction in some of their animals as compared to previous dry seasons and periods of drought.

Cost Comparison

The following cost analysis focuses on comparing the direct costs of the Milk Matters livestock intervention with the direct costs of a treatment program for SAM. The analysis compares costs using three different scenarios:

- In the first scenario, direct costs of the intervention are calculated based on the cost of Sudan grass plus transportation costs, with both costs being incurred by an NGO implementer.
- In the second scenario, the intervention cost is the price of Sudan grass alone, and assumes that a cash or voucher scheme allows households to buy feed directly from private suppliers.
- The third scenario assumes that the project purchased livestock feed at higher than normal costs, because local suppliers inflated the prices as the buyer was an international NGO. Discussions with local informants indicated that this price inflation was approximately 30 percent.

Scenario 1 reflects the Milk Matters experience, whereas scenarios 2 and 3 estimate the potential cost for scale-up of future interventions that use vouchers or other mechanisms of support to pastoralists to purchase feed independently from local markets. In reality, the prices for these two scenarios will vary from those quoted here depending on factors such as feed type (maize stalks are more widely available on the market) and animal species being fed (e.g., cow vs. goats). Table 20 provides sample cost calculations for the interventions in Liben Zone under each approach and provides cost per cow per day, cost per cow for the duration of the intervention (73 days in Liben Zone), and the cost per child for the full intervention, assuming each cow provided milk for two children on average. These intervention costs are compared to the cost of treating a child suffering from severe acute malnutrition in a community-based therapeutic feeding program which ranges from 145 to 200 USD per child (Puett, Sadler et al. 2012). Table 20 shows that direct costs of the intervention were 45 percent (scenario 1) to 75 percent (scenario 3) less than those estimated for therapeutic feeding programs.

Table 20. Costs of Milk Matters' Interventions (Liben Zone) vs. SAM Feeding Program, in USD

	Scenario 1	Scenario 2	Scenario 3	Therapeutic Feeding
Direct cost/cow/day	2.21	1.32	0.93	N/A
Cost/cow for duration of intervention	161.16	96.62	67.63	N/A
Cost/child for duration of intervention	80.58	48.31	33.82	145-200

All costs in Ethiopian Birr were converted to US dollars using the exchange rate of 1 USD to 17 ETB.

While this analysis of quantifiable costs is useful, it inevitably excludes the long-term benefits that accrue but are not easily measureable. In livestock, supplementary feeding will improve reproductive performance and survival, in addition to increasing milk production. Reducing risk and vulnerability in the pastoral livelihood through ensuring herd survival can lead to direct improvement in health and wellbeing of the family through mechanisms such as greater disposable income for food security and healthcare (Admassu, Nega et al. 2005; Abebe, Cullis et al. 2008; Barasa, Catley et al. 2008; Catley, Leyland et al. 2008). Moreover, *averting* episodes of SAM is hugely important for child development as even short episodes are associated with lifelong disabilities (Gross and Webb 2006), and interventions such as this may hold potential to improve maternal health, with demonstrated positive impacts for child nutrition and wellbeing. Finally, as will be discussed in greater depth below, there are many ways in which livestock feed can be procured and transported in a more cost-effective manner than used in this research, a change that would likely reduce the cost per child seen in this project. Thus it is anticipated that, after accounting for less easily-quantifiable benefits and delivery of feed at lower cost, similar livestock interventions would prove to be substantially more cost effective than the cost of waiting to intervene with treatment for high numbers of children with SAM.

The Challenges of Intervention Delivery

The implementation of the intervention faced many challenges in both Shinile and Liben, and these are important to consider as they have implications for both the impact of the intervention seen here and the design of similar interventions in the future (Table 21).

