Exploratory Assessment of the Relationship between Dairy Intensification, Gender and Child Nutrition among Smallholder Farmers in Buret and Kipkelion Districts, Kenya

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1 INTRODUCTION

Of the 1.3 billion people living in absolute poverty globally, 80% live in rural areas and of these two thirds or 678 million people keep livestock (ILRI 2010). With access to markets and knowledge, many researchers and institutions maintain that small livestock ownership has the potential to lift millions of the rural poor out of poverty. On the household level, livestock and livestock products can produce a regular supply of nutrient-rich foods to families who are often lacking key micronutrients such as Vitamin A and iron, helping to prevent anemia, stunting, blindness, illness, and even death. In addition, livestock and their products can generate income, enhance social status, and serve as financial capital and assets, which may either directly or indirectly result in improved nutrition. Conversely, livestock interventions can hinder human health and nutrition. The allocation of land and labor to livestock systems can in some situations reduce production, consumption, and sale of other food (Randolph et al 2007). Moreover, alterations in livestock systems may potentially increase the risk of individual and household exposure to zoonotic disease, from direct contact while performing dairy activities and consumption of milk products, and indirectly from filth borne diseases (Huss-Ashmore 1996). Additionally, changing workloads may require that women spend less time on the care and feeding of young children, which could have negative effects on their nutritional status (Leroy andFrongillo 2007).

Dairy farming in particular has been seen as a potential way to increase household income and improve food and nutrition security. In Kenya, it is estimated that the number of smallholder dairy farms is between 1 and 1.8 million households (TechnoServe 2008). This represents about 35% of rural households and 26% of total households. The International Livestock Research Institute (ILRI) estimates that about 40% of these smallholder dairy households' income comes from dairy (TechnoServe 2008).

Livestock contributes directly to food security in developing countries as a source of nutritious foods and indirectly as productive assets that generate income and buffer shocks. As such, livestock interventions are shown to increase production and consumption of animal-source foods at the household level (Leroy et al. 2007; Randolph et al. 2007, Sadler et al. 2009). Nevertheless, there remain key gaps in our knowledge of how interventions affect the household level. Few studies have looked rigorously at the full range of benefits and costs associated with such interventions, including income-consumption trade-offs, alterations to the pattern of zoonotic disease exposure, impacts on workloads and the implications on caregiver time and subsequently on child nutrition. Few studies also have examined systematically how such benefits and costs are distributed *within* households. Finally, the roles and responsibilities of women in livestock systems tend to vary and often are poorly understood (Tipilda and Kristjanson 2008). Women's roles and gender relations are major considerations in explaining and enhancing the impacts of livestock development projects on health and nutrition (Kristjanson et al. 2009).

This report discusses a mixed methods study which was conducted in Buret and Kipkelion districts in Rift Valley Province, Kenya, in an effort to provide results to contribute to the gaps in knowledge about the effects of dairy intensification on households and in particular, young child nutrition.

2 OBJECTIVES OF THE STUDY

The overall objective of this study was to carry out formative research that will inform the efforts and future interventions of the East Africa Dairy Development project (EADD) in developing an assessment of the impact of dairying on human, and in particular,young child nutrition. EADD is a Bill and Melinda Gates Foundation funded project working to boost the yields and incomes of small-scale dairy farmers in Kenya, Rwanda, and Uganda.EADD is implemented by Heifer International, in partnership with ILRI, TechnoServe, African Breeders Services (ABS), and the World Agroforestry Center. For the purposes of this study, the research team collaborated primarily with ILRI, the knowledge arm of EADD.

The overall aim of the study was to collect information about the pathways by which dairy intensification affects farming households and in particular young child nutrition from a selection of male and female farmers. In order to achieve this aim, the study focused on how dairy intensification would influence child nutrition through four hypothesized pathways:

1. Changes in the overall intake of milk, intra-household distribution of milk intake, and changes in diet and dietary diversity, particularly in children under five years old;
2. Changes in the time allocation of women or children's primary caregivers, particularly as it relates to infant and young child feeding practices;
3. Changes in income and expenditures, including women's control of income from dairy, intra-household decision-making, and trade-offs between the sale and consumption of dairy and other foods;
4. Changes in exposure to zoonotic diseases and risk of injury and disease, as it relates to changes in dairying practices.

Related to these pathways, the study included a focus on gender and the economic tradeoffs associated with dairy farming, and health. The gender component explored gender roles in dairying systems, including household decision-making for milk consumption and sales, dairying responsibilities, household expenditures, and health-seeking behavior, including their impact on the nutritional benefits derived from dairying intensification. The study also sought to better understand the likely tradeoffs experienced by smallholder dairy farmers who participate in intensified dairy production, such as sales and consumption and work load, and how this impacts the welfare of household members, especially young children. Finally, the study explored community perceptions and practices as they related to injuries and zoonotic diseases, as well as reported disease incidence in humans and animals.

3 DESCRIPTION OF STUDY METHODS

3.1 LOCATIONS/SETTINGS

A multidisciplinary team of studentsand faculty from Emory University in Atlanta, Georgia, collaborated with a research team from ILRI in Nairobi, Kenya, to design and conduct 27 focus group discussions (FGDs) and a survey of 94 households in three locations – Cheborge Division in Buret District and Kipkelion, and Kebenet Divisions of Kipkelion District in Rift Valley Province, Kenya. In this area, the predominant population is the Kipsigis, a Kalenjin-speaking ethnic group. Although traditionally most Kalenjin groups were semi-nomadic pastoralists, the Kipsigis were agropastoral and incorporated more agriculture than other Kalenjin groups. In the 1930s, the Kipsigis adopted maize as both a subsistence and cash crop and settled into permanent homesteads (Borgerhoff 1989). During the later stages of colonialism in the 1950s and 1960s, the Kipsigis incorporated tea farming. In the study sites, tea farming consists of a mixture of large corporate tea estates and smallholder farms. Currently, the Kipsigis are a mixed farming community, focusing mainly on dairy and crops, particularly tea, maize, sorghum, and millet. Cattle remains highly valued, often as the household's most valuable resource, and as such, are symbols of wealth and status (Huss-Ashmore 1996). Therefore, dairy cattle are common and dairy products are an integral part of the diet for children and adults. Maize, sorghum and millet also play an important role in the Kipsigis diet. Among this group, *ugali* (a stiff porridge) and *uji* (a soft porridge)—staples in the diet—are prepared with a mixture of sorghum and millet added to maize flour and water (Kipng'eno 2010).

3.2 SAMPLE SELECTION AND SIZE

Focus Group Discussions
Participants were purposively sampled based on self-identification as farmers and their level of dairy intensification. In order to determine and compare across levels of dairy intensification, participants were asked toreport the current, daily milk production of their highest-yielding cow. The four subpopulations were identified as:

1. Households without any currently milking cattle (referred to as the no cow group);
2. Households whose best cow currently produces less than 2 liters/day (referred to as the indigenous dairy group);
3. Households whose best cow currently produces between 2 and 6 liters/day (referred to as the emerging group, the EADD target group);
4. Households whose best cow currently produces more than 6 liters/day (referred to as the advanced group).

Male and female farmers who fit the above criteriawere selected for separate focus groups and female farmers with children less than five years old (referred to as the maternal group) were sampled for a third focus group. Although recruitment was designed to find farmers who fit into the four levels of intensification, once in the field it was apparent that the levels were not representative of the sites. The groups were subdivided into intensification levels based on the participants who were present that day, which varied by site (Table1).

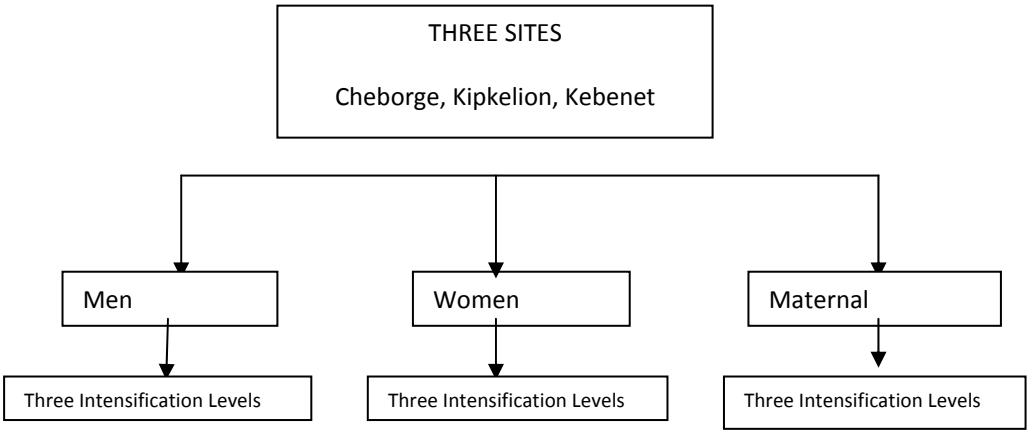
Table 1. Definitions of intensification categories for each focus group discussion by site

Amounts reflect reported range of current daily milk production of highest-yielding cow, in liters.

	Cheborge[1]			Kebenet[2]			Kipkelion		
	Men	Women	Maternal	Men	Women	Maternal	Men	Women	Maternal
No milk	0	0	0	0	0	0	0	0	0
Indigenous	0-6	1.5-5	1-5	1-9	1-3	2-9	3-9	3-6	1-6
Emerging	7-10								
Advanced	>11	>6	>6	>10	>4	N/A	>10	>7	>7

Participant recruitment was done by EADD staff, EADD interns, and community leadership who were briefed on the selection criteria. In each site, men were invited to participate and were then subdivided into smaller groups of about 6-10 people based on reported level of milk production. The procedure was repeated the next day with women and the next day with women who had children under 5 years old (Figure1). A total of 27 FGDs were conducted with an average of 10 people in each group. Approximately 270 people participated in the discussions in all three sites.

