Economic value of camel milk in pastoralist communities in Ethiopia

Findings from Yabello district, Borana zone

Galma Wako

Country Report
April 2015

Drylands and pastoralism

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This is one of a series of reports synthesising the findings of field research conducted by masters' degree students at Ethiopian universities who investigated the contribution of pastoral production to the national economy. The students developed the research to complement their degree studies, with support from the International Institute for Environment and Development and Tufts University.

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Acronyms

BZoPDO	Borana Zone Pastoral Development Office
SE	standard error

Glossary

adolessa	cold dry season (June–August)
birr	Ethiopian currency. Exchange rate US$1=18.81 birr from October 2013 (www.oanda.com) can be applied to all costs mentioned in this report
bona	long dry season (December–February)
gada	The *gada* broadly encompasses the social, political, and economic institutions of the Borana and other Oromo branches. Legesse (1973) correctly describes the term gada as a concept that stands for the whole way of life of the Oromo (Debsu 2013)
ganna	long rainy season (March–May)
gibira	tax
hagayya	short rainy season (September–November)
kebele	The smallest administrative unit in Ethiopia. It is part of a **woreda**, which in turn is part of a zone, which is part of a region
kookkii	A local unit used in the study area, 3 kookkii = 1 litre
woreda	A third-level administrative division in Ethiopia. A district

Executive summary

Pastoralism is a viable economic system which contributes an immense share to the formal and informal economy at national, regional and global levels. This study investigates the economic importance of camel milk production in local and household economies in Borana zone, southern Ethiopia through original research at a case study site in Yabello *woreda*. The study reveals that the production of camel milk has a high economic value for pastoralist households and local communities, providing sustainable income and nutrition. Camel milk production is improving household incomes and the wider local economy. We estimate that camel milk production in the Borana zone has a total value of 902,253 birr a day and 329.3 million birr a year, based on the total value of camel milk from sampled households, which is 11,739 birr a day and 4.2 million birr a year.

Introduction

1

Pastoralism is a viable economic system which makes an immense contribution to economies at national, regional and global scales. To assess the benefits of pastoralism in Yabello woreda, we used a broad framework developed to assess the value of pastoralism in East Africa (Hesse and MacGregor 2006), which looks beyond the immediate benefits of livestock and livestock products. Past research estimated the total annual economic value of pastoralism in Ethiopia at 15 billion birr (around US$1.6 billion)[1] (SOS Sahel 2006). Domestic and international export sales of livestock and livestock products account for 12–16 per cent of the country's GDP and 30–35 per cent of its agricultural GDP (REGLAP 2012).

Camels can provide a useful addition to the economy and food security in terms of milk, meat and other products (Ahmad *et al.* 2010). The economic viability of camels in arid lands is assured by their comparative advantages in their ability to adapt and remain productive under harsh climatic conditions (Nori *et al.* 2007). Previous research has proved that camel and camel milk production makes a considerable contribution to local and national economies as well as to individual livelihoods (Musinga *et al.* 2008). The camel milk industry has a lot of potential for growth to improve the livelihoods and economic status of pastoralist communities (CARE Kenya 2009).

The first continent-wide policy framework on pastoralism recognises the economic potential of camel production in Africa's Sahel regions and identifies camel husbandry as a priority area for further research (African Union 2010). Between 1 October and 15 December 2013, Galma Wako carried out field research as part of a masters' degree project at Hawassa University, to investigate the economic value of camel milk production in the Borana zone, southern Ethiopia. This paper summarises the findings of this research, which is presented in full in the thesis.

[1] Exchange rate US$1=18.81 birr from October 2013 (www.oanda.com). This exchange rate can be applied to all costs mentioned in this report.

Methods and materials

2

2.1 Description of research area

The study took place in Yabello district, Borana zone, in the extreme southern lowlands of Ethiopia, 575km south of Addis Ababa, along the East African (Addis Ababa–Nairobi) main road (Figure 1).

The area is characterised by an arid and semi-arid climate, with pockets of sub-humid zones. The rainfall in the area is bimodal where the average annual rainfall varies between 350 mm and 900 mm with a considerable inter-annual variability of 21 to 68 per cent. The rainfall of the area is erratic by nature and there are four distinct seasons:

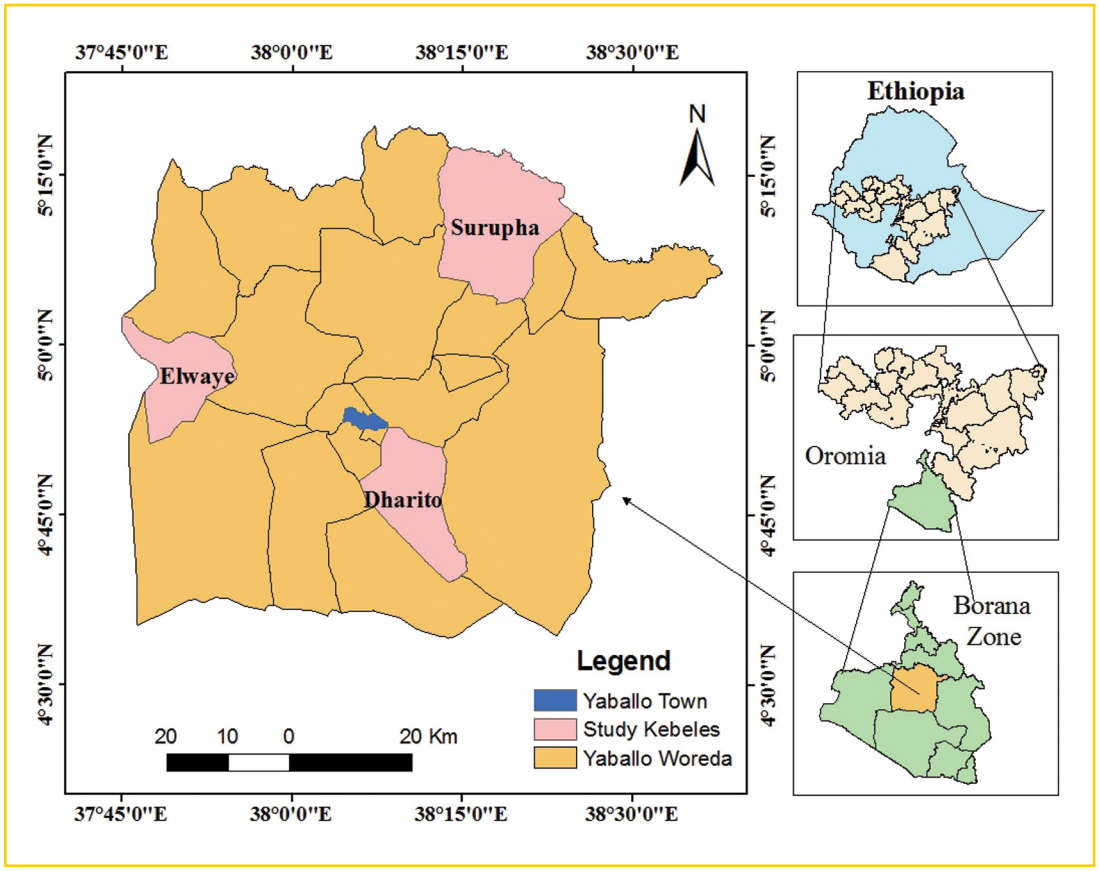
- *ganna* long rainy season March–May
- *hagayya* short rainy season September–November
- *bona* long dry season December–February
- *adolessa* cold dry season June–August

Recurrent droughts are common in pastoral systems, but the frequency and severity of drought in the area has increased in the face of climate change (PFE 2010).

The topography of Borana rangelands is distinguished by plain rangelands, intersected with occasional mountain ranges, volcanic cones and depressions, and an altitude of 750–1,700 metres above sea level. A particular feature is the supply of permanent water from the traditional deep wells. The rangelands are dominated by savannah vegetation, with varying proportions of open grasslands, perennial herbaceous and woody vegetation (Coppock 1994). Pastoralists in the study area have a rich and respected cultural heritage and customary institutions for local governance, rules and regulations of social relationships and resource management under the umbrella of the Borana *gada* system (Legesse 1973).

Production in the study area is primarily a pastoralist system – where livestock production is the main source of livelihood and social prestige for most of the population – together with agro-pastoralism, which relies on livestock and cereal crop production (Coppock

Figure 1. Map of study area



1994). In the face of ongoing environmental change, many people have diversified their livelihoods and also engage in activities such as petty trading, forest products and others.

As the earth's climate and the natural environment has undergone perpetual change, the camel has proved more adaptable than other livestock. This attracted the attention of many Borana pastoralists and has led to the ongoing growth of the camel population in the study area since the 1970s (Wassie and Fekadu 2014).

2.1.1 Camel population in Borana zone

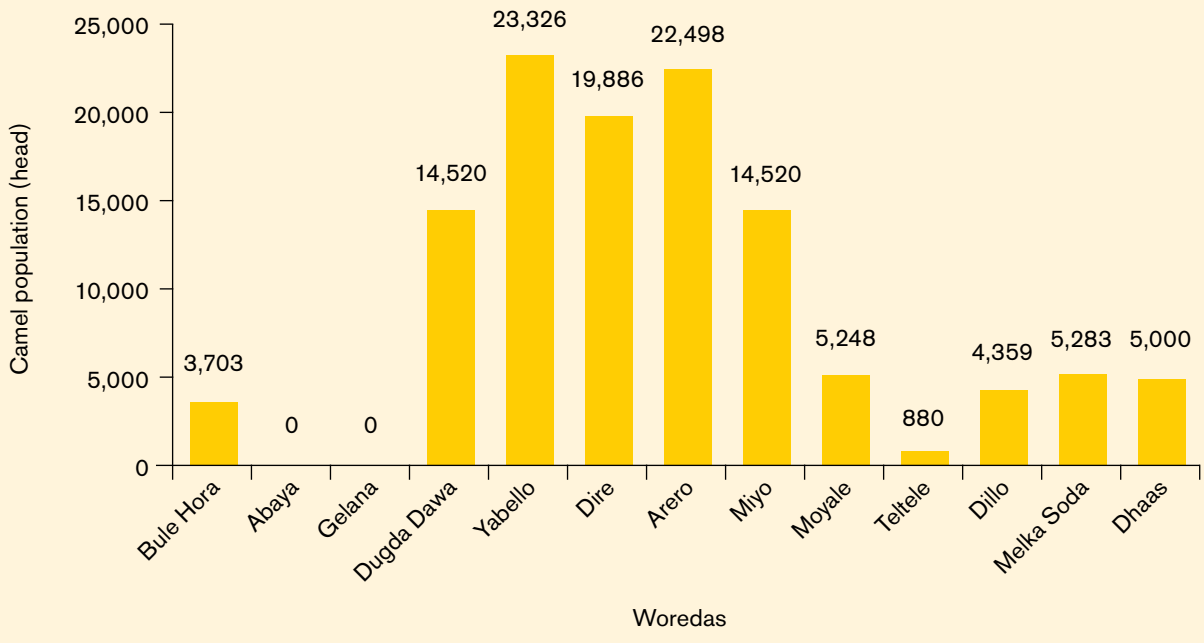
According to the Borana Zone Pastoral Development Office (BZoPDO), in 2012 the total camel population across the zone's 13 woredas was 119,223 (29,690 male and 89,533 female). Yabello woreda had the highest of the 13 districts, with nearly 19 per cent of the zone's total camel population. Two of the woredas – Abaya and Gelana – had no camels (see Figure 2).