Livestock feed procurement

Livestock feed procurement proved to be most difficult in Shinile. While in Liben local cooperatives in close proximity to Dollo Ado that were supported by SCUS were engaged to grow and arrange the transport of Sudan grass to the sites, feed had to be procured through several private vendors for Shinile. In both areas the costs of transporting feed into intervention sites were very high relative to all other implementation costs. In addition, miscommunications around required amounts of feed, a frost early in the growing season in Shinile, and the drought later in the growing season in Liben meant that additional feed had to be procured from a second vendor at both sites. This added considerable unforeseen cost to the interventions and will certainly have affected the cost comparison, as discussed above. This suggests that the costs might be reduced further with a change in feed procurement and delivery strategy. Lastly, it proved difficult to control the quality of feed coming from suppliers outside the

Table 21. Summary of Implementation Challenges

Site	Implementation Notes for Interpretation of Analyses
Dollo	
Biyoley	Long distances between feeding sites and homesteads, serious water shortages, a large proportion of households not included in the intervention led to wide sharing of milk.
Washaqabar	No major implementation issues.
Shinile	
Ayiliso	Problems with feed delivery—home-based feeding; no Sudan grass; cattle migrate. Some sharing of milk with non-project households.
Waruf	Rain led to flooding and cattle migration.

intervention areas. At times, the feed was delivered moldy, having been cut and bundled without adequate time for drying.

Livestock feed distribution

According to the design of the intervention, feeding of the animals was supposed to occur exclusively at feeding centers. However, in some sites, households were allowed to take feed back to their homes, at which point the project could no longer monitor that only targeted animals received the feed. As a result, other animals almost certainly benefited from the feed and diluted the impact of the intervention seen here. In some areas the distances between the location of households and milking animals and the feeding centers proved too large. This will have impacted on the nutritional status of the animals and also meant that calves needed to suck frequently on route. This is likely to have reduced the milk available for household use. Finally, distribution of feed to all sites suffered from frequent transportation-related disruptions that resulted in inconsistent supply of daily feed to animals, another factor that likely affected overall milk off-take.

Study Limitations

The complete failure of the Deyr rains (October–December 2010) in Liben, which coincided with the period immediately before the start of the long dry season and our intervention, had several ramifications. First, it meant that the quantity of feed provided had to be increased at the last minute. Instead of serving as supplementary feed for the animals, as was the original design, the feed was now the only nutrition available to the animals. Second, the drought impacted the availability of water and led to cattle migration. Several sites stated water shortages as a key problem in the intervention, particularly in the Liben site of Biyoley. There was also some water shortage in Ayiliso in Shinile, meaning some families transitioned to the area around Waruf, while in Waruf, migration of cattle meant that several children defaulted from the surveillance system as families looked for pasture far from the feeding center. Between August 2010 and January 2011, only 16 children had exited the surveillance system, while between February and June 2011, during the intervention months, an additional 28 children exited the system. Of those who remained under surveillance, however, an increasing proportion received milk each month, from 49.7 percent in February to 86.5 percent in June.

In project sites, some study households fed animals using both project feed and feed that was purchased privately. This raises the question of attribution, and the extent to which increases in milk off-take were attributable to project inputs. The first consideration is the type and amount of feed that the Milk Matters project used, and details are provided in Table 22 on next page. This indicates a high level of ration delivered by the study relative to recommended levels, which suggests very limited, if any, feeding of study animals with privately-purchased feed is likely to have taken place. Private feed was most likely fed to non-study animals. The implication is that the changes in milk off-take in study animals were mainly attributable to feed provided by the project.

A significant challenge to assessing impact on milk consumption and nutritional status was the widespread sharing of milk with non-project households. This practice occurred most extensively in Biyoley and Ayiliso. As families shared with non-project households, the total number of project children receiving milk decreased—in both Ayiliso and Biyoley, on average each month only 50 percent of the project children received milk. This has implications for the design of future interventions and is discussed below.