Figure 1. Sampling frame for focus group discussions



A second part of the qualitative assessment included meetings with key informants to discuss dairy intensification, actual and perceived gender issues, health, and nutrition in the area. The interviews lasted between 15 minutes and 1 hour and were conducted by one member of the Emory research team in English and Kiswahili. A total of eight key informant interviews were conducted with the District Veterinary Officer from Kipkelion District, a Meat Inspector from Buret District, and the District Public Health Officers, District Livestock Production Officers, and District Public Health Nurses from both districts.

Household Surveys

The household surveys were conducted using cluster random sampling.In each site, 30 households were surveyed, sampling10 households from each intensification level. From the FGDs, it was clear that the

[1] Only the men's group in Cheborge captured the four intensification levels.

[2] In Kebenet, only two FGDs were held with women with young children because the number of women who showed up was initially too small to subdivide into more than two groups.

previously defined intensification levels from the EADD baseline data were not well represented in each site. Therefore, the four intensification levels were redefined into three intensification levels:

1. No Milk– No milkproduction for the last 30 days
2. Emerging– Current daily milk production of best cow is up to six liters
3. Advanced – Current daily milk production of best cow is six or more liters

For each site, 15 GPS points were randomly generated using OSI Explorer, within a 5 kilometer radius from the site hub. Once the point was located, the nearest household was screened for the presence of a child under five years old and milk production based on the defined intensification levels. If the household did not qualify based on screening criteria and/or the quota had been met for the specific intensification level, the team used snowballing to identify other nearby households.If, once the 15 GPS points were exhausted and the 10 household quota per intensification level was not met, five new, random GPS points were generated and households were identified using the previously mentioned method.

The final sample size consisted of 94 household surveys as shown in Table 2.In Kipkelion, since only five advanced households were identified in the first sample of 30 households, anadditional five GPS points were generated from which four more advanced households were identified,resulting in a total of 34 surveyed households. In Kebenet, only 25 households were surveyed from the original 15 GPS points due to terrain and weather limitations. An additional 15 GPS points were generated and four more households were identified.Data from two surveys (1 for Kipkelion and 1 for Kebenet) were discarded because upon review it was determined that the respondents and the households did not meet the selection criteria.

Table 2. Stratification of surveyed households by intensification level and site, n=92

Sites	No milk	Emerging	Advanced	Total
Cheborge	10	10	10	30
Kebenet	10	10	9	29
Kipkelion	10	11	12	33
Total	30	31	31	92

3.3 DEVELOPMENT OF STUDY TOOLS

Focus Group Discussion Guides
Four semi-structured field guides were developed to generate discussion around the various pathways through which dairy intensification affects the nutrition of farmers and their households. The guides were developed and then adapted to the local context following sessions with the Kenyan research team focused on appropriateness of content and language. The four guides used were: a general guide for men and women, a guide for women with children under 5 years of age, a general guide for men and women who did not currently have milking cows, and a guide for women with children under 5 who did not currently have milking cows (Appendix). All the guides were coded by study staff to facilitate expansion of field notes and compilation of notes from the different FGDs.

Household Surveys
The household survey consisted of two parts, Part A, which was administered to the head of household or primary caregiver of the index child, and Part B, administered to the primary caregiver of the index

child. The survey included questions that addressed each pathway, including householddemographics, household income and investments, milk production and dairy inputs, dairy consumption with a focus on the youngest child, dietary diversity and food security, time allocation of the primary caregiver, syndromic surveillance of zoonotic disease in animals as well as humans, and household health-seeking behavior and practices.Once in the field, the survey was revised using the data collected from the FGDs and input from the FGD facilitators and Kenyan field assistants. The survey was field-tested prior to its administration and changes were made to the language and order of questions based on recommendations from the Kenyan field assistants. In addition to questions answered by the household members, a direct observation checklist was completed by the enumerator to classify households into categoriesthat reflected the poverty status. The three categories were: "Very poor", "Not so poor," and "Non-poor." This tool was developed by ILRI as a way to assess household assets such as housing type, furniture and presence and condition of latrine facilities. Additionally, photographs of cows (when available) and cattle housing were taken and graded to assess for cleanliness and condition.

3.4 IMPLEMENTATION

Focus Group Discussions

The FGDs were held in a mix of settings including churches, a local chilling plant, outdoors, a health clinic, and a school. All the participants gathered in one location and were introduced to EADD and the partner organizations, the purpose of the day's discussion, and overall study objectives. Confidentiality was explained and informed consent was given. Participants were asked to introduce themselves by name and indicate the current total milk production of their best cow in liters per day. Smaller groups were then formed based on these milk production categories. Once in the smaller groups, the group decided which language (Kiswahili, English, or Kalenjin) to use for the discussion. The participants were encouraged to respond in the language they felt most comfortable using to explain themselves. Most of the groups were conducted in a mix of all three languages.

Three facilitators assisted in the FGDs. Three field assistants, trained university graduates from Egerton University fluent in the local language of the predominant local Kalenjin-speaking group, the Kipsigis, assisted with translation and facilitation of the discussion when participants preferred to discuss in the Kalenjin language. Members of the Emory research team sat in on focus groups to take observational notes and probe. When participants consented, the discussions were tape recorded. The FGDs lasted on average about 3 ½ hours, including an introduction (purpose of study, confidentiality, and informed consent), the discussions, and a de-briefing with all participants to answer questions on zoonoses and what each of the small groups had discussed.Detailed notes were recorded during the discussion by an Emory student and a Kenyan field assistant to capture group dynamics and content. Field assistants provided simultaneous translation of key points to the Emory students to allow the Emory students to follow the discussion and probe when needed.

Household Survey

In Kipkelion and Kebenet, household identification occurred first, followed by the administration of the questionnaire on a subsequent visit. Four teams, each consisting of an Emory student and a Kenyan field assistant, were accompanied by local community membersto introduce the members of the team to the households.Confidentiality was explained and informed consent was given verbally.Appointments to administer the household questionnaire were then made for later that same week. In Cheborge, identification, consent, and administration of the questionnaire occurred on the same day and the four teams were accompanied by EADD interns when available.

The survey was conducted in a number of settings, including in and around the respondent's home, in tea fields, and as the respondent worked in the family garden. Questionnaires were administered by the Kenyan field assistants in Kiswahili or Kalenjin, in the presence of the Emory team member. On average, each survey took 1 ½ hours to complete. In addition to the survey, the respondents were asked their consent to have their cows photographed (if the cows could be found at the homestead). Photographs were taken of the dirtiest cow, a close-up of the cow udder, the whole cattle building, and the cattle lying area. Photographs were labeled by household ID, which was assigned to each survey, based on the district, site and household number. After labeling, photographs were stored on password-protected laptops and analyzed based on standards.The direct observation checklist was completed by the enumerator at the conclusion of the interview.

3.5 PRELIMINARY ANALYSIS

Focus Group Discussions
Each day following the FGDs, the field assistant, Emory student, and facilitator, met to expand the notes into a single document of a detailed description of the content of the discussion and group dynamics. Notes from each of the groups were combined into a single document organized by code and separated by different colors for the different intensification levels. The entire research team met daily to debrief on the main findings from the discussions and emerging themes. After all FGDs were completed in each site, notes from the men, women, and maternal discussions were compared by theme across group and intensification level by the research team. An Emory researcher and field assistant then met to summarize data by the hypothesized pathways and a larger group discussion was held to share the findings.

Household Survey
Each day, every team would review their surveys, which consisted of reviewing the data collected to ensure that all appropriate fields were filled in and data was understood by all members. The surveys were then given to another team to review again. Each survey was reviewed by no less than three people to ensure quality data was collected. The surveys were then entered in an Access database upon returning from the field.Descriptive statistics for this report were generated using Microsoft Excel.

3.6 IRB AND ETHICS

The study was considered social-humanist behavior research with no more than minimal risk to the participants. It was approved as an exemption by the Institutional Review Board (IRB) of Emory University.In all phases of research, informed consent was verbal and given in the participant's language of choice. The total time commitment for each study participant was no more than 1-4 hours, taking into account transportation, when applicable.Transportation costs were provided to FGD participants, as well as a beverage and light snack.

4 RESULTS AND DISCUSSION

4.1 DAIRY INTENSIFICATION AND CHANGES IN DIRECT CONSUMPTION OF MILK AND INTRA-HOUSEHOLD DISTRIBUTION OF MILK

Previous studies have shown that livestock interventions increase the production and consumption of animal-source foods at the household level. Nevertheless, few studies have closely examined the effect of dairy intensification on dairy consumption for individual household members, particularly for young children and breastfeeding women, and the nutritional impact. Studying dairy consumption is not only important for the nutritional value of milk itself, but as milk is one of the earliest complementary foods introduced to infants in the Kalenjin community, any changes in consumption patterns and practices as a result of or associated with dairying are of interest in this study. Infant and young child feeding practices for children 0-23 months directly affect the child's nutritional status, health, andcognitive and physicaldevelopment. Milk availability and distribution and income for food purchases as a result of dairying may influence infant and young child feeding practices and child nutrition.

Parts of the FGD guide were designed to explore the patterns of individual-level household consumption of milk, particularly the consumptionpatterns of children under five years and breastfeeding women, and the decision-making roles related to milk consumption versus sales, across intensification categories. The key indicator was the amount of fresh milk consumed per day in cups. In the FGDs, participants reported the daily portion of milk kept for household consumption from the production total and portions kept from morning and evening milk. Metal cups of 300 ml volume that were commonly used in the community were provided so that participants could visualize and demonstrate the quantities of milk kept for household consumption and quantities used for preparing tea, drinking fresh, and adding to other foods. In addition, descriptions of typical diets for men, women, school-age children, young children, and infants was collected from the FGDs to provide information on eating patterns and the role of milk in the overall diet. Questions on the FGD guide asked about decision-making roles and processes related to milk sales, consumption, and intra-household distribution. The information collected from the FGDs informed the development of the household questionnaire. Most questions relating to household and individual-level milk consumption were included in the part of the household questionnaire that was administered to the primary caregiver of the youngest child in each household.