2.1.2 Estimated volume and value of camel milk production in Borana zone

We extrapolated the survey results from our sample households in Yabello to estimate the volume and value of camel milk production at zonal level. We obtained up-to-date data on the zone's camel population from the BZoPDO and estimated the number of lactating camels and the daily volume of milk per camel based on results from the sample households in the case study site. Finally, we worked out the value of milk produced by multiplying the estimated volume of milk by the average price for the year.

Based on the above, we assumed that 19,845 of the 89,533 total population of female camels were under lactation (see Table 1), estimating the annual volume of milk production at 32,366,270 litres, with a value of 339,845,837 birr. This translates into 85,929 litres a day, with a value of 902,253 birr.

Figure 2. Total camel population, by woreda (2012)



Source: BZoPDO

Table 1. Estimated lactating camel population, volume and value of milk produced in Borana zone

NO.	WOREDA NAME	ESTIMATED NUMBER OF CAMELS UNDER LACTATION (HEAD)	ESTIMATED TOTAL VOLUME OF MILK (LITRE/ANNUM)	ESTIMATED TOTAL VALUE OF MILK (BIRR/ANNUM)
1	Bule Hora	611	965,6545	10,139,377
2	Abaya	0	0	0
3	Gelana	0	0	0
4	Dugda Dawa	2,396	3,786,758	39,760,961
5	Yabello	3,883	6,136,887	64,437,317
6	Dire	3,281	5,185,456	54447293
7	Arero	3,712	6,868,870	72,123,139
8	Miyu	2,435	3,848,396	40,408,155
9	Moyale	916	1,447,692	15,200,768
10	Teltele	195	308,188	3,235,971
11	Dillo	719	1,136,344	11,931,607
12	Melka Soda	872	1378152	14,470,600
13	Dhaas	825	1,303,871	13,690,648
Total		**19,845**	**32,366,270**	**339,845,837**

Notes: daily milk yield per camel= 4.33litres, annual milk yield per camel= 1580.45, average price of milk per litre = 10.50 birr
All totals are rounded to the nearest litre.
Source: Researcher estimation

2.2 Sampling techniques

The study took place in three sample kebeles in Yabello district – Dharito, El Waye and Surupha – purposively selected on their potential for camel and milk production and their proximity to the market centre for milk sales. We selected households using a two-step sampling procedure: purposive identification of camel-keeping households, followed by stratifying the identified households by wealth. The research focused on camel-owning households since our aim was to assess the importance of camel milk.

Key informants helped us identify the camel-owning households in each of the three kebeles. In total, there were 625 camel-keeping households: 195 in Dharito, 180 in El Waye and 280 in Surupha. We then used the formula below to determine our sample size.

$$n = \frac{N}{1+N(P)2}$$

Where:

N = total households (sample frame)

n = total sample size

p = sampling error (0.07)

The selected households were distributed across the kebeles in proportion to the sampling frame, consisting in the total household numbers identified. There were 156 households: 49 from Dharito, 45 from El Waye and 62 from Surupha.

We then stratified the sample respondents into three wealth groups which resulted in 28 rich households, 50 medium and 78 poor households. Key informants set the criteria for categorising households into wealth groups, using herd size as the main criterion. Respondent households were randomly taken from the lists of households owning lactating camels.

2.3 Data collection and tools

The study used qualitative and quantitative data from primary and secondary sources. To collect data from primary sources – sample households, key informants and groups of pastoralists – we used a household survey (see Appendix 1), group discussions and key informant interviews (see Appendix 2). Secondary data included published and unpublished articles, reports and documents from various institutions.

To explore the magnitude of camel milk production at household level, we collected data from the sample households through a household survey. We estimated the magnitude of production at zonal level by extrapolating the results of these research samples to a larger scale.

To address the seasonal variability of milk production and use, we collected production data for both wet and dry seasons. We also collected milk price data for both seasons, to estimate the value of milk produced and average prices for the year.

2.4 Limitation to research methodology

The scope of the research was narrow and limited to camel milk production and its value to producers' economies. We did not focus on the entire value chain from production through processing to end consumption. This would have been helpful to reveal the economic contribution of camel milk, not only to the camel-owning pastoralists but also to non-pastoral communities and/or individuals, whether directly or indirectly. Nor did we directly assess the production volume and value of camel milk for the whole zone. Instead, we extrapolated this from the results of the sample woreda to the larger scale.

2.5 Data analysis

To analyse the data, we used descriptive statistical tools such as ANOVA tests presented in mean and standard error and applied the Statistical Package for Social Science (SPSS version 20) software and Microsoft Office Excel 2007.

Study results

3

3.1 Number of camels owned

3.1.1 Mean number of camel owned per sample household

The overall mean number of camels owned per household was 9.94±0.84, including 7.46±0.65 female and 2.47±0.21 male. The average number of camels owned by rich households (25.39±2.82) is twice as high than the number owned by medium households (10.6±0.67) and six times higher than the number owned by poor households (3.96±0.27). The ANOVA test showed the significance of the difference ($p<0.05$) in camel holdings per household among the three wealth categories.

3.1.2 Total number of camels owned by all sample households

The total number of camels owned in our sample households is 1,550: 1,164 (75 per cent) female and 386 (25 per cent) male. The figure accounts for about 6.6 per cent of the Yabello woreda's total camel population.