Lastly there were several issues with data collection that made analysis difficult. We employed and trained local people from within each village as data collectors. Whilst this served to support trust and participation from study participants and meant that the data collection team could follow children as they moved frequently and often far distances, their learning curve was steep for collection of anthropometric data. As a result, there is likely to be a certain amount of error present in our data, although with high levels of supervision and data quality control we are confident that for weight data this

Table 22. Livestock Feeding Rations for Study Animals Compared to Recommended Levels

	Liben Sites		**Shinile Sites**	
	Biyoley	*Washaqabar*	*Waruf*	*Ayiliso*
Primary livestock type fed	Cows	Goats	Cows	Cows
Milk Matters daily ration:				
– Sudan or Rhodes grass	9kg	3kg	6kg	6kg4
– Wheat bran[1]	--	--	3kg	3kg
Duration of feeding	73 days	73 days	70 days	47 days
Feeding approach	Feeding center[3]	Feeding center[3]	Feeding center[3]	Home feeding[3]
Recommended daily feed amounts:[2]				
– Roughage e.g., hay	1.4kg minimum	Not available	1.4kg minimum	1.4kg minimum
– Concentrate e.g., wheat bran	1.5-2.5kg	Not available	1.5-2.5kg	1.5-2.5kg

1 Wheat bran was provided only in Shinile for 47 days at the end of the intervention.

2 For lactating cows. Source: Ministry of Agriculture and Rural Development (2008). *National Guidelines for Livestock Relief Interventions in Pastoralist Areas of Ethiopia*. Ministry of Agriculture and Rural Development, Addis Ababa, Ethiopia.

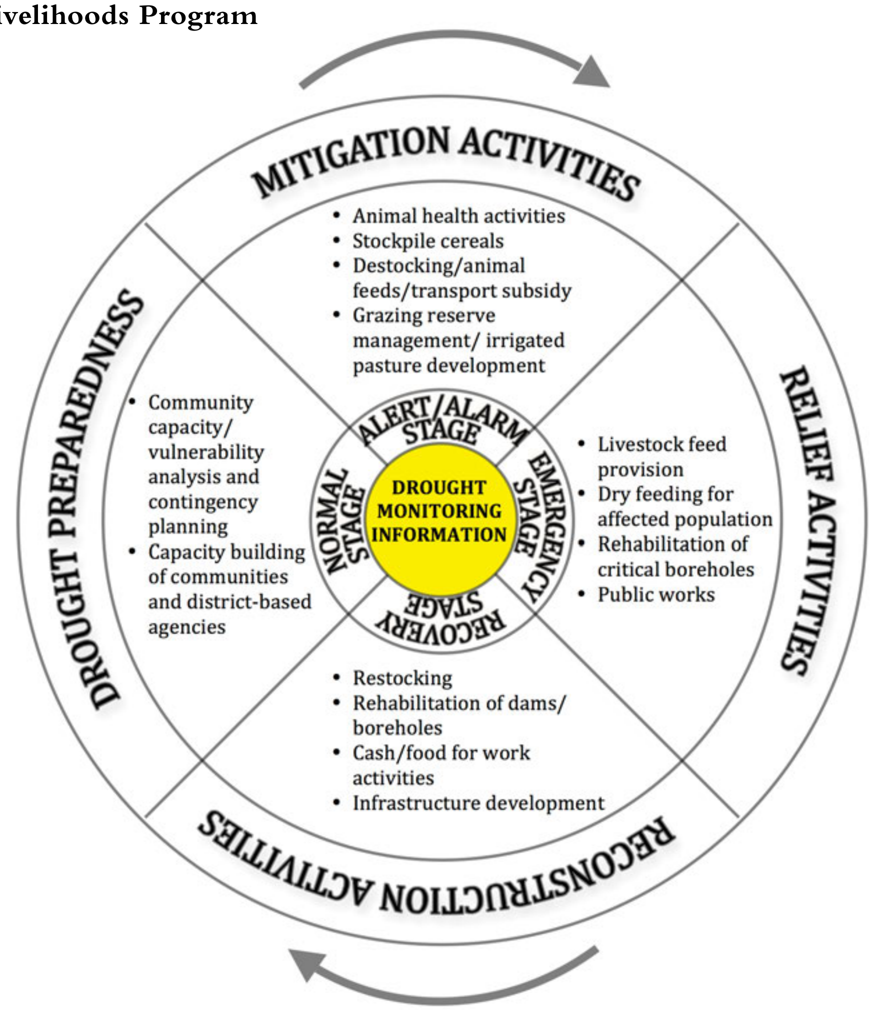
3 A feeding center approach to feeding allows greater control and measurement of the feed compared to home-based feeding.