4.1.1 Does increased milk production translate into increased household consumption?

Table 3 indicates the average daily amounts of household milk production and consumption among dairying households. Advanced households produced an average of seven more liters of milk a day than the emerging households and kept more than twice as much milk for home consumption than the emerging households. The emerging households kept an average of 61% of the milk produced for household consumption and the advanced households kept on average, 50%. The majority of households in both categories kept all of the evening milk for home consumption, which is consistent with practices reported in other studies in Kenya (Meinzen-Dick et al. 2010). Prior to the commercialization of the dairy market, morning milk was designated for sale and evening milk was designated for home consumption (Meinzen-Dick et al. 2010). In this study it appeared that the proportion of milk kept for consumption, including the proportion of evening milk, decreased with intensification, although it should be noted that the net mean amount in liters for daily consumption was still 4.88 liters/day in the advanced households.

Table 3. Mean daily household milk consumption and production and evening milk consumption, n=62

	Emerging, n=31	Advanced, n=31
Daily milk production and consumption patterns		
Mean daily milk production, in liters	3.0	10.8
Mean daily milk consumption, in liters	1.8	4.9
Proportion of daily milk kept for household consumption	0.6	0.5
Evening milk production and consumption patterns		
Proportion of households keeping all of evening milk for consumption, n=59 (n, %)	26, 93%	23, 74%
Mean amount of milk kept for evening milk for consumption, in liters, n=59	1.3	3.4

Data from the household survey was consistent with what was learned from the FGDs. Farmers reported that in general, as the total amount of milk produced increased, the amount kept for household consumption also increased. In addition, several farmers in the FGDs reported reserving most or all of the milk from the evening milking for household consumption. One reason for this practice according to the farmers was because there were fewer formal outlets for selling the evening milk. Several farmers explained that they share or sell some of the evening milk to family, friends, or neighbors. A female farmer from the emerging group in Cheborge said she shares the evening milk with her married sons. One male farmer from the emerging group in Cheborge said he sold seven liters of milk to the New Kenya Co-operative Creameries (KCC) and then gave two liters of milk to his son for the grandchildren. This suggests that there may be positive spillover effects on child nutrition from dairying households who share milk with other households who have small children.

Households in the no milk category obtained on average 1.18 liters of fresh (unpasteurized) milk per day, which was less than the 1.82 liters/day and 4.88 liters/day reported by the emerging and advanced households respectively. Households in the no milk category obtained milk either by purchasing it or receiving it as a gift. In the FGDs with farmers in this category, not having milk at times for household use and not having the desired amount of milk for household needs was a concern. For example, a female farmer from the no milk group in Kebenet said “It is a common occurrence not to have milk in my household.” This woman was from a discussion group that reported using an average of 1 cup of milk a day for household consumption. Responses from the household survey indicated that a greater proportion of adults and children in no milk households reported going without milk at least one time in the last 30 days than households in the emerging or advanced groups (Table 4). Based on responses to this question, it appears that as dairy intensification increases, adults and children are less likely to go without milk.

Table 4. Proportion of households reported going without milk at least one time in the last 30 days, n=92

	No milk	Emerging	Advanced
Adults in household went without milk at least 1 time in last 30 days	43%	23%	3%
Index child in household went without milk at least 1 time in last 30 days	30%	10%	0

4.1.2 Does increased milk production translate into increased consumption per household member, particularly children under five?

Even if dairy intensification results in increased household consumption, the increase may not be equitably distributed within the household or to those who would benefit the most, i.e. young children. The amount of fresh milk given to young children increased across intensification (Table 5). Children 12-18 months in the advanced households were receiving more than two times the amount of milk that children in emerging or no milk households were receiving (1.14 cups vs. 0.5 cups). For children 18-24

months, the difference was even greater. Children in advanced households received almost 1 cup more a day (2.17 cups) than the children in the emerging households (1.25 cups). An opposite effect was seen in children 6-12 months. Infants in this age group from no milk households were consuming more milk than infants from emerging or advanced households. In this case, it is possible that the milk consumption is less a reflection of availability and more of a reflection on breastfeeding and complementary feeding practices.

Table 5. Mean daily consumption of fresh milk for primary caretakers and index children, n=92

	No milk	Emerging	Advanced
Primary caretaker			
Adult females	0.39	0.39	1.40
Breastfeeding women, n=47	0.53	0.73	1.45
Index child			
Children 6-12 months	1	0.71	0.5
Children 12-18 months	0.5	0.5	1.14
Children 18-24	0.3	1.25	2.17

Results from the survey are consistent with what was learned from the FGDs. Participants across intensification categories reported that young children were prioritized in the distribution of milk. Regardless of the level of dairying intensification, farmers explained that it was important to give milk to young children. When asked why it was important to give milk to children, the farmers provided a variety of reasons including health reasons and for growth. As one woman from the emerging group in Cheborge said, "We want the children to have beautiful and handsome faces – that's why we give milk." One female farmer in Cheborge who was also a trained community health worker said, "For most of the women in the area, they've been told that milk is good. Most of these women have cows, so taking milk is not a problem."One male farmer said it was important to give milk to children so they can grow up to be runners.[3] There appeared to be consensus across sites and intensification groups that there was an association between the absence of milk and overall nutritional deficiencies and malnutrition. Many farmers described the symptoms and named marasmus and kwashiorkor as the consequences of children not taking enough milk. One farmer said, "The child becomes weak without milk and the face becomes dry." Another farmer said milk was important to give to young children "to avoid swollen stomachs." Other farmers mentioned that if children were not given milk, they will have big stomachs, sagging cheeks, brown hair, and bowed legs; they'll be weak; and they will have a lot of diseases. Several farmers mentioned the importance of giving milk to children under two years old, in particular. "Children given milk from birth are very strong," said a female farmer from the emerging group in Cheborge. A woman from the maternal group in Cheborge explained that children under two years old are given milk in a cup to drink and are expected to drink the entire cup after they are fed. She used the Kalenjin word, *cholol*, which means once the cup of milk touches the lips it cannot be set down until the milk is gone, and is a word exclusively used in reference to drinking milk. Some children, depending on taste preferences may start taking *mursik* (fermented milk) after the first year, but the diets that were described for children under two years old showed that milk was consumed mainly as fresh milk, mixed with *uji*, added to *ugali*, and added to tea.

Previous studies among the Nandi of Kenya indicate that milk was distributed within the household beginning with men and initiated boys receiving the morning milk and then children and women

[3] Many of Kenya's most well-known, champion long-distance runners are Kalenjin.

receiving the evening milk (Huss-Ashmore 1996). Others have argued that with the expansion of dairy commercialization and the growing tendency of households to sell morning milk, intra-household distribution of milk and therefore nutritional benefits will change (Huss-Ashmore 1996).Farmers did not report any gender preference. There was consensus among the male farmers in the emerging group in Cheborge that no preference was given to male children over female children. Some farmers explained that male children eat more and may ask for more milk than female children. Milk seems to be allocated to infants and young children first. Children 3 to 5 are given next priority, followed by school-age children. Men are given next priority, with pregnant or breastfeeding mothers next, and adult women last. If there is not enough milk, women explained that they will forgo milk. One woman explained, "I will deny myself [milk] to feed the small child."

Breastfeeding mothers

An additional consideration in the pathway from direct consumption to child nutrition is the consumption patterns for breastfeeding mothers. Focusing on children under five years old means that many of the surveyed children will still be breastfed and therefore dependent upon the nutritional status of the mother to some extent. Fresh milk consumption for the breastfeeding mothers in this study increased across intensification (Table 5). The daily mean amount consumed was greater than the mean amount consumed by non-breastfeeding women across all intensification categories, although the difference was very small among the advanced category with the breastfeeding women consuming only 0.05 cups more than non-breastfeeding women.

Results from the survey and FGDs indicate that household and individual milk consumption increased with dairy intensification, but in order to understand the different tradeoffs households face that may influence child nutrition, it is important to also examine changes in income and expenditures across intensification and household decision-making.

4.2 DAIRY INTENSIFICATION AND CHANGES IN INCOME AND EXPENDITURES, INCLUDING INTRA-HOUSEHOLD DECISION-MAKING AND TRADE-OFFS BETWEEN THE SALE AND CONSUMPTION OF DAIRY AND OTHER FOODS

The income mediated nutritional effects of dairy intensification are the result of the different trade-offs that households face across decisions of production, consumption, sales, and expenditure. In the dairy production process, the first trade-off that households face is between consumption and sales. Like many households engaged in agriculture, dairying households are peculiar economic entities in that they are "both producing and consuming units: as producers, they maximize profits subject to prices, assets and available technology, and as consumers, they maximize utility subject to prices and income" (Alderman 1994). So, dairy farmers face a crucial opportunity cost when trading milk consumption for milk sales or vice versa, and when dietary patterns of a community and cultural significance of certain foods play an integral role in determining the perceived value of milk as a food source in relation to the market value of milk as a cash crop.

The primary objective of dairy interventions, such as EADD in East Africa and Project Flood in India has so far been to trigger increased income generation in smallholder communities, with an intention to improve various facets of human development by helping farmers (Alderman 1994). According to Pinstrup-Andersen and Caicedo, "considerable improvements in human nutrition can be made, even in the absence of expansion in overall food supply, by allowing a larger proportion of income growth to be obtained by nutritionally deficient income groups" (Pinstrup-Andersen and Caicedo 1978). However, this implies that the basic nutritional and food consumption needs of the household have not yet been met

(i.e. nutritional deficiency), and that food is the primary expenditure item mitigated by increased income. However, as household nutritional levels increase, households may seek to maximize other factors of human development. Frankenburger suggests that nutritional impact is also affected by the control of income and the frequency of payment (Frankenburger 1985). Therefore, after receipt of the income, by a specific person on a specific payment schedule, the household unit faces a series of tradeoffs on expenditures as potential consumers of nutrition, other facets of human development, such as education, and a variety of other goods.