3.1.3 Total and mean number of lactating camels

Our sampled households own a total of 258 lactating camels, with an overall mean of 2.08±0.10 per household (Figure 3). About 22 per cent of female camels are lactating camels. Relatively rich households own a higher average number (3.08±0.34) of lactating camels, than medium (2.26±0.16) and poor (1.53±0.18) households (Figure 3). We identified a statistically significant difference ($p<0.05$) in the average number of milking camels owned by the three wealth groups.

3.2 Volume of camel milk produced and used

3.2.1 Mean daily and annual milk produced, sold and consumed

Among the 156 study households, each produces an overall daily mean (plus standard error) of 8.56±0.53 litres of milk during the wet season and 5.79±0.36 during the dry season (see Table 3). Overall mean daily production per household for both seasons is 7.18±0.44 litres, with estimated mean annual production at 2,620±160 litres. The richer households have the highest share of milk production (46.5 per cent),

Table 2. Mean and total number of camels owned per household

CAMEL	WEALTH CATEGORY AND CAMEL HOLDING						
	RICH	MEDIUM	POOR	OVERALL TOTAL SUM			ANOVA P-VALUE
	(N=28) MEAN ± SE	(N=50) MEAN ± SE	(N=78) MEAN ± SE	(N=156) MEAN ± SE	HEAD	%	
Male	6.0±0.68	2.84±0.22	0.96±0.11	2.47±0.21	386	25	0.000
Female	19.36±2.24	7.76±0.49	3.0±0.19	7.46±0.65	1164	75	0.000
Total	25.39±2.82	10.6±0.67	3.96±0.27	9.94±0.84	1550	100	0.000

Note: SE= standard error

Figure 3. Mean number of lactating camel owned by sample households

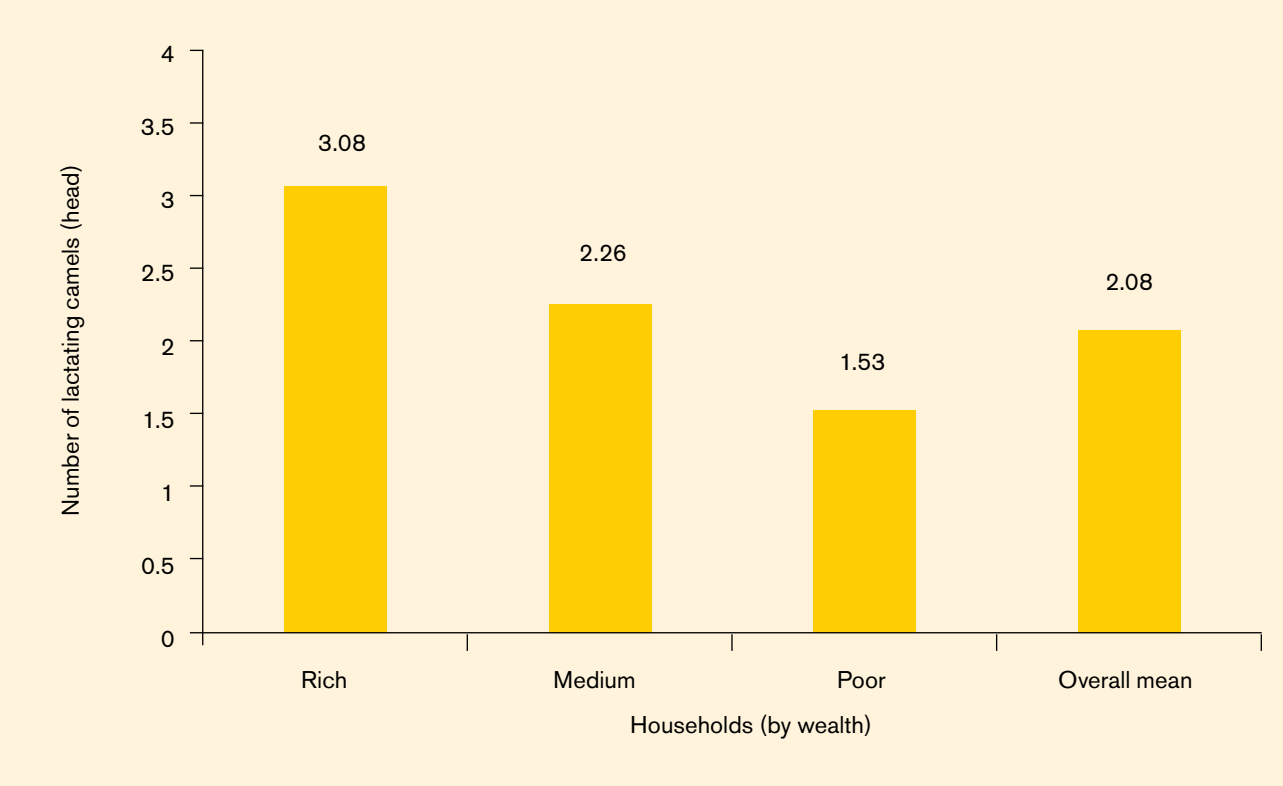


Table 3. Mean volume of milk produced, sold and consumed per household

		RICH	MEDIUM	POOR	OVERALL	P-VALUE
		MEAN±SE	MEAN±SE	MEAN±SE	MEAN±SE	
Wet season/ day	Produced	13.7±1.75	10.0±0.80	5.8±0.51	8.56±0.53	0.000
	Sold	9.02±1.20	6.80±0.64	4.21±0.39	5.91±0.38	0.000
	Consumed	4.71±0.63	3.20±0.41	1.56±0.17	2.65±0.21	0.000
Dry season/ day	Produced	9.3±1.18	6.8±0.54	3.9±0.35	5.79±0.36	0.000
	Sold	6.36±0.88	4.81±0.42	2.87±0.25	4.12±0.27	0.000
	Consumed	2.91±0.53	1.96±0.26	1.03±0.10	1.67±0.15	0.000
Mean daily	Produced	11.5±1.46	8.4±0.67	4.9±0.43	7.18±0.44	0.000
	Sold	7.69±1.00	5.80±0.53	3.54±0.32	5.10±0.32	0.000
	Consumed	3.71±0.50	2.50±0.33	1.31±0.13	2.09±0.17	0.000
Mean annual/ 365 days	Produced	4,198±523	3066±240	1,780±153	2,620±160	0.000
	Sold	2813±360	2116±190	1281±115	1860±115	0.000
	Consumed	1385±180	950±117	499±47.2	760±61	0.000

