



SMALL-SCALE MILK PROCESSING, UTILIZATION AND MARKETING OF TRADITIONAL DAIRY PRODUCTS IN BAHIR DAR ZURIA AND MECHA DISTRICTS, NORTHWESTERN ETHIOPIA

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ABSTRACT

This study was conducted to assess processing, utilization and marketing of traditional dairy products produced in Bahir Dar Zuria and Mecha districts in Northwestern Ethiopia. A single-visit-multiple-subject formal survey was conducted to collect data. A total of 150 households (75 households from each district) were individually interviewed using a semi-structured questionnaire. The major dairy products produced in the study area include butter, ghee, Ayib, Arera (defatted sour milk), Ergo (naturally fermented sour milk), Zure and Metata Ayib. Among these, two of the traditional dairy products, Zure and Metata Ayib, are unique to the area and have never been reported before. The respondents interviewed claim that these products are of high nutritional values and have therapeutic properties. Many aspects of Zure and Metata Ayib such as physico-chemical properties, microbiological and sensory qualities are unknown. Thus, detailed scientific investigation needs to be conducted in order to verify the claimed nutritional and medicinal properties of these products.

Keywords: Ethiopia, Marketing, Processing, Traditional dairy product, Utilization.

Contribution/ Originality

This study documents for the first time the processing and utilization of two new traditional dairy products, Zure and Metata Ayib, produced in Northwestern Ethiopia.

1. INTRODUCTION

Ethiopia is a big country with a total land area of one million sq km, diverse agro-ecological zones and different livestock production systems. Dairy products are manufactured and consumed in many parts of the country. Fresh whole milk, whole sour milk (*Ergo*), butter, Arera (defatted sour milk) and Ayib (a traditional cottage cheese) are the major dairy products produced and

consumed in many parts of the country (Beyene, 1994; Tola, 2002; Fita, 2004). Many of these products are produced using artisanal technologies on-farm and the types and processing steps of these dairy products can vary considerably from one area to the other.

The mainstay of the population in the Amhara region is rain-fed subsistence agriculture. About 73% of the smallholders practice mixed crop-livestock farming, 19% practice crop cultivation, while the remaining 8% undertake livestock rearing (ZDA, 2005). Like in other regions of Ethiopia, milk production is an integral part of the farming system. Local milk production is mainly from indigenous Zebu cattle which are kept by about half a million smallholder farming households (CSA, 2005) most of whom are poor.

In order to improve the production and quality of traditional dairy products, it is important to assess all the dairy products produced in the different production systems of the country and understand their traditional processing steps. The traditional handling, processing and utilization of milk in southern (Beyene, 1994), western (Tola, 2002) and central Ethiopia (Yilma and Inger, 2001a) have been assessed and reported. Identification and understanding of traditional dairy products are essential in order to devise appropriate development interventions that would result in improved production and quality of dairy products. The overall aim of this study was to investigate the traditional dairy products produced in Northwestern Ethiopia and identify new dairy products that are unique to the area. The specific objective of this study was to document processing, utilization and marketing of traditional dairy products in Bahir Dar Zuria and Mecha districts in Northwestern Ethiopia.

2. MATERIALS AND METHODS

2.1. Description of the Study Area

The survey was conducted in two districts of the West Gojam Zone in Amhara Regional State: Bahir Dar Zuria (altitude 1700 to 2300 masl; annual rainfall 820- 1250 mm; 10°C daily average minimum and 32°C daily average maximum) and Mecha (altitude 1800 to 2500 masl; annual rainfall 820-1250 mm; 17°C daily average minimum and 30°C daily average maximum).

2.2. Sampling Procedure

Both secondary and primary data sources were used for the study. Primary data sources included the household heads and dairy cooperatives in the respective districts. The secondary data were taken from the respective district agricultural offices, zonal office of agriculture and NGOs operating in the respective districts and from documents that have been written about the study area.