While the dairying household can be viewed as a single economic actor, its dairying decision outcomes are often negotiated through intra-household roles and structures. Therefore, gender dynamics play an integral role in the final decisions a household makes in the consumption, production, and expenditure of milk, based on the various gender designations existing within dairying systems and the structural uniqueness of each household.

4.2.1 What tradeoffs do households make between milk consumption and sales?

Gender and ownership in the Kipsigis and Nandi communities

The sites of Cheborge, Kipkelion, and Kebenet are predominantly populated with Kalenjin speaking groups such as the Kipsigis and to a lesser extent the Nandis, who have been historically a pastoralist community. Huss-Ashmore, in her study of the Nandi community in the UasinGishuDistrict, found that men traditionally inherited and controlled livestock, which the Kalenjins see as the household's most valuable economic resource (Huss-Ashmore 1996). However, in von Bulow's work on gender and property ownership of the Kipsigis in Kericho, it is pointed out that "regardless of men's ultimate rights in livestock, women had a considerable influence on the management of that property" (von Bulow 1992). Similarly, Huss-Ashmore describes that because of the Nandi women's position as the manager of the household, she is responsible for providing food for the household, which gives her a unique decision-making role in the household allocation of milk. With regards to the traditional allocation of livestock and its resources amongst the Nandi, Huss-Ashmore points out that "upon marriage, a woman would have cattle assigned to her house to provide milk for her and her children" (Huss-Ashmore1996). So, given the Kalenjin woman's unique position as the manager of household food consumption, women's role in milk consumption, sales and expenditures decision is integral to analyzing the income mediated benefits of dairying on nutrition.

Milk consumption in light of increased milk sales

The Uasin Gishu study reveals the importance of milk in the rural Nandi diet in which 74% of the sampled households were shown to consume fresh milk daily and 84% consume milk in daily tea. This diet pattern has "remained traditional" in the Uasin Gishu District, in spite of increased commercialization in agriculture (Huss-Ashmore 1996). Regarding this issue, the household survey and the FGD data collected from this study seem to indicate a similar portrayal as the Uasin Gishu project. The FGDs conducted in Buret and Kipkelion districts have shown that market factors are not likely to affect the milk consumed within the household. In Kipkelion, men who are much attuned to the financial benefits of selling milk as a cash crop, nevertheless admit that "without milk, it is as though you haven't eaten anything." This is also evident from the average milk consumption data collected from the household survey, where milk production increased from 3.20 to 10.77 liters with consumption increasing from 2.02 liters 4.88 liters across the emerging and the advanced groups (Table 3). Data from the FGDs indicate that women have significant control over food allocation decisions of the household. "Women are the only ones that know about keeping what's enough for the household," one advanced group woman in Cheborgesaid. She further explained, "The man says that the women can decide what to do with the extra amount of milk."Therefore, there are indications from the consumption,

production, and sales patterns that only after the primary consumption needs of the family are met is the remaining milk is used for sales. In this regard, intensification and higher milk sales have no negative implications on the Kalenjin community.

Farmers in Buret and Kipkelion districts milked their cows mainly during the morning and the evening, and these two milking times are often designated traditional distinctions of gender and utilization. Curry states that among the Kalenjin groups, the morning milk**,** which was traditionally allocated to the males of the household, is generally "the milk sold to the local creamery, while the evening milk under the control of women is reserved for household consumption" (Curry 1996). He goes on to further explain that "income from the morning milk generally goes to the males and has implications for both women's control of income and household nutrition" (Curry 1996). Curry's assessment is confirmed in this study, with FGD participants in Kipkelion and Cheborge making the distinction about the control of morning milk to men and evening milk to women. In the Cheborge FDG, one farmer distinguished the two milking times by saying that the "father decides on morning milk (for sales)" and that "only the other mother uses the evening milk for the household; it is the domain of the woman." Across intensification, fewer households are keeping all of their evening milk for consumption (Table 6). Twenty-three households in the advanced group reported keeping all of the evening milk compared with 28 households in the emerging group (out of 31 households in each category). In the advanced households, increased milk production is most likely satisfying milk consumption needs channeling the remaining evening milk towards sales.

Table 6. Households keeping all of evening milk for consumption stratified by intensification level and site, n=62

Sites	Emerging (n=31)	Advanced (n=31)
Cheborge	10	8
Kebenet	7	7
Kipkelion	11	8
Total	28	23

However, there is some evidence that women in the advanced intensification group are capturing some control of the total milk sales by making sales decisions on evening milk remaining post consumption, which traditionally falls under their domain. Of the households who reported selling evening milk (n=41), the percent reporting that the spouse (majority of whom are women in the sample) makes the decision on how much evening milk to sell increased from 54% in the emerging group to 82% in the advanced group (Table 7). Simultaneously, the percent of households reporting that the head makes the decision on evening milk sales decreased from 36% to 5% with intensification.

Table7. Decision-making patterns for sales versus consumption of evening milk stratified by intensification, n=41[4]

Decision Makers	Emerging (n=19)	Advanced (n=22)
Head	36%	5%
Spouse	54%	82%
Joint	16%	14%

While women seem to be gaining control over evening milk sales decisions, men seem to be increasingly controlling total dairy income with intensification. Thirty-three percent of emerging households

[4] Change in sample size indicates response rate - 41 of the surveyed households reported selling the evening milk.

reportedthat the head is managing dairy income versus 44% of advanced households (Table 8).However, trend is somewhat countered by the increase in households reporting joint decisions in milk income management with intensification (14.3% in emerging compared to 27.6% in advanced). Some of this increase in joint managing of total milk income may be attributed to spouses increasingly taking over evening milk sales decisions.

Table 8. Management patterns of total milk income stratified by intensification, n=50[5]

Decision Makers	Emerging (n=21)	Advanced (n=29)
Head	33%	44.8%
Spouse	52.4%	27.6%
Joint	14.3%	27.6%

The dynamic effects of dairying on women's decision-making power are still unclear. An erosion of control in higher levels of advanced intensification may be possible when livestock systems are more likely to be of large scale and highly commercial, contrasting with a possible retention or growth in women's control in the lower advanced intensification levels, where dairy keepers are largely still smallholders. It is also crucial to explore the time effects of intensification further. Women, especially in the Kalenjin community, are the main actors in household nutritional allocation and because of this "women's income is more likely to be spent on food than is men's income" (Huss-Ashmore 1996).Therefore, changes in women's control over milk income across intensification serves as a crucial factor to be examined as an indicator of nutritional impact, since income mediated food expenditures are largely and increasingly made by the women in the household across intensification: 66% of food purchases were made by spouses in the emerging group and 74% of food purchases were made by spouses in the advanced groups.[6]

4.2.2 What role does milk income have in households of varying dairy intensification levels?

Milk income seems to increase with intensification and it seems to be associated with a slight increase in average monthly income across intensification levels (Table 9). An increase in milk income seems to also be causing a substitution effect for other sources of income whereby percent of monthly income received from wages is diminishing from 71% in the no cow level to 44% in the advanced intensification level.

[5]Change in sample size indicates response rate – only 50 households chose to answer the question about who manages income from milk sales

[6] Food purchases were counted per individual food purchase. Among emerging dairy households, there was a total of 218 purchases; and among advanced dairying households, there was a total of 213 purchases. Therefore, the 66% of purchases made by the spouse in the emerging group does not reflect 66% of households, but 66% of the actual purchases made across that group of dairying households.

Table 9. Contribution of different sources of income and primary expenditures, n=92

Proportion of total monthly income from various sources			
Income Source	No cows (n=30)	Emerging (n=31)	Advanced (n=31)
Milk Sales	0%	9%	23%
Animal Sales	0%	17%	0%
Crops Sales	27%	20%	25%
Income from wages	71%	49%	44%
Income from remittances	2 %	5%	6%
Income from other sources	0%	0%	3%
Proportion of households reporting income from various sources			
Income Source	No cows (n=30)	Emerging (n=31)	Advanced (n=31)
Milk Sales	n/a	74%	94%
Animal Sales	n/a	13%	0%
Crop Sales	47%	42%	71%
Income from wages	73 %	65%	45 %
Income from remittances	7%	3%	3 %
Income from other sources	0%	7%	7%
Average Monthly Income (in Ksh)	9,080	11,495	11,830

However, the limited sample size, some potential systematic bias that may have been introduced by under-reporting of income, and the high variability of reported household incomes prevent us from seeing a more pronounced trend towards either income substitution or income augmentation. Potential nutritional impact of milk income might come from the fact that payments are steady, and relatively predictable compared to an income closer to crop sales, the payments for which are made in large lump sum payments only a couple of times a year. Citing Leegwater et al., Huss-Ashmore explains that "lump sum or windfall income is less likely to be spent for food that is steady or regularly distributed income" (Leegwater et al. 1990; Huss-Ashmore1996).

4.2.3 Could land ownership confound the effects of dairy intensification on nutrition?

Average land and asset holdings across the intensification levels and across the surveyed sites serve as an initial crude indicator for wealth factors confounding the impact of dairying on nutrition. There was some variation in average land owned across sites, with farm holdings in Kipkelion and Cheborge being smaller than land holdings in Kebenet across intensification levels (Table 10). Kipkelion and Kebenet saw an increase in average land holdings across intensification levels compared to Cheborge where it remained the same. In further analysis of the data, a weighted control of land and assets will likely diminish the initial perceived effects of increased income on variables such as dietary diversity (see Section 4.3).