4 Less feed was delivered in Shinile sites because the drought was less severe compared to Liben.

is random rather than systematic. Weighing the children monthly also faced multiple challenges. The parents sometimes refused to allow their children to be weighed due to fear of infection from the weighing pants or from perceived discomfort experienced by the children. As a result, there is a certain amount of missing data. The questionnaire was designed to include information on confounding factors, especially infection status, but several misunderstandings among the mothers led to widespread underreporting and an underestimation of the prevalence of infection. As a result, the true impact of infections on nutritional status among study children cannot be determined with any confidence.

This is one of the first studies to document an explicit, quantitative link between livestock interventions and impact on child nutrition in pastoralist areas. In pastoralist Ethiopia, livestock is at the heart of the economy, and food security and livelihoods actors recognize this by supporting livestock projects. Meanwhile nutrition actors have continued to respond to acute malnutrition with child feeding programs. This study has demonstrated that through targeted livestock support to milking animals that stay close to women and children during dry season and/or drought (overall a relatively small proportion of the whole herd), milk production and consumption among children is improved, and their nutritional status benefits. There is some consensus in the programming literature at present that the humanitarian community tends to spend much more time before humanitarian disasters preparing to treat acute malnutrition rather than trying to prevent it (Levine and Chastre 2011). The interventions presented here provide us with the opportunity to change this focus and reconnect food security interventions and nutrition outcomes in these areas with the potential of creating substantial aid cost savings by preventing the need for large CMAM programs. To do this, there needs to be a "nutritional lens" applied to the common food security analysis and response that happen in pastoralist areas. This might be done, for example, through ensuring that interventions implemented under the drought management cycle[11] are nutrition sensitive (Figure 18). This

Figure 18. The Drought Management Cycle Adapted from Save the Children's Pastoral Livelihoods Program



[11] A tool commonly used by agencies to support adoption of livelihoods-based programming for phased management of drought and its consequences.

may include: (1) support for preservation of milk surplus during the rainy season and, where appropriate, community-level feed production/storage under the drought preparedness stage; (2) focusing animal health and feeding interventions on the reproductive/milking stock during the mitigation stage, an activity already shown to be a normal priority for pastoralists in times of drought (Catley, Admassu et al. 2012); and (3) ensuring that public works or cash/food-for-work activities do not impact negatively on women's time and abilities to maintain their own or their children's nutritional status during the reconstruction stage.

There were several challenges experienced during the delivery of the interventions tested here. Critically, the purchase of feed from outside intervention areas and from private vendors was extremely costly, particularly for transport, and made it more difficult to control the quality of feed. The PIAs for this project found that households frequently purchased animal feed from local sources as a "normal" strategy during drought. This is a very promising trend, and future interventions might simply support households to purchase their own feed through vouchers or other financial mechanisms where market supply is adequate. An approach such as this would also help reduce transportation costs significantly. If feed is supplied directly, household feed quotas should be allocated to all households in a target community to prevent dilution of impact, as we saw here, and should be fixed based on number of young children instead of milking animal holding, in order to maximize poor households' benefit from such an intervention.

Less clear is the role of aid projects in supporting local livestock feed production, using approaches such as irrigated production or rangeland enclosures. The feasibility of aid support for these approaches partly depends on good analysis of existing private sector production and the apparent growth of this activity. It follows that if the private sector is already growing and selling more fodder, one option for aid actors is to help create demand for livestock feed via approaches such as well-targeted voucher schemes. Experiences in Somali Region with small-scale irrigation projects demonstrate the challenges of aid-supported, group-based approaches, and the tendency for these approaches to become absorbed by pre-existing private operators (PLI Policy Project 2010). Similarly, the potential for substantial impacts from community-based rangeland enclosures needs to be weighed against the far wider and well-established trend of private rangeland enclosure, including enclosure by groups with the main objective of commercial fodder production (Napier and Desta 2011). Ultimately, private sector fodder production seems to be part of the overall livestock commercialization trend in "high export" pastoralist areas of Ethiopia (Catley and Aklilu 2012) and seems likely to expand independently of aid support.