The target sampling population was defined as all households in the study area who owned both indigenous Zebu cattle and crossbred (Zebu cattle x Holstein-Friesians) cows, produce milk and process dairy products. A total of 10 peasant associations (PAs), five PAs (15% of the total) from each district were randomly selected. From the list of registered members of each PA, households who owned indigenous and crossbred lactating cows and produce milk were purposively selected and among these only 15 households from each PA were randomly selected

and interviewed. Accordingly, a total of 150 households (75 from Bahir Dar Zuria and 75 from Mecha) were individually interviewed using a semi-structured questionnaire. Each informant was asked both closed and open-ended questions.

2.3. Data Collection

A single-visit-multiple-subject formal survey was conducted to collect data on processing, utilization and marketing of traditional dairy products manufactured in the area (ILCA, 1990).

2.4. Statistical Analysis

Descriptive statistics such as means, frequency distributions and percentages were used to analyze the data using SPSS software version 12.0. Preliminary analysis of data collected showed no significant differences between the two locations for the variables considered. Thus, the statistical analysis was based on the combined values of each variable from the two districts.

3. RESULTS AND DISCUSSION

3.1. Consumption and Utilization of Dairy Products

In the study area, milk is consumed either in its raw state or after processing to various products. Fresh whole milk, Ergo (naturally fermented sour milk), Arera (defatted sour milk), butter, ghee, Ayib (a traditional cottage cheese), Metata Ayib (a traditional fermented cottage cheese) and Zure are the common dairy products produced and consumed in the study area. Some of the respondents in the area reported that they boil milk before use. The naturally fermented sour milk (Ergo) is used as a raw material for processing and production of different traditional dairy products and thus rarely consumed by the producers.

Traditional milk processing is a common practice of all smallholder farmers who own lactating cows in the study area as it is elsewhere in the country. Butter is used for cooking, for sale and cosmetic purposes, mainly by the female members of the household (Table 1). All the respondents reported that Arera (defatted sour milk) is used for Ayib making, *Metata Ayib* production, *Zure* making and direct consumption.

All the milk produced and consumed in the area is obtained from cows and there was no report of consumption of milk of small ruminants due to cultural taboo (Table 1). Besides their nutritional value, milk and milk products have other additional functions in the area. Fresh whole milk is traditionally used to neutralize toxins and butter is used for hair ointment. This result agrees with the practice in the central highlands of Ethiopia (Yilma and Inger, 2001a). Farmers in the study area also reported that *Metata Ayib* is used to cure malaria and stomach upset. These claimed medicinal values of *Metata Ayib* need further and detailed scientific study.

The consumption pattern of different milk and milk products in the study area is shown in Table 2. Even though all the dairy products reported are consumed, their relative level of consumption varied from household to household depending on the wealth status and the number of lactating cows owned by a household at a time. The respondents ranked Ayib, *Metata Ayib*, ghee and Ergo as their first, second, third and fourth preferences, respectively (Table 2).

The farmers reported that they prefer processed milk products to raw milk because processed products diversify their diets and generate income. In this study, it was impossible to estimate the amount of milk and milk products consumed by a household at a time because the respondents found it difficult to estimate. The high demand for processed dairy products in the area suggests that there is a bright prospect for expanding and improving milk processing in the area.

3.2. Traditional Dairy Products Manufactured

The traditional dairy products produced in the area include butter, ghee, Ayib, Arera, Ergo, Zure and Metata Ayib. Among these, Zure and Metata Ayib are unique traditional dairy products produced in this region and never reported before.

3.3. Buttermaking and Preservation

In the study area, butter is made by churning *Ergo* (sour milk) which has been collected over a few days. When sufficient amount of milk (7-8 liters) is collected, it is transferred to a churn made of gourd (*Lagenaria siceraria*) or clay pot. Then the milk is churned until butter granules are formed. In order to break the curd and to mix the fermented milk, farmers usually insert a wooden stick that has three finger like projections at one end into the container half filled with fermented milk during churning time.