SE = standard error

medium households 34 per cent and poor households 19.5 per cent. This is because the rich households own more lactating camels. Statistically, the result showed significant difference in average milk production among the wealth groups ($P<0.05$).

On average, respondents sell 1,860 litres of milk a year and consume only 760 litres. In the wet season, pastoralist households sell about 5.91 litres a day and consume about 2.65. But in the dry season, when the camels produce less milk, households sell an average of 4.12 litres a day and consume 1.67. In the dry season, households sell a higher percentage of their total milk production (see Table 4). This is because they need the cash and have increased access to food grains and other goods for consumption during the dry season.

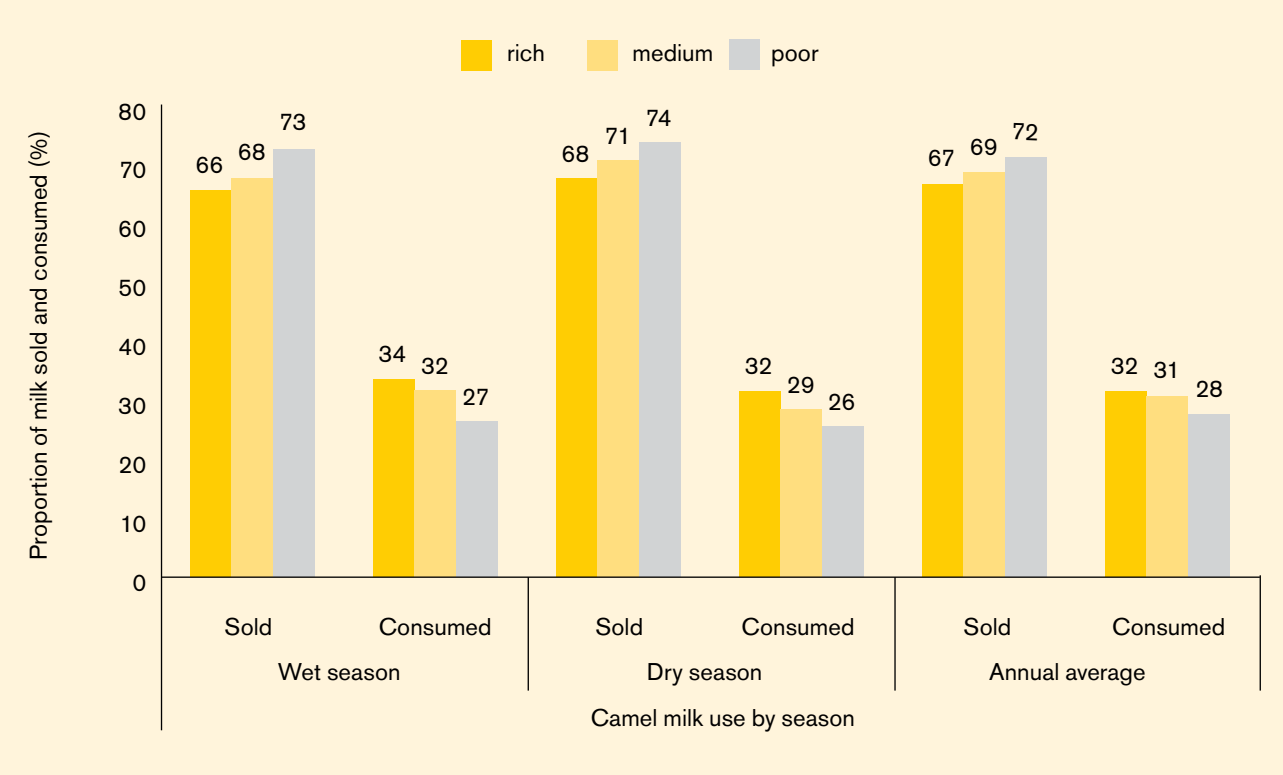
3.2.2 Total volume of milk produced, sold and consumed

The study revealed that the sampled households produce a daily total of 1,334 litres of camel milk in the wet season and 902 litres in the dry. Total average volume for the two seasons is 1,118 litres a day or 408,070 litres a year (365.25 days). Of this total production, households sell about 289,730 litres (71 per cent) and consumed 118,340 litres (29 per cent) (see Table 4).

Table 4. Total volume of milk produced, sold and consumed by all households

		TOTAL MILK VOLUME	
		LITRE	%
Wet season/day	Produced	1,334	100
	Sold	921	69
	Consumed	413	31
Dry season/day	Produced	902	100
	Sold	642	72
	Consumed	260	28
Mean daily	Produced	1,118	100
	Sold	793.8	71
	Consumed	324.2	29
Mean annual/365days	Produced	408,070	100
	Sold	289,730	71
	Consumed	118,340	29

Figure 4. Proportion of milk sold and consumed, by wealth and season



3.2.3 Proportion of milk sold and consumed

Over the year, all respondent households in all wealth groups sell a higher proportion (71 per cent) of the milk they produce than they consume (29 per cent) (see Table 4 and Figure 4). All households in all wealth groups sell a higher proportion (but not necessarily volume) of milk in the dry season (72 per cent) than in the wet (69 per cent). Poor households sell a larger proportion of their total milk production than both medium and rich households, and consume a lower proportion throughout the year.