Table 10. Average land owned across intensification categories and sites, in acres, n=92

Sites	No Cows (n=30)	Emerging (n=31)	Advanced (n=31)	Average across sites
Cheborge	5.1 (n=10)	4.9 (n=10)	5.3 (n=10)	5.1 (n=30)
Kipkelion	2.9 (n=10)	5.5 (n=11)	6.1 (n=12)	4.9 (n=33)
Kebenet	7.4 (n=10)	7.9 (n=10	16.5 (n=9)	10.4 (n=29)
Across intensification	5.1 (n=30)	6.1 (n=31)	8.9 (n=31)	

An overview of expenditures

Across the intensification levels, food expenditure remained the primary expenditure item reported (Table 11). Sixty-five percent of households in the emerging group reported food expenditures being the primary purchase from dairy income, while 45% of the households in the advanced group reported the

same. Frequency of school fees reported as the primary expenditure item increased withintensification (17% in emerging and 28% in advanced), along with dairy inputs (17% in emerging and 21% in advanced). This may be because food consumption needs are being satisfied through increased income with the remaining income being utilized towards investment towards increased production, and other aspects of human development, such as education.

Table 11. Proportion of households who reported using dairy income for three priority expenditure items, n=52

Priority expenditure items	Emerging (n=23)	Advanced (n=29)
Food Items	65%	45%
School Fees	17%	28%
Dairy Inputs	17%	21%

*Change in sample size indicates response rate – only 52 households chose to answer the question about priority expenditure items for dairy income.

4.3 DAIRY INTENSIFICATION AND CHANGES TO HOUSEHOLD AND CHILD DIETARY DIVERSITY

A third aspect, besides direct consumption and income-medicated pathways to child nutrition to explore in this study was dietary diversity. Using dairy intensification as a proxy for income, the dietary diversity patterns of households and the index child were compared to ascertain changes and differences across intensification. The key indicators used were the household dietary diversity score (HDDS) and the individual dietary diversity score (IDDS) for the index child. In the questionnaire,household dietary diversity was collected using a seven-day recall of foods consumed in the household and a HDDS was calculated based on the number of different food groups, out of 11 food groups, consumed in the seven-day period.[7] The seven-day recall was administered to the primary caretaker of the index child. Household dietary diversity was an appropriate measure for this study because it has been associated with socio-economic status, household food security, and nutritional indicators such as birth weight, child anthropometric status, caloric and protein adequacy, and percentage of protein from animal-source foods (Swindale and Bilinsky 2006). The HDDS can be used as a proxy measure for household economic status and an IDDS can be used as a proxy measure for the nutritional quality of an individual's diet (Swindale and Bilinsky 2006). Dietary diversity for the index child was collected using a 24-hour recall of foods consumed by the child, administered to the primary caretaker of the index child. An IDDS was calculated based on the number of different food groups out of eight.[8]

Household dietary diversity can be used as an indicator for a household's access to a variety of foods. In addition to the HDDS, an IDDS was calculated for the index child in each household. In this sample, the mean IDDS for children in advanced households was greater for all age groups than for children in emerging households and for children from no milk households (Table 12). Overall, the IDDS was low although this was expected based on what was learned from the FGDs and reported in previous studies. In one particular study among preschoolers in Western Kenya, 45% of the children had very low dietary diversity, which was defined as having consumed less than 12 different food items in the 7 days prior (Ekesa 2008). Even so, there was not a clear increase in IDDS across intensification because in several

[7] The HDDS can be based on up to 12 food groups. In this study, the HDDS was calculated from 11 food groups: cereals; roots and tubers; vegetables; fruits; meat, poultry, offal; eggs; fish and seafood; pulses, legumes, nuts; milk and milk products; oils and fats; and miscellaneous. Sugar and honey are typically listed as the twelfth food group.

[8] The IDDS for children under five years was based on eight food groups: grains, roots, or tubers; vitamin-A rich plant foods; other fruits and vegetables; meat, poultry, fish or seafood; eggs; pulses, legumes or nuts; milk and milk products; and foods cooked in oil or fat.

age groups, the mean IDDS for emerging households was lower than for children in no milk households (Table 12). One reason for this decrease could possibly relate to women's workload and the practice of leaving young children with other caretakers, which was a theme heard in the FGDs and described further in this report (Section 4.4). Another possible explanation could be that the emerging households are more in a transitional state of dairying intensification and increased income is not being translated into improved food purchases. More detailed analysis of these confounding factors will be necessary to understand the differences.

Table 12. Mean dietary diversity scores and food consumption patterns for households and index children, n=92

	No milk	Emerging	Advanced
Household dietary diversity score	8.3	8.5	9.1
Individual dietary diversity score (index child over 6 months), n=78			
Overall	4.8	4.4	5.1
6-12 months	4.8	3.9	5
12-18 months	4.6	4.3	5.3
18-24 months	4.4	4.3	5
24-60 months	5	5	5.1
Animal-source food score (index child over 6 months)[9]			
Overall	1.4	1.3	1.4
6-12 months	1.3	1.3	1
12-18 months	1.8	1.3	1.6
18-24 months	1.2	1	1.3
24-60 months	1.3	1.44	1.3

Dietary diversity scores were in line for what was expected based on what was heard in the FGDs. Across sites and categories, children above three years old had diets similar to their parents, which included a standard diet of milky tea, *uji* without milk, *ugali*, vegetables such as kale or cabbage, indigenous vegetables, and *githeri* (a vegetarian maize and bean mixture). Children under 3 years were consuming *uji* with milk. Rice was mentioned in some groups and sites, but it did not appear to be a standard part of the diet. As a young mother from the emerging group in Cheborge explained, "Even if the kids have rice, they have to have some ugali. If the kids have rice, the next morning, they will say, 'Mom I didn't have anything to eat yesterday.'" Across all sites and groups, *ugali* emerged as a regular part of the diet. When asked to describe diets for men, women, and children, farmers repeatedly said "*Ugali ni lazima*," which means "Ugali is a must." This is important to note when considering the importance of milk in the diet because the two are often paired together in a meal. One female farmer from the maternal group in Cheborge said, "When there's ugali, there must be milk."

Several farmers mentioned milk as a replacement for meat in meals. Meat did not appear to be a regular (>1 times/week) occurrence in any of the groups or sites. When asked about meat purchases as part of overall food purchases, farmers reported that meat was not necessary if milk was served. "We are not bothered with meat because we have eggs and milk to substitute," said a male farmer from the emerging group in Kipkelion. Only 15% of the index children over 6 months had consumed meat in the 24 hours prior, compared to 100% who had consumed milk in the 24 hours prior. If households are substituting milk for meat in the diets of children, it could potentially be detrimental to child development. In a feeding intervention among Kenyan school-children in Embu District, children who received a meat supplementation surpassed children who received a milk supplementation in cognitive

[9] The animal-source food score was based on consumption of three food groups: any meat including poultry, fish, or seafood; eggs; and milk or milk products.

performance (Whaley 2003). The results of the study suggest that for children who are mild or moderately undernourished, proteins and nutrients in animal-source foods are important for normal growth and function, but milk and meat are not equivalent dietary supplements (Whaley 2003). Although milk is a good source of vitamin A, calcium, vitamin B-12, riboflavin and folate, it does not contain the values of iron and zinc that are found in meat. Nutrition education on the importance of dietary diversity and meat-milk balance would be an important next step.

Conclusions

Dairy intensification results in increased household and individual-level fresh milk consumption. As intensification increased, the amount of milk kept in the household also increased. Milk was particularly important in the diets of adults and children in the study sites as demonstrated by household and child dietary diversity measures and by farmers' explanations in FGDs about how milk is a desirable part of the diet. Furthermore, in this particular sample the nutritional value of milk for young children was well-recognized and giving milk to young children was prioritized. Although dairy intensification resulted in increased consumption, at this point in the study it is not clear how this translates into a nutritional impact. More research is needed to determine the magnitude of nutritional impact on child status. Secondly, dietary diversity increased across intensification levels, but there could be a number of factors, such as wealth, confounding this association. In future analysis, confounding factors need to be controlled for in order to confirm the relationship between dairy intensification and dietary diversity.

4.4 DAIRY INTENSIFICATION AND CHANGES IN THE TIME ALLOCATION OF CHILDREN'S PRIMARY CAREGIVES AND QUALITY OF CHILDCARE

In recent years, more attention has been given to childcare as an important nutritional indicator. Care behaviors for young children can be classified into four categories: i) feeding behaviors, which includes the frequency and duration of breastfeeding and the timing and composition of complementary feedings; ii) hygiene behaviors related to food, person and home; iii) psychosocial behaviors including responsiveness, warmth and involvement; and iv) health behaviors such as sick care and health-seeking behaviors.

While recognizing that childcare behaviors can greatly impact child nutrition, it must also be said that caregivers themselves, especially rural women, often take on many roles within the home. They often act as primary caregivers to their children and as income earners for their households. These multiple demands may conflict with childcare activities, and as such, impact child nutrition (Montagne et al. 1998). To cope with time constraints, women might delegate certain childcare activities to others—often older siblings—or might multitask more, resulting in a decrease in the quality of childcare, which in turn has a negative impact on child nutrition (Engle 1991).

This study looks at this tradeoff more closely within the context of dairy intensification. Specifically, how does increasing dairy production—an activity often entirely carried out by women—affect women's time allocation and in turn, her childcare activities? In the maternal FGDs, a 24-hour time clock was used to capture the women's daily activities, paying special attention to child feeding and care activities. As the mothers recounted their daily activities, they were asked the location of their youngest child, who the caretaker was, who was responsible for feeding the child and what the child was fed. This data was used to examine whether dairy activities conflicted with childcare activities, and if so, how the mothers compensated. In addition, the FGDs were used to finalize a list of activities to focus on in the household survey. The household survey was administered to the primary caregiver of the index child

and focused on the following indicators: 1) workload;2) time allocated to childcare activities and sick care; 3) child feeding practices, specifically breastfeeding, weaning and complementary food practices, nutritional status of the primary caregiver; and 4) intra-household resource control and caregiver autonomy.

4.4.1 How does dairy intensification affect the primary caretaker's workload?

Women's time commitments are seen as a zero-sum game, no new activities can be introduced without affecting the efficiency and/or the time allocated to other activities (Engle et al. 1997). So then, how do changes in livestock systems, namely intensification, impact women's workload, how are these activities incorporated into their day, and how are other daily activities affected?