The gourd churn used in the area is hanged on a tripod and swung to and fro. When using clay pot, the churn is placed on a mat on the floor and rocked back and forth until butter grains are formed. According to farmers' report the breakpoint, i.e., the point when butter grains start to form is detected by inserting a grass stick into the churn through a vent on the neck of the churn. If there are small butter grains adhering to the surface of the grass stick, the breakpoint has been reached. Furthermore, the breakpoint of butter grain formation is also known through change in the sound made while churning. When a butter grain is formed, the churn is opened, the butter is skimmed off and then it is kneaded and washed in cold water. The use of gourd churn observed in the current study is in line with the report of O'Mahony and Bekele (1985) while use of clay pot churn observed in the present study is similar with the report of Yilma and Inger (2001b) in the central highlands of Ethiopia.

The average volume of fermented milk churned at a time per household in the study area was 7.5 ± 1.8 liters and the average churning interval was 3.8 ± 0.7 days. According to the respondents, volume of fermented milk churned at a time depends upon the number of milking cows, the amount of milk produced and the amount consumed by the family. No additive is used to preserve raw milk produced in the study area except that the milk is allowed to ferment naturally. However, the farmers clean and smoke the milk containers to impart good aroma to the product. They put the containers in a cooler area of their house and also change the storage vessels occasionally especially during the dry season.

In the present study, the average volume of fresh whole milk required to produce one kilogram of butter was 18.1 ± 1.1 liters. This value is relatively higher than the findings of Tola

(2002) who reported that an average of 16.2 liters of milk is required to produce 1 kg of butter in eastern Wollega.

Spices used to preserve butter in the study area are shown in Table 3. The majority of the respondents reported that they add different spices into butter to extend its shelf life. Spices are added into butter as follows: first, the butter is immersed in a watery solution of *Zingiber officinale* (Zingebile) and *Allium sativum* (Netchshinkurt) and kept for one or two days. Then, it is washed with water. Finally, ten more spices (indicated in Table 3) are made into powder and mixed thoroughly with the butter. Butter made as such is used either for home consumption or sale. Similar practices are followed to preserve butter in eastern Wollega (Tola, 2002) and in east Shoa zone of Oromia Region (Fita, 2004).

3.4. Ghee Making and Utilization

Ghee (clarified butter oil) is made by melting butter on a frying pan on an open fire. Butter is placed in a clay pot and put on an open fire to melt. Heating and stirring continue until foam is formed and a clear liquid is obtained. Along heating the butter, spices are added to impart good aroma and taste to the butter. Then the pot is removed from the fire and allowed to cool. Finally, the liquid fat is filtered through sieve or a clean cloth into a container. Similar procedures have been reported by different authors in Ethiopia (Tola, 2002; Fita, 2004).

Different spices are used during ghee making which varies from household to household. The spices used during ghee making in the study area are shown in Table 3. Ghee made as such is either added into *wot* (a traditional sauce) to impart good flavor, used as a sauce during raw meat consumption, or drunk with coffee. It is also consumed by mixing it with *Metata Ayib*. Ghee is not marketed in the study area rather it is exclusively used for home consumption.

3.5. Ayib Making and Utilization

Ayib is a traditional cottage cheese produced in Ethiopia. All the respondents in the study area reported that they make Ayib from cows' milk. Arera (defatted sour milk), which is a by-product of the buttermaking process, is the raw material used for Ayib making. The Arera is placed on a clay pot and heated on slow fire at approximately 40°C to 50°C for about 30 minutes. After cooling, the whey is drained off. This procedure of Ayib making is consistent with the reports of other authors in Ethiopia (Beyene, 1994; Tola, 2002; Fita, 2004). Ayib made at household level is not marketed but used for home consumption and/or *Zure* making. The whey obtained is either used for consumption by the family members or given to animals such as cats or calves. On average 8.9 liters of Arera is required to produce one kilogram of Ayib. This value is in agreement with the yield estimates for Ayib reported by O'Connor (1993). According to the respondents in the present study, Ayib can be kept unspoiled up to 3 days at an ambient temperature.

3.6. Zure Making and Utilization

Zure is a unique traditional dairy product produced in the study area. The raw materials used for Zure making are whole fresh milk, Arera, Ayib, sour milk and whey. Three types of Zure making methods are reported and the procedures are indicated below.