3.3 Economic value of camel milk in household economies

3.3.1 Mean value of camel milk per household

The study found that the overall mean value of camel milk per household is nearly 76 birr a day or 27,510 birr a year (see Table 5). It has the highest mean value in rich households, at 44,079 birr. In medium households camel milk generates 32,193 birr a year, and in poor households 18,690 birr.

The value of the milk increases with increasing wealth status, because the wealthier households produce more milk. The value of milk sold (53 birr a day and 19,530 birr a year) outweighs the value of milk consumed (22 birr a day and 7,980 birr a year) because pastoralists sell a larger proportion of their milk so they can meet their financial needs without selling other key assets such as livestock.

Table 5. Mean value of camel milk produced by sample household

		MEAN VALUE OF CAMEL MILK (BIRR/HOUSEHOLD)			
		RICH	MEDIUM	POOR	OVERALL MEAN
Mean daily value	Sold milk	80.75	60.9	37.17	53.55
	Consumed milk	38.85	26.25	13.76	22.05
	Total milk	**119.60**	**87.15**	**50.93**	**75.6**
Mean annual value	Sold milk	29,536.5	22,218	13,450.5	19,530
	Consumed milk	14,542.5	9,975	5,239.5	7,980
	Total milk	**44,079**	**32,193**	**18,690**	**27,510**

Note: estimated value based on average price of 10.5birr a litre

3.3.2 Total value of camel milk

We estimated the total value of camel milk produced by all sample households at 11,739 birr a day and 4,284,735 birr a year (Table 6). This is a significant value, both at household and local economy level.

Table 6. Total value of respondents' camel milk production

	TOTAL VALUE OF CAMEL MILK	
	MILK VOLUME (LITRE)	VALUE (BIRR)
Daily total	1,118	11,739
Annual total	408,070	4,284,735

Note: estimated value based on average price of 10.5 birr a litre

Discussion

4

Previous studies have described the historic shift towards increased camel production among the Borana pastoralists (Desta and Coppock 2004). Our study findings shed further light on the reasons for this phenomenon. Respondents told us, in group discussions and interviews, that households in the Borana zone keep camels for their milk production potential. This confirms earlier observations that the camel is well suited to meet the milk requirements of pastoral people, as well as other populations, if managed, bred and fed properly (Ahmad *et al.* 2010). Households favour female camels, a strategy to maximise milk production.

The results of our study also suggest that previous research has underestimated the value and volume of milk production in Ethiopia. We found that pastoralists produce a significant volume of camel milk in the study area, and our key informants told us the camels produce a relatively reliable amount of milk for the households who own them. They can be milked three or more times a day, and lactation lasts, on average, for one to two years. Although the milk volume depends on feed and water conditions, camels continue to produce milk through periods of extended drought without significant reductions in yield. We estimate that pastoralists in Borana are producing around 31.3 million litres of camel milk a year – this is 27.6 per cent of the previous estimate of 114.8 million litres of camel milk produced across the whole of Ethiopia (SOS Sahel 2006). We also calculated that the value of the milk produced by the 258 lactating camels in the study is 11,739 birr.

Our key informants said that camel milk production contributes immensely to the local economy, at household and community levels. Camel milk is the prime source of income and food in respondent households, who use the cash generated from milk sales to ensure food security throughout the year. The cash return from camel milk enables most households to preserve their assets such as livestock, which they would otherwise have to sell to access food. This enables asset accumulation and sharing, which plays a huge role in enhancing the economic wellbeing of pastoralist households in the study area.

Our study confirms and illustrates various observations from earlier studies:

- the interfaces for analysing the economics of camel milk are the terms of trade between pastoral milk marketing and purchased goods (Nori *et al.* 2006)
- the economic potential of the camel and its milk in the arid and semi-arid lands is increasingly recognisable (Bekele 2010), and
- camel milk contributes to the maintenance of rural livelihoods and economic development and facilitates the integration of pastoralists in the global economy (Faye 2011).

These observations are at odds with the older, long-accepted premise that milk does not factor significantly in the economic value of camels (Yagil 1982). Clearly this is no longer the case.

To our knowledge, there has been no previous research on camel milk production and its economic value in the study area. This created a challenge for discussing and comparing our results in relation to other studies. We did, however, find studies from other regions for comparison.

The lack of relevant and up-to-date information on the value of the camel milk subsector in Borana means it has received little attention from both government and researchers. This lack of research and policy attention is part of the reason for the lack of investment in measures to address the problems of camel and milk production (Bedilu *et al.* 2014). We hope that our findings, which demonstrate the value of camel milk, can be instrumental in contributing to a change in this situation. At the very least, they underline the justification and scope for more research in this area.

Conclusion

5

The study area has high potential for camel milk production. Camels are a reliable source of milk which provide sustainable milk supplies to households, even during periods of drought. Camel milk production is of substantial value to both households and the local economy. Our findings suggest that previous assessments have underestimated the value of camel milk production. For the full value of camel milk production to be recognised, we recommend that the research projects are further expanded. At the same time, we need to raise awareness among development practitioners and policymakers of the economic value of camel milk.