A number of themes emerged from the FGDs about the general workload of women in this area. The first is that the women, at all intensification levels, had a full day working on both household and economic activities. Indeed, from the time they get up to light the fire and prepare tea to the time they retire to bed, the women are working continuously in their homes and in the family farms. Waking time did differ slightly across intensification levels. In Kipkelion for instance, the no milk, emerging and advanced groups woke at 0630 hours, 0600 hours, and 0530 hours respectively. The earlier rising times were usually in order to accommodate additional work demanded by dairy production such as warming water to clean the teats and the morning milk. Across all sites and intensification levels, it was rare that women had unaccounted time, and even rarer that they would mention rest. The only exception to this was the women in the no milk group from Kipkelion, who recounted almost two hours of rest time in the evening. The reasoning behind may be that many of these women lived in town, and rather than working on their own farms, worked on other's farms as casual laborers. In addition, these women were largely not Kipsigis, and differences could therefore have to do with different cultural practices, or due to a history of post-election violence in this area, the lack of family farms. Other women, such as the advanced group from Kipkelion, reported only 20 minutes of rest throughout the day, and the emerging group from Kebenet, when asked when they rested, said they did so only on Saturdays and Sundays.

In the household survey, the respondent was asked to recall the amount of time she spent on specific activities on an average day. These activities were divided into three categories: dairy, childcare (discussed below), and other income-generating activities. Dairy activities were further divided into watering, feeding, milking, and grazing cattle, gathering and preparing feed, and selling milk. Income-generating activities include working in the family garden, working on the farm, picking tea, and work.There was no significant difference in mean time spent on income-generating activities across intensification levels. Women from the no milk, emerging, and advanced levels reported spending 281.9, 283.9, and 275.5 minutes on income generating activities respectively (Table 13). However, there was a moderately significant finding for mean time spent on dairy activities. While women in the emerging group reported being involved in dairy activities an average of 112.1 minutes on an average day, women in the advanced group, reported engaging in these activities 56.9 minutes, almost half the time of the previous group (Table 13). This represents a significant increase in workload for women in the emerging group, and is consistent with the findings from the FGDs.

Table 13. Mean time primary caretakers spent on dairying and other income-generating activities, in minutes

	No milk	Emerging	Advanced
Time spent on all dairy activities, in minutes	15.3	112.1	56.9
Time spent on all other income- generatingactivities, in minutes	281.9	283.9	275.5

Looking further into women's involvement in dairy activities there is a difference in the proportion of women reporting involvement in at least one dairy activity. In the emerging group, 83.9% of women are involved in dairying, while in the advanced group, only 48.4% of women reported being involved in dairying (Table 14). There is very little difference between the emerging and advancedhouseholds in terms of the proportion who reported hiring labor for dairying activities with 19.3% of emerging households and 22.5% of advanced households have hired labor to help with dairying activities (Table 14).

Table 14. Dairy involvement of primary caretakers and prevalence of households who hired labor for dairying

	Emerging	Advanced
Proportion of primary caregivers involved in dairy activities	83.9	48.4
Proportion of households that hire labor for dairy activities	19.3	22.6

If there is little difference in the hired labor between intensification groups, but a marked difference in the number of women involved in dairy activities, it could indicate that women in advanced dairying households are taking a step back from dairy activities and others are stepping into the role. This finding, while positive in terms of women's workloads has to be interpreted within the context of income and decision control. Namely, as women take a more hands off role in dairy activities, how does this affect women's control of the income generated by dairy and the decision making surrounding sale and consumption of household milk?

4.4.2 How does dairy intensification affect general childcare, childcare strategies, and sick care?

In the FGDs, it was found that regardless of the intensification level or site, women remained with their young child for a large portion of the day. A woman from the emerging group in Kipkelion summarized this point by stating that, "children are like an identification card." Literally she means that like an identification card, she carries her child with her everywhere, but also, that her infant is a means of identifying her as a mother within the community.

In the morning, when most women went to work on the farm or to pick tea, the youngest child would most often be carried on the mother's back. During this time, a small minority of women across all sites and intensity levels would leave their children behind at the homestead. Although most would leave food for the child at this time—generally *uji*, millet and milk—the appropriateness of this practice depends largely on the child's age. In the afternoon, when the majority of the dairy activities would occur (except for the morning milking), young children were either with the mother or left with older siblings just returning from school. This practice of leaving a young child with an older sibling, especially one under 13 years old, is an important nutritional indicator. According to Engle, children who are taken care of by preteen siblings have a lower nutritional status even when primary caregiver education and income are controlled for (Engle 1991).

Looking at this trend closer in the household survey, there was no difference in the mean time that women spent away from their youngest child across intensification levels (Table 15). However, what was interesting was who the child was left with. Twenty-three percent of the emerging women left their child with young siblings compared to only 13% of women in the advanced households. Women in the emerging group have a significantly heavier dairy workload, and more of these women are leaving their children with young siblings while performing these activities, putting their young child at risk of receiving lower quality childcare which in turn may affect their nutritional status.

Table 15. Childcare practices among dairying households across intensification levels

	No milk	Emerging	Advanced	Overall
Mean time primary caretaker spent away from youngest child on a typical day, in hours	3.2	3.6	3.5	
Proportion of caretakers who ever left youngest child with a sibling under 13 years old during dairy activities (%)	25	30.7	20	26.7
Proportion of caretakers who left youngest child with a sibling under 13 years old during dairy activities (%)	25	23.1	13.3	20.0

No difference was found in the amount of time delegated to childcare activities between intensification levels. These activities include home hygiene behaviors such as cleaning the house, washing dishes and children's clothes, and bathing the children, and food preparation. The mean time spent on all childcare activities across the no milk, emerging and advanced intensification levels were 201, 227, and 291 minutes respectively. This is consistent with the information from the FGDs where it was found that most women do not delegate these responsibilities to others. What is not clear however, is if dairy intensification, particularly for the emerging group who appear the most over burdened, interferes with the efficiency and quality of childcare activities by evidence of more multitasking. This warrants further investigation.

With regard to sick care of the children, there was little difference between dairy households. The primary caregiver was available to provide sick care of the youngest child in 80% of the time in emerging households and 84% of the time in advanced households. However, in no milk households, the primary caregiver was the one providing sick care only 70% of the time. Increased dairy activity does not appear to interfere with the availability of the primary caregiver to provide sick care and actual seems to improve from non-dairy to dairy households.

4.4.3 How do breastfeeding, weaning, and complementary feeding practices differ across levels of dairy intensification?

In the FGDs, it was found that mother and infant are rarely apart throughout the day, which allowed for on-demand breastfeeding. It was generally reported that children were breastfed up to 24 months, until the women was trying for another child, or until the child would eat complementary foods well. Weaning foods included water, milk, and *uji*, generally introduced in that order and around the third or fourth month.

Consistent with the information from the FGDs, the results from the survey show that, on average, across intensification levels, women do not leave their children with other caregivers until around six months of age. However, looking at the duration of breastfeeding by intensification level, there are some differences. For women with children under 12 months, the proportion of women still breastfeeding is the lowest for the emerging group, at 86.6%, compared to the no cow and advanced groups in which 100% of respondents reported still breastfeeding children in this age bracket (Table 16). When looking at the proportion of children between 12 and 24 months that are still breastfed, there is an even more marked difference. While there is a significant drop off in the number of children age 12 to 24 months still being breastfed, the most marked drop off happens in the dairy households. Seventy percent of no milk mothers continue breastfeeding up to 24 months whereas only 42.8% and 50% of emerging and advanced mothers respectively report doing the same (Table 16). These results support the idea that as households intensify, and more of women's time is allocated to dairy activities—the

largest time constraints being seeing in the emerging group—women will be less available time to breastfeed, and in turn will stop breastfeeding earlier.

The results from the household survey support the idea that weaning foods, mainly water, milk, and *uji* are introduced around the third and fourth months. The no milk group introduced weaning foods consistently later than both dairying groups, reinforcing the hypothesis that dairying is associated with earlier breastfeeding cessation and earlier introduction of complementary foods (Table 16). The early introduction of *uji* is especially significant in emerging households. *Uji* is a food that can be made in the morning, put in a thermos for the rest of the day, and is often left with alternative caregivers. *Uji* represents an easy, time saving food, therefore it is consistent that *uji* would be introduced earlier in households where women are under greater time constrains, namely in the emerging group.

Table 16. Breastfeeding and complementary feeding practices for children under 24 months across intensification levels

	No Milk	Emerging	Advanced
Proportion of children under 12 months currently breastfeeding (%)	100	86.6	100
Proportion of children 12-24 months currently breastfeeding (%)	70	42.8	50
Mean age water was introduced, in months	4.48	4.0	3.2
Mean age milk was introduced, in months	4.5	4.1	4
Mean age porridge was introduced, in months	4.4	3.5	4.1

4.4.4 How does dairy intensification affect caregiver health, nutritional status, and stress?

An especially relevant point to emerge from the FGDs was that of maternal depletion. There are two pathways – direct and indirect – in which maternal depletion can affect the nutritional status of the children in the household (Engle et al. 1997). The former occurs when the caregiver has too little energy to provide quality childcare, and the latter deals with the link between depletion of caregiver, specifically for pregnant and lactating women, and its impact on infant birth weight and lactation. In line with the latter pathway, one woman from the advanced group in Kipkelion noted that "because we work hard and don't always eat well, we don't have enough milk of our baby." An example of not eating enough comes from the focus group in Kebenet. Here, all the women agreed that from 0800 hours to 1200 hours when they are working on the family farm, they would not eat, although at this time they would continue to "breastfeed as usual." Moreover, when allocating food and especially milk within the household, men and the youngest child are prioritized. Indeed, many times the women mention that "the man must have milk." Women, however, are usually the lowest priority, and are the first to forgo food and milk if there is little in the households in order to allocate more to their children. Women's low priority in terms of intra-household food allocation, paired with the increasing workload associated with dairy intensification and specifically emerging households, puts women in these households at risk for maternal depletion.