Type I: Fresh whole milk is placed on a clay pot or pan and heated on a slow fire at approximately 30°C to 40°C for 30 minutes and then Arera is added. Immediately after adding Arera or whey or both on the warmed fresh whole milk, the mixture is continuously stirred while heating with a wooden stick that has two projections at one end. The stirring is continued for approximately 20-30 minutes until a thick coalesced product is formed. After gradual cooling at room temperature, the product (*Zure*) is taken out of the pot using ladle and the whey remains in the pot or alternatively, the whey is poured out and *Zure* remains in the pot.

Type II: Fresh whole milk is placed on a clay pot or pan and heated on a slow fire at approximately 30°C to 40°C for 30 minutes and then Ayib is added into it. The rest steps are the same as Type I.

Type III: Whole sour milk (*Ergo*) is placed on a clay pot or pan and heated on a slow fire at approximately 30°C to 40°C for 30 minutes. When it starts warming, it is continuously stirred just like types one and two described above. In all of the types identified, the final mixture is coalesced into a semi-solid mass called *Zure* and the whey is a by-product of the process.

3.7. Metata Ayib Making and Utilization

Metata Ayib (a fermented cottage cheese) is another traditional dairy product made from defatted sour milk (Arera) in the study area and unique to the region. Arera is placed on a clay pot or pan and heated on an open fire at approximately 40°C to 50°C until a distinct curd mass is formed. After about 30 minutes of heating, the vessel is removed from the fire and allowed to cool at room temperature. Upon cooling, the curd whey mixture is transferred into another smoked container (gourd or clay pot) and kept at room temperature. Next day, another fresh batch of curd mass (Ayib) is produced following the same procedure and added into the previous batch after completely draining the whey from the earlier batch. This step is repeated every day for up to 3 to 4 days until sufficient amount is obtained for making *Metata Ayib*.

When sufficient amount of curd (3-4 kg) is obtained, the vessel containing the curd mixture is covered with fresh succulent grass or leaves of *Cordia africana* (Wanza), *Ocimum hardiense* (Kessie) or leaves of false banana (Koba in Amharic). Then the vessel is tilted down for continuous drainage of whey for up to 3 days during which the vessel cover is changed every day. After three days of whey drainage, fine powders of the spices *Brasica nigra* (Senafitch) and *Cordiandrum sativum* (Dimbillael) are added into the container and mixed with the curd. After adding these spices, the vessel is tilted down again for further drainage of whey for another 3 days with continuous change of the vessel cover each day. Then, the tilted vessel is upturned and the drained curd mass is taken out from the vessel using ladle and mixed with ten more spices (Table 3). These spices are added in the form of fine powder and thoroughly mixed with the curd.

Finally, the spiced curd is put into another smoked container (clay pot or gourd) and the vessel is covered with clean cloth and kept at an ambient temperature for 15 days for natural fermentation to take place. The farmers reported that the vessel is not opened before 15 days and this is the minimum time that is required for fermentation. The fermentation process is completed in 15 days. The final product (*Metata Ayib*) is now ready for home consumption and/or sale.

Many aspects of Zure and Metata Ayib such as physico-chemical properties, microbiological and sensory qualities, and nutritional values are not known and their processing steps not yet standardized. Thus, more scientific studies need to be conducted on these two indigenous dairy products.

3.8. Containers Used For Processing and Storage of Dairy Products

Table 4 shows the different containers used for milking, churning and storage of various dairy products produced in the study area. Gourd (*Lagenaria siceraria*) is the major container used for milking and storing dairy products. The majority of the respondents use gourd for milking although some farmers use plastic containers instead. Over sixty one percent and 38.7% of the respondents use gourd and clay pot, respectively to churn milk.

In general, the use of clay pot for storage of various dairy products and its use for churning observed in the current study is in agreement with similar practices in the central highlands of Ethiopia (O'Mahony and Bekele, 1985; Yilma and Inger, 2001b) while the use of gourd as a churn and a storage vessel agrees with the report of Tola (2002) and Fita (2004).