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Appendices

Appendix 1: Household survey questionnaire

A. Identification of the respondent

Kebele name _____

Zone/cluster _____

Village name _____

Household head (optional):

Name _____

Sex _____

Age _____

Marital type of head:

Monogamy _____ Polygamy _____ If polygamy, how many wives? _____

Years of residence in the area:

_____ years

Wealth status:

Rich _____ Medium _____ Poor _____

Name of the enumerator _____

Date of interview _____

Signature _____

B. Household demographic profile

Table 1. Household demographic profile (Tell the information of each of your household member, beginning with household head)

NO	NAME OF FAMILY MEMBER	SEX	AGE	MARITAL STATUS FOR FAMILY MEMBERS (AGE 18+)	EDUCATIONAL LEVEL FOR FAMILY MEMBERS (AGE 5+)	OCCUPATION

C. Livestock and land ownership (production)

Does your household own livestock? If **Yes**, fill in the following table

1. Yes 2. No

Table 2 (a). Livestock ownership

	LIVESTOCK TYPE	OWNED NOW	DIED LAST YEAR	SOLD LAST YEAR	SLAUGHTERED	VALUE (BIRR) / AVERAGE PRICE OF YEAR
1	Cattle total					
	Cow					
	Bull					
	Heifer					
	Calf					
2	Camel					
3	Goat					
4	Sheep					
5	Horse					
6	Mule					
7	Donkey					
8	Poultry					
	Other					

Does your household own farmland? If **Yes,** how many hectare(s)?

1. Yes _____hectare 2. No

Have you produced crop in the last year? If **Yes,** fill the Table 2b (for both rainy seasons).

1. Yes 2. No

Table 2 (b). Crop production

	TYPE OF CROP	TOTAL YIELD PER 100KG	AMOUNT SOLD IN KG	AMOUNT SOLD IN (BIRR)
1	Maize			
2	Beans			
3	Teff			
4	Sorghum			
5	Wheat			
6	Barley			
7	Other			

D. Camel production

How many camels do you own currently?

1. _____male _____female

How did you initially acquire it/them?

1. Inherited from parents
2. Purchased
3. Restocking by NGO/GO
4. Gift from relatives
5. Buusaa-gonofaa (Ethiopian micro-finance institution)
6. Other (specify) _____

When (which gada period) did you first start rearing camel and how did the trend go over time?

1. Jilo Aga (1976–1984)
2. Boru Guyo (1984–1992)
3. Boru Madha (1992–2000)
4. Liban Jaldessa (2000–2008)
5. Guyo Goba (2008–2013)

What was (were) the factor (s) that drove you to engage in camel production?

1. _____
2. _____
3. _____
4. _____

Table 3. Trends in camel population/production over time (please fill number of camels owned at the end of each Gada period; beginning from the period in which you first started rearing)

NUMBER OF CAMELS OWNED DURING EACH GADA PERIOD (GC)				
Jilo Aga (1976–1984)	Boru Guyo (1984–1992)	Boru Madha (1992–2000)	Liban Jaldessa (2000–2008)	Guyo Goba (2008–2013) (present)

Why do you rear camels? (Rank the uses below in order of importance to you) Why?

1. Milk production
2. Meat production
3. To sell
4. Transport
5. Reason(s) _____

E. Camel management and input supply

What time of camel production system do you use?

1. Traditional system, mainly for subsistence
2. Improved production system, for commercial purposes
3. Combination of the two
4. Other (specify) _____

Is there enough forage for your camel(s) now?

1. Yes
2. No

Is there enough water for your camel(s) now?

1. Yes 2. No

What is your source of food for your camel(s)?

1. Natural forage only 2. Supplementary feed plus natural forage
3. Crop residue 4. Other (specify) _____

What is your source of water for your camel(s)?

1. Surface dam 2. Deep well
3. Purchase from motorised scheme 4. Other (specify) _____

Average distance travelled for grazing wet season: _____ km/day or _____hours/day

Average distance travelled for grazing dry season: _____ km/day or _____ hours/day

Distance travelled for water in wet season: ____ km/day or _____hours/day

Distance travelled for water in dry season: ____ km/day or _____hours/day

Watering frequency (times a day): wet season ____dry season _____

Do you provide supplementary food for your camel(s) any time?

1. Yes 2. No

If **Yes**, when (seasons)? _____

If **No**, why not? _____

What inputs did your household supply to get optimum level of camel milk production?

Table 4. Inputs and production costs

	TYPES OF INPUTS	COSTS/YEAR (BIRR)
1	**Health services**	
	Veterinary drugs	
	Parasitic and infection control (spray)	
	Traditional medicines	
2	**Herding**	
	Herding (food and provisions for herder)	
	Tax (gibira)	
	Watering	
	Supplementary feed	
	Mineral salt	
3	**Milking**	
	Milking (labour)	
	Milk management	
	Additional input for milking camel	
	Transport for milk marketing	
	Other (specify)	

F. Camel milk production and use

Does your household own any milking camels? If **Yes**, fill the following blanks based on your current situation

1. Yes 2. No

If **Yes**,

a) Number of milking camel (head) _____

b) Frequency of lactation a day (24 hours) _____

c) Lactation length in day/month _____

d) Milk yield/camel/day (kookkii[2]) _____

e) Total milk produced by your household (kookkii) a day _____ a year_____

f) Amount of milk your household sells a day (kookkii) _____

g) Amount of milk your household consumes a day (kookkii) _____

h) Amount of milk your household gifts a day (kookkii) _____

i) Other (specify) _____

If **No**: why not? List below: _____

_____

Table 5. Detailed information on camel milk production, by household per day (please use the code number for lactation stage and category for each camel

CODE FOR EACH MILKING CAMEL	LACTATION STAGE 1. EARLY (1–3 MONTH) 2. MID (4–6 MONTHS) 3. LATE (7–9 MONTHS)	MILK YIELD STATUS 1. HIGH 2. MEDIUM 3. LOW	DAILY MILK YIELD (KOOKKII)
C1			
C2			
C3			
C4			
C5			
C6			
C7			
C8			
C9			
C10			
C11			
C12			
C13			
C14			
C15			
Average			
Total			

[2] Kookkii is local unit used by the community in study area, where 3 kookkii = 1 litre

G. Market-related conditions for camel milk sale

Does your household sell milk?