Conclusions

Across intensification levels the results show that while time allocated to childcare activities and income-generating activities remained the same, there was a large increase in the amount of time spent on dairy activities, especially for women in emerging households. Since this increase in workload is not accompanied by a decrease in other activities, we can infer that time not captured in the households survey, such as leisure time, is being replaced. The increase in workload and time constraints paired with the information from the FGDs concerning the nutritional status of mothers in the community and intra-household food allocation, leads to the conclusions that maternal nutritional status, depletion and stress are areas that need further investigation as possible tradeoffs of dairy intensification. In addition,

increased workload may lead to more multitasking and the need alternative caregivers that provide lower quality childcare. This is consistent with the finding that almost a quarter of caregivers in emerging households, when carrying out dairy activities, are leaving their young children in the care of preteen siblings. Lastly, additional time constraints added by dairy intensification may make it harder for women to breastfeed and can lead to earlier weaning and introduction of complementary foods. This is consistent with the finding that a lower percentage of women from emerging and advanced households are breastfeeding children age 12-24 months, and introducing *uji* and water at an earlier age.

Dairy intensification has the potential to greatly impact women's workload, childcare strategies, child feeding practices, and maternal nutritional status, depletion, and stress. Therefore, it is important to further investigate this pathway, taking into account these mitigating factors—seen largely at the emerging level—to improve the intervention and further benefit the nutrition of women and children.

4.5 DAIRY INTENSIFICATION AND CHANGES IN EXPOSURE TO ZOONOTIC DISEASES AND RISK OF INJURY AND DISEASE

In Sub-Saharan Africa, more than 137 million people are poor rural livestock keepers and are daily exposed to potential zoonotic diseases (WHO 2010c). Animal-source foods like milk and meat are the "main sources of zoonoses of bovine origin" and therefore much more than 137 million have the potential for zoonotic exposure (Cavirani 2008). Because milk is such an integral part of the Kalenjin diet, the number of households potentially exposed to zoonotic disease is very high. The topics of focus for this study were chosen based on three of the most important zoonotic diseases in the developing world: brucellosis, tuberculosis and gastrointestinal (GI) or diarrheal diseases, all of which can be transmitted through direct contact with milk and cattle. The WHO's 2004 Global Burden of Disease statistics indicate that tuberculosis and diarrheal diseases are two of the highest causes of death (WHO 2008). Brucellosis is considered a neglected tropical zoonosis that is transmitted by direct contact with infected cattle. The majority of all cases are caused by drinking unpasteurized milk from infected livestock (WHO 2010a).Brucellosis-affected cattle experience a decrease in calving rate, milk production, and sale value. When humans are affected, there is a decreased work capacity due to illness as well as the potential for increased spontaneous abortion in pregnant women (Mangen et al. 2002; Kurdoglu et al. 2010). Tuberculosis affects one-third of the world's population and of that, it is estimated that of the cases in African countries, 0.4-10% of all cases are caused by Mycobacterium bovis (M. bovis), the major causative organism in tuberculosis in cattle (Michel et al. 2010; WHO 2010e). Although M. bovis accounts for a small percentage of human cases it is nevertheless considered to be "a pathogen of significant economic importance"(Theon et al. 2009).

The hypothesis for the zoonosis pathway is that with intensification, some health risks may increase and may have a negative effect on child nutrition**.** The purpose of the zoonosis portion of the FGDs was primarily to understand the community's perception about presence, risk, and exposure to diseases caused and carried by dairy animals. Every effort was made to ask questions regarding the symptoms of the disease, rather than just the name of the disease to assess for syndromic surveillance. In all three sites and in almost every intensification group, participants mentioned brucellosis by name as a serious problem, but when probed about symptoms in cattle and in humans, very few had ever seen them. Participants were asked about physical injury and chemical exposure associated with keeping dairy cattle. Answers from all the sites varied widely, but there seemed to be some consistency among each site and across all intensification levels. Because of the association of tuberculosis with HIV/AIDS, the decision was made not to inquire about the incidence of tuberculosis in humans during the FGDs.

4.5.1 What is the community's perception of the problems associated with keeping dairy cattle?

In the FGDs, participants listed a variety of problems associated with keeping animals. Those in the no cow and emerging intensification groups said there were little to no problems with keeping cattle. Consistent with what is reported about cattle keeping among the Kipsigis in the literature, FGD participants emphasized the value of keeping cattle and did not name many specific problems associated with cattle. One participant in Cheborge stated, "It is important – you must keep cattle." Another participant, a woman from the FGD in Kebenet said "a cow cannot be bad." Only after probing did many participants mention diseases as a problem. There was often debate as to whether flies were a nuisance or not and the answers varied greatly across intensification levels. One participant in the emerging group in Kebenet said "flies are a blessing."

4.5.2 How does the community perceive the relationship between cattle illnesses and human illnesses?

The link between human and cattle has been established. Researchers recognize that zoonotic illnesses are becoming more important in terms of public health. It is estimated that "75% of emerging human infectious disease are zoonotic or have recent zoonotic origins, with livestock serving as important reservoirs of infection"(Rwego et al. 2008). During FGDs, the question was posed to see if the members of the community perceive a link between illnesses in cattle and illnesses in humans. Twenty-three of 27 FGDs included brucellosis as a disease transmitted from livestock to humans. At least five FGD participants identified themselves as having suffered from brucellosis in the past. Participants also identified anthrax, injuries, tetanus, and rabies as zoonotic diseases affecting their communities.

4.5.3 Have the symptoms of brucellosis, tuberculosis, and diarrhea been seen in the cattle in your community or in your herd?

The incidence of brucellosis, tuberculosis, and diarrhea in cattle is relatively small, so it was not expected to find a large number of participants who had experienced this in their cattle. In the key informant interviews with the Meat Inspector in Buret District and the District Veterinary Officer for Kipkelion District, both said that they had never seen brucellosis in cattle. Although the District Veterinary Officer for Kipkelion District said he had never seen brucellosis in cattle, he had heard of cases in humans, "so it must come from somewhere." During the FGDs, pictures representing these diseases were printed and shown to each focus group. Three pictures were used for brucellosis. The first was a picture of a cow with an aborted fetus late in gestation with the fetus being leathery and brown. The second was a cow with swollen knees and the third, a bull with swollen testicles. After each picture was shown, the members were asked if they had seen these in their herd or in other herds in the community. For tuberculosis, a picture of a thin, coughing cow was used. A picture of a cow with diarrhea was used to depict gastrointestinal diseases (Figure 2). Participants were then asked if they had seen this and what they thought caused these illnesses.

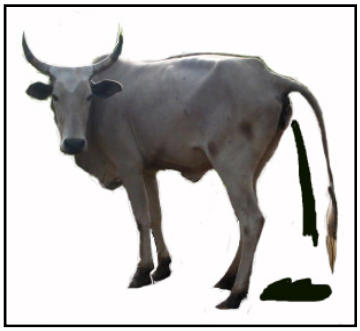


Figure 2: Sample instrument used with focus group discussions for symptom recognition.

It is estimated 16.2% of cattle in sub-Saharan Africa are sero-positive for brucellosis (Mangen et al. 2002). No clear pattern occurred during the FGDs in the reporting of symptom recognition from the pictures. For instance, the advanced intensification group of male focus group participants in Cheborge and the advanced women's group from Kipkelion identified all three pictures

of brucellosis, but advanced women in Kebenet had never seen symptoms in cattle resembling any of the three pictures.

Although there is a wide variation of prevalence of tuberculosis in cattle, the incidence in Ghana is 13.8% (Bonsu et al. 2000). Bovine tuberculosis has not officially been reported in cattle in Kenya but is believed to be present. When participants in every focus group conducted saw the picture of the thin, coughing cow, they said it could be East Coast Fever. East Coast Fever, while a common problem in East Africa, is not a zoonotic disease. Only one advanced woman participant in Kipkelion indicated that the cow in the picture could have tuberculosis. Surveyed households reported 5.2% occurrence in their cattle.

In the household survey, members of the emerging and advanced groups were asked to list the symptoms and diseases their cattle have experienced in the last five years. The percentage of responses, divided by having never experienced and experienced rarely, or occurs some or most years is presented in Table 17. For all sites, 39.7% of households surveyed reported diarrhea in their cattle in the last five years, with 48.3% of emerging households and 31% of advanced households reporting an occurrence. Incidences of cattle with tuberculosis in the last five years were reported in 5.2% of households, with 10.3% of emerging households and no advanced households reporting an incidence. Brucellosis reportedly affected cattle in 5.1% of households surveyed in the last five years with 6.7% of emerging households and 3.4% of advanced households reporting an occurrence. Unlike the FGDs, the household questionnaire asked respondents about the diseases by name and not by symptom. Therefore, it cannot be concluded from the survey results whether households recognized that these symptoms and diseases were related.