3.9. Cleaning and Smoking Milk Vessels

The plants that are used for cleaning and smoking milk vessels are indicated in Table 5. All the respondents wash the utensils used for processing of milk. The most common technique is washing the containers with warm water using leaf of *Ocimum hardiense* (Kessie) and finally it is rinsed with cold water. Moreover, the farmers reported that the milk utensils are washed with warm water first and then with cold water when the plant species are not available around their homestead. *Ocimum hardiense* is the most common plant species used to clean vessels used to store milk and milk products. This report is consistent with the findings of Tola (2002) and Fita (2004) who reported similar practices in eastern Wollega and east Shoa Zones of Oromia Region, respectively.

Terminalia brownii (Abalo in Amharic) and *Acacia* spp. (Cheba in Amharic) are the most frequently used plant species for smoking milk vessels in the study areas (Table 5). These plants are used to impart good flavor to the milk and milk products. Besides, it is claimed that they are known to extend the shelf life of milk. Thus, the effect of these plant species on the quality and safety of milk and milk products deserves further study. On the contrary, *Olea africana* is the most frequently used plant for smoking milk containers in other parts of the country (Beyene, 1994; Tola, 2002; Fita, 2004; Yilma and Faye, 2006).

3.10. Reported Shelf Life of Dairy Products Produced in the Study Area

The shelf life of sour milk (Ergo), Ayib and *Metata Ayib* were reported to be 4.1 ± 1.1 days, 2.9 ± 0.8 days, and 2.8 ± 1.2 years, respectively at an ambient temperature. The respondents also reported an average shelf life of 13.7 ± 5.1 days for unspiced butter, 11.4 ± 6.9 months for spiced butter and 19.2 ± 9.8 months for ghee at an ambient temperature. The informants also mentioned that spoilage of dairy products is limited (10.7%) in the area and they attributed this to the production of shelf stable products such as *Metata Ayib*, spiced butter and ghee. The longer shelf life of *Metata Ayib* is important to smallholder farmers who usually do not have milk preservation and cooling facilities.

3.11. Marketing of Milk and Milk Products

In the current study, the majority of farmers use an informal marketing system to sell their milk and milk products to neighbours or in the local markets. In addition, the farmers in the Bahir Dar Zuria district sell their dairy products through farmers' milk marketing channel. The dairy products sold in the study area were fresh whole milk, butter, spiced butter and *Metata Ayib* (Table 6).

Butter is the major dairy product marketed in the study area. This is in agreement with the reports of [Beyene \(1994\)](#) in the southern region, [Yilma and Inger \(2001a\)](#) in the central highlands of Ethiopia, [Tola \(2002\)](#) in eastern Wollega and [Fita \(2004\)](#) in the east Shoa zone of the Oromia region, where most of the farmers do not sell fresh milk but sell butter. All the respondents stated that they never sold Ayib, Ergo, whey or *Zure* in the market. The price of milk and milk products sold in the study area is shown in Table 6. The average price of fresh whole milk observed in the current study is lower than that reported by [Tola \(2002\)](#) who indicated an average price of 2.8 and 2.9 Birr/liter for fresh whole milk during the rainy and dry seasons, respectively in eastern Wollega. The same author reported that the average price of butter in eastern Wollega was 15.4 and 27.78 Birr/kg for the rainy and dry seasons, respectively. The major market intermediaries for sale of dairy products in the study area were individuals, dairy cooperatives and retailers (Table 7). From the foregoing it seems imperative to develop and strengthen farmers' milk marketing group in the area in order to minimize exploitation by middlemen and retailers. The majority of the respondents (85.3%) reported problems of marketing of dairy products in the study area. Marketing problems occur in the study area mainly during fasting and the rainy season (Kiremt). About 55.9% of the respondents reported that there is less demand for dairy products during fasting time, while 44.1% of the respondents reported the rainy season (Kiremt) as a marketing problem due to the increase in milk production and the concomitant decrease in price of dairy products. The majority of people living in this region are followers of Orthodox Christian faith and thus do not consume dairy products especially during the Easter fasting period (55 days). Overall, Orthodox Christians are abstained from dairy products for about 200 days per year ([Ahmed et al., 2004](#)). Thus, in order to alleviate the marketing problem in the area, it is imperative to educate farmers and demonstrate the importance of milk production and/or processing in order to develop the dairy sector and improve their livelihood.