1. Yes 2. No

If not, why not? _____

_____

If **Yes**, do you go to the market centre to sell milk?

1. Yes 2. No, why? _____

Where do you sell your milk?

1. At the village 2. At the local market

3. Other (specify) _____

Which market centre is closest to you? _____

How long does it take you to get there (hours)? _____

At what price do you currently sell your milk (birr/kookkii)? _____

Are you comfortable with price you are selling your milk at?

1. Yes 2. No, why? _____

What means of transportation do you use to bring milk to the market?

1. Car 2. On foot 3. Animal back

If you use a car, in total, how much does your household spend on transporting milk?

_____ (birr a year)

In total, how much money does your household earn from the sale of camel milk (birr)?

_____ a day _____ a year.

On what does your household spend the income you make from selling camel milk? Please list them here, with the amount and proportion of money spent on each (annually).

1. _____: _____ birr _____%
2. _____: _____ birr _____%
3. _____: _____ birr _____%
4. _____: _____ birr _____%
5. _____: _____ birr _____%

H. Camel milk in households' food security

What proportion of your household income from camel milk sales is spent on buying food items annually?

_____ %

Do you think this has any impacts on your household's food security situation?

1. Yes 2. No

If **No**, why? _____

If yes, how? Please explain your idea in detail _____

_____

_____

Do you think consuming camel milk has any impact on your household's food security situation?

1. Yes 2. No

If **No**, why? _____

If yes, how? Please explain your idea in detail _____

_____

_____

I) Infrastructure and extension services

Is transport service available to you?

1. Yes 2. No

Why? _____

Is your village (road) accessible to car?

1. Yes 2. No

Why? _____

Is animal health service available in your kebele?

1. Yes 2. No

Why? _____

Do you get veterinary drugs for your camel?

1. Yes 2. No

Why? _____

From where do you get the drug?

1. Local market (shop) 2. Kebele animal health centre

3. NGO/GO support 4. Other (specify) _____

Are there animal health workers in your kebele?

1. Yes 2. No

If yes, do they provide enough services for your camel?

1. Yes 2. No

Why? _____

Do you vaccinate your camel?

1. Yes 2. No

Why? _____

Generally, how do you rate the quality of the service?

1. Good 2. Very good 3. Bad 4. Very bad

Have you or any member of your household ever received any training related to camel and milk production and marketing?

1. Yes 2. No

If **Yes**, by whom (organisation), what (topic) and how (approach)?

Please explain in detail _____

_____

Is there a camel milk marketing cooperative in your kebele?

1. Yes 2. No

Is your household a member of any of such cooperatives?

1. Yes 2. No

Why? _____

Does your household have access to credit service?

1. Yes 2. No

Why? _____

If yes, who provided you with that credit service?

1. NGO 2. Government 3. Other (specify) _____

J) Constraints to — and opportunities for — camel milk production and sale

What are the challenges to camel milk production and marketing? Please rank the challenges based on the level of their effects in the following table

Table 6. Constraints to camel milk production and marketing

CONSTRAINTS TO PRODUCTION	RANK (1ST, 2ND)	REASONS (EXPLANATION)
CONSTRAINTS TO SALE	**RANK (1ST, 2ND)**	

What are/were opportunities for camel and milk production and marketing? Please rank the opportunities based on their importance in the following table,

Table 7. Opportunities for camel milk production and marketing

OPPORTUNITIES FOR MILK PRODUCTION	RANK (1st, 2nd)	REASON (EXPLANATION)
OPPORTUNITIES FOR MILK SALE	**RANK (1st, 2nd)**	

K) Service providers (input suppliers)

Table 8. Service providers. Please list the name of organisations and the activities they implement in relation to camel production in your kebele

NAME AND TYPE OF ORGANISATION (NGO, GO)	ACTIVITIES (SERVICES PROVIDED)

Appendix 2: Key informant interview and group discussion checklist

- What are the main criteria for wealth ranking in your kebele? Please explain.
- When did the community in your kebele first adopt camel production (excluding Surupha)? For what purposes?
- What factors derived them community in your kebele to adopt camel production (excluding Surupha)? Please list.
- What is/are the camel management system in your kebele?
- How do camels work with the current changes of environmental and climatic conditions of the area? What are the advantages and disadvantages of such changes for camels and camel milk production with regards to pasture (forage) and water conditions (changes in milk yield, lactation length and frequency, reproductive capacity and other)?
- What is the milk production potential of camels in your kebele? What determines their milk production?
- List and prioritise the major constraints and opportunities for camel milk production and sale in your kebele, explaining the reasons for them.
- How do you assess the contribution of camel milk to pastoralist livelihoods in general and households' food security in your kebele? Can you justify this?
- How do you see your community's attitude towards camels, camel milk and their economic importance during the long past and current period? Have seen any changes? What?
- How do you assess availability, access to and quality of extension services, particularly those related to camels and camel milk production in your kebele – for example, the health service?
- Are there any development organisations serving your community? Who are they and what services do they provide in your kebele, particularly with regard to camels and camel milk production?

This is one of a series of reports synthesising the findings of field research conducted by masters' degree students at Ethiopian universities who investigated the contribution of pastoral production to the national economy. The students developed the research to complement their degree studies, with support from the International Institute for Environment and Development and Tufts University.

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