Finally, in order to build the evidence base on the potential for nutrition benefits of interventions such as those implemented under this study, food security and livelihood programs must start monitoring more systematically their impact on nutrition outcomes. This need not involve the collection of anthropometric data and the measurement of nutritional status itself, which, as discussed above, can be challenging in these environs. But simple tools for measuring nutrition impact, such as participatory impact assessment (Catley, Burns et al. 2008) and the dietary diversity index (Drescher, Thiele et al. 2007), need to be used as standard if we are to create the momentum for investment in food security interventions to prevent increases in rates of malnutrition where these have been shown to be effective.

Appendix 1

Anthropometric Data Sheet for Milk Matters
To be completed and given to Milk Matters supervisor every month

Data collector name: ______________________
Kebele (site) name: ______________________
Month: ______________________

Child Number	Child Name	Sex (M/F)	Breast-feeding (Y/N)	Age (mths)	Date	Weight (kg)	MUAC (cm)	Edema (Y/N)

Appendix 2

Food Frequency Questionnaire
To be completed for every child in the nutritional surveillance system and given to the Milk Matters supervisor every month

Data collector name: ______________________
Kebele (site) name: ______________________
Month: ______________________
Child number: ______________________

Ask the mother: **Q1: Milk consumption**	Record Time	Record Type of Milk	Record Amount (mL)
At what time did you first give animal milk to this child yesterday, what type of milk was it, and how much did the child drink?			
At what time did you give the child animal milk the second time, what type was it, and how much did the child drink?			
The third time?			
The fourth time?			
The fifth time?			

Q2: Tea with milk consumption	Record Time	Record Type of Tea (family or special)	Record Amount (mL)
At what time did you first give tea to this child yesterday, what type of tea was it (family or special), and how much did the child drink?			
At what time did you give tea to this child the second time, what type of tea was it, and how much did the child drink?			
The third time?			
The fourth time?			
The fifth time?			

Q3: Milk products consumption

Last week, how many times did your child eat foods made from milk?
Answer:

Danaan/Gharoor	Burcad	Subag	Other
0 times 1 time 2 times 3 times >3 times	0 times 1 time 2 times 3 times >3 times	0 times 1 time 2 times 3 times >3 times	0 times 1 time 2 times 3 times >3 times

Q4: Food with milk consumption

Yesterday, how many times did your child eat cereal/rice with milk?
Answer: 0 times
1 time
2 times
3 times
>3 times

Q5: Sale of milk

During the last month, did you or anyone in your household sell any milk?
Answer: Yes
No

If Yes:
A. What type of milk was sold and how much of each type was sold?

B. How much money did you receive from the sale of milk last month?
ETB ________________________

C. What did you use the money for?

Record Type of Milk Sold	Record Amount (liters)

Appendix 3

Infection Frequency Questionnaire
To be completed for every child in the nutritional surveillance system and given to the Milk Matters supervisor every month

Data collector name: ________________________
Kebele (site) name: ________________________
Month: ________________________
Child number: ________________________

Q1a: For how many days did your child have fever* during the past 2 weeks?
*Fever is defined as raised temperature, hot to the touch, thirsty

Answer: days
1-2 days
3-4 days
5-6 days
>6 days

Q1b: When your child had a fever, what did you do?

Answer: Health Center
Pharmacy for Drugs
Traditional Healer
Nothing
Other________________________

Q2a: For how many days did your child have diarrhea* during the past 2 weeks?
*Diarrhea is defined as > 3 loose stools a day

Answer: 0 days
1-2 days
3-4 days
5-6 days
>6 days

Q2b: When your child had diarrhea, what did you do?

Answer: Health Center
Pharmacy for Drugs
Traditional Healer
Nothing
Other______________________________

Q3a: For how many days did your child have a cough during the past 2 weeks?

Answer: 0 days
1-2 days
3-4 days
5-6 days
>6 days

Q3b: When your child had a cough, what did you do?

Answer: Health Center
Pharmacy for Drugs
Traditional Healer
Nothing
Other______________________________

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