Table 17. Reported cattle syndromes stratified by intensification level

Syndrome	Total Households			Emerging Households			Advanced Households		
	Never %	Rare, or occurs some or most years %	*n*	Never %	Rare, or occurs some or most years %	*n*	Never %	Rare, or occurs some or most years %	*n*
Late abortion (last 3 months) and calf was very dry	89.8	10.2	59	86.7	13.3	30	93.1	6.9	29
Abortion mainly in young cattle	83.3	16.7	60	83.3	16.7	30	83.3	16.7	30
Swelling of the knees	89.8	10.2	59	86.7	13.3	30	93.1	6.9	29
Testicular swelling (use picture)	96.3	3.7	54	93.3	6.7	30	100	0	24
Dry chronic cough	66.1	33.9	62	61.3	38.7	31	71	29	31
Wasting	84.7	15.3	59	80	20	30	89.7	10.3	29
Diarrhea in cattle	60.3	39.7	58	51.7	48.3	29	69	31	29
Tuberculosis in cattle	94.8	5.2	58	89.7	10.3	29	100	0	29
Brucellosis in cattle	94.9	5.1	59	93.3	6.7	30	96.6	3.4	29
Respiratory problems	86.4	13.6	59	76.7	23.3	30	96.6	3.4	29

4.5.4 Have you seen the symptoms of brucellosis in humans in your community?

The incidence of brucellosis in humans has not been accurately estimated (Kunda, 2008), and it was not expected to find a high number of people who had been affected by brucellosis (Kunda et al. 2008). During FGDs, symptoms of brucellosis were specifically probed for without mentioning the disease by name in order to eliminate any bias or leading questions. In key informant interviews, the District Public Health Officer in Buret District and the District Public Health Nurse for Kipkelion District said that brucellosis is a problem and is common among the community, but the District Public Health Officer for Buret said "it is not worrisome", with no more than five cases estimated per month at the Buret District hospital. Focus group participants were asked about common symptoms of brucellosis: fever which is accompanied with body aches that lasted for several months and wasn't cured by anti-malarials and if it was tested for, it was not malaria or typhoid. Many participants became uncomfortable, losing eye contact and becoming quiet, and several participants asked if the researchers were asking about HIV/AIDS. When the FGD facilitator felt comfortable proceeding, participants were asked to use proportional piling to estimate the number of people in the community they felt suffered from symptoms like these. Only the emerging and advanced groups were asked, since it was assumed that participants in the no cow group would not own livestock. It was found that very few households had no cows at all. From the FGDs, perceptions of occurrence of brucellosis ranged. Women in Kipkelion believed between 4-6% of the community suffer from the disease, while women in Cheborge said between 8-21%. Women in Kebenet estimated the highest rate, between 38-48% of the population suffered from brucellosis. Men in the focus groups were not as inclined to participate in proportional piling and said symptoms mentioned by the facilitators were "very rare" and they did not see them.

Respondents of the household survey were asked if anyone in the household had ever suffered from brucellosis (Table 18). Ten percent of no milk households and 19.4% of advanced households reported members affected by brucellosis. No respondents from emerging households reported anyone affected by the zoonotic disease. Households in Kebenet, despite having reported the largest percentage of perceived cases of brucellosis during theFGDs, had the smallest number of reported cases in the household survey; there was only one household (n=29). Households in Kipkelion reported the largest number of cases of brucellosis among the three sites. Community members in Kipkelion have in the past received dairy cattle from Heifer International and with that, most likely received education on disease and cattle management. The likelihood that the farmers are better educated and therefore more likely to report symptoms is higher.

Table 18.Proportion of households reporting a member was affected by brucellosis across site and intensification level, n=92

Sites	No milk (%)	Emerging (%)	Advanced (%)
Cheborge, n=30	3.3	0	3.3
Kebenet, n=29	0	0	3.4
Kipkelion, n=33	6	0	12.1
Total	10	0	19.4

4.5.5 Is there a perceived link between diarrhea in humans and in cattle?

Of the causes of diarrhea in cattle, there are multiple organisms that are considered zoonotic and a threat to humans who keep dairy animals and consume milk products from infected animals. Campylobacter and Salmonella are two zoonotic organisms that were found in children under 5 years old in the Nyanza region, around 100 kilometers away from the study sites (Beatty et al. 2009; WHO 2010b; WHO 2010d).Every household surveyed was asked about diarrhea in children under 5 years old,

but more than 50% of the households reported that their children had never suffered from diarrhea and the data was not analyzed due to such a poor response rate and small sample size. The poor response rate could be a result of a number of factors including enumerator and/or respondent fatigue (as the question came at the end of the survey), and a general unwillingness to answer questions about family health that could be construed as pertaining to HIV.

Certain gastrointestinal diseases can affect both humans and cattle and when humans are consuming more milk, as with the more intensified households, there is a possibility that the number of cases of diarrheal diseases will increase. When participants in the focus groups were asked their opinion about potential links between diarrhea in humans and in animals, the answers varied widely, but a majority of participants said there was no link between diarrhea in cows and diarrhea in humans. One female participant said "if you take care of the cows, they take care of you", meaning if tend to the health of the animal, the animal in turn will have a protective effect on the family.

Conclusion

With intensification, households may face more health risks but we expect this to be relatively small and offset to some degree by increased awareness and access to services. To draw conclusions based on this study would be difficult, as there are many biases and the sample size is very small. Reporting of diseases in both humans and animals is fairly limited and difficult to track. Cultural biases may prevent some respondents from answering fully and honestly and therefore getting a complete picture of the prevalence of disease is difficult. With intensification, association between animal and human disease reporting may increase. It is difficult to say if the association between disease reporting in animals and humans will increase because of an actual increase in disease presence or whether recognition and reporting will increase. To confirm changes in health risk would require large scale epidemiological investigation but awareness in health issues suggest EADD interventions are needed.

4.6 STUDY DESIGN LIMITATIONS

There are some limitations to this study. As previously mentioned, the early definition of intensification levels changed from the first phase of the study to the next to reflect the milk production levels found in the sites. Mobilization and recruitment procedures differed in the three sites as EADD interns were not readily available in all three sites to help with outreach. In addition, some intensification levels were less represented in some sites making it challenging to have an equal distribution across levels. Opportunities for data bias existed, especially in Kipkelion and Kebenet sites. Heifer International's previous work in Kipkelion may have led farmers to misinterpret the objectives of the study, and could have contributed to under-reporting of milk production in the hopes of receiving a cow. In Kebenet, the history of post-election violence and subsequent aid given by governmental and non-governmental bodies, may have given a false incentive for people to participate. For instance, at the Kebenet women's FGD, three times the mobilized number of women arrived in order to get their names recorded. Nevertheless, in all cases, the field team worked with the EADD contact persons to clarify the objective of the study so as to avoid miscommunication with the communities.

5 OVERALL CONCLUSIONS

This report presents findings of FGDs and a household survey conducted in three sites in Rift Valley Province in Kenya, looking at the pathways between dairy intensification and child nutrition. Three categories of households were considered: no milk (households with no milking cow at time of survey); emerging dairy households (those whose best cow produces up to 6 liters per day) and advanced households (those whose best cow produces more than 6 liters per day). Four pathways were identified: direct consumption, income mediated, quality of childcare, and exposure to health risks.

Analyzing the first pathway, there is clear evidence that household and individual milk consumption increased with dairy intensification. Children under 5 years old in advanced households received a much greater amount of milk than children in emerging or no households received. In particular, children aged between 12-18 months in the advanced households were receiving more than two times the amount of milk that children in emerging or no milk households were receiving (1.14 cups vs. 0.5 cups). For children aged between 18-24 months, the difference was even greater. Children in advanced households received almost 1 cup more a day (2.17 cups) than the children in the emerging households (1.25 cups). In 3 households over 10 in the no milk household category, the reference child went without milk at least 1 time in last 30 days, compared to only 1 household over 10 in the emerging category. In the advanced category, no household reported the index child going without milk in the last 0 days.

Regarding the link between income and nutrition, the study was unable to provide clear cut conclusions. In fact, while data show that income from dairy increases with intensification, total household income increases only marginally, meaning that there is substitution with other income sources. With increased dairy income, less income is spent on food (45% in the advanced category versus 65% in the emerging). While women seem to be gaining control over evening milk sales decisions, men seem to be increasingly controlling total dairy income with intensification, with 33% of emerging households reporting that the head is managing dairy income versus 44% of advanced households. However, trend is somewhat countered by the increase in households reporting joint decisions in milk income management with intensification (14.3% in emerging compared to 27.6% in advanced). Some of this increase in joint managing of total milk income may be attributed to spouses increasingly taking over evening milk sales decisions. Finally, milk was particularly important in the diets of adults and children in the study sites as demonstrated by household and child dietary diversity measures and by farmers' explanations in FGDs about how milk is a desirable part of the diet. Dietary diversity, a proxy for food expenditures, increases across intensification levels, but possible confounding factors such as wealth need to be controlled with further analysis. This relationship would need to be confirmed through a larger scale quantitative study.

Looking at the quality of childcare, across intensification levels, there was a large increase in the amount of time spent on dairy activities, especially for women in emerging category, even though the time allocated to childcare activities and income-generating activities remained the same. Increased workload coupled with lower nutritional status of mothers in the community and intra-household food allocation suggests that the impact of dairy intensification on maternal health, nutritional status, and well being need to be investigated. Increased workload may increase the demand for alternative caregivers who may provide lower quality childcare. In fact, almost a quarter of caregivers in emerging category, when carrying out dairy activities, left their young children in the care of preteen siblings. Lastly, the additional time constraints generated by dairy intensification may make it harder for women to breastfeed and thereby lead to earlier weaning and introduction of complementary food. This is consistent with the finding that a lower percentage of women from emerging and advanced categories are breastfeeding children aged between 12-24 months, and introducing *uji* and water at an earlier age.

It is therefore important to further investigate this pathway, taking into account these mitigating factors—seen largely at the emerging category—to improve the intervention and further benefit the nutrition of women and children.

Lastly, with intensification, it is expected that households may face more health risks, but it is expected that this increase would be relatively small and mitigated to some degree by increased awareness and access to animal health services. No clear conclusions can be drawn from this study due to small sample size and what appears to be some cultural biases that may have prevented accurate reporting of disease incidence in cattle and humans to the study team. Furthermore, district and province-level surveillance is inadequate to provide further information on changes in disease patterns in the area. Nevertheless, with intensification, association between animal and human disease reporting may increase. It is difficult to say if the association between disease reporting in animals and humans will increase because of an actual increase in disease presence or whether recognition and reporting will increase. To confirm changes in health risk would require large scale epidemiological investigation. Based on results from this study, EADD interventions which include educational components to increase awareness of animal and human health issues and preventive measures would be useful.

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