4. CONCLUSION

Zure and *Metata Ayib* are traditional dairy products produced in the Bahir Dar Zuria and Mecha districts in Northwest Ethiopia and are unique to the area. This report on *Zure* and *Metata Ayib* is the first of its kind and many of the properties of these products are not yet known. Thus, detailed scientific study is needed to investigate the properties and potential uses of *Zure* and *Metata Ayib*.

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Table-1. Utilization of dairy products in the study area.

Product utilization	Percent of total respondents (N = 50)
Consumption of dairy products	
Consumption of processed dairy products	70.0
Raw milk consumption	22.6
Sour milk consumption	7.4
Uses of dairy products	
Butter used for sale	42.1
Butter used as hair ointment	32
Butter used for food	25.9
Arera* used for consumption	100
Arera used for Ayib production	100
Arera used for Metata Ayib production	100
Arera used for Zure production	100

n = number of respondents; *Arera is defatted sour milk.

Table-2. Reported priority for consumption of various dairy products in the study area.

Product	Ranks (weighted average scores)
Ayib	1 st (6.59)
Metata Ayib	2 nd (6.12)
Ghee	3 rd (5.86)
Sour milk (Ergo)	4 th (4.93)
Zure	5 th (3.15)
Arera (defatted sour milk)	6 th (2.88)
Fresh whole milk	7 th (2.59)
Whey	8 th (1.97)

Total number of respondents = 150; Values in parenthesis are weighted average scores.

Table-3. Spices used during manufacturing of butter (1), ghee (2) and Metata Ayib (3) in Bahir Dar Zuria and Mecha districts.

Vernacular name (Amharic)	Common name	Scientific name	Product used for
Nechishinkurt	Garlic	<i>Allium sativum</i>	1, 2, 3
Zingebile	Ginger	<i>Zingiber officinale</i>	1, 2, 3
Korerima	Korerima	<i>Aframomum korerima</i>	1, 2, 3
Tenadam	Rue	<i>Ruta graveolence</i>	1, 2, 3
Krinfude	Clove	<i>Syzygium aromaticum</i>	1, 2
Abish	Fenugreek	<i>Trigonella foenum-graecum</i>	1, 2, 3
Zekakibe (Basobila)	Basil	<i>Ocimum basilium</i>	1, 2, 3
Tikur-azmud	Black cumin	<i>Nigella sativa</i>	1, 2, 3
Netch-azmud	Bishop's weed	<i>Trachyspermum ammi</i>	1, 2, 3
Timiz	Indian long pepper	<i>Piper longum</i>	1, 2
Ird	Turmeric	<i>Curcuma domestica</i>	1, 2
Mekimeko		<i>Rumex abyssinicus</i>	1, 2
Kundoberbere	Black pepper	<i>Piper nigrum</i>	2
Kerefa	Cinnamon	<i>Cinnamomum zeylanicum</i>	2
Keyshinkurt	Shallot	<i>Allium cepa</i>	2, 3
Senafitch	Mustard	<i>Brasica nigra</i>	3
Dimbillael	Coriander	<i>Coriandrum sativum</i>	3
Tosign	Thyme	<i>Thymus serrulatus</i>	3

Table-4. Containers used for processing and storage of dairy products in the study area (percentage of the total respondents, n = 150).

Purpose	Containers		
	Gourd	Clay pot	Plastic container
Milking	85.05	Nu	29.91
Churning	61.19	38.81	nu
Storage of			
Fermented milk	53.55	46.45	nu
Arera (defatted sour milk)	43.24	45.18	11.59
Ayib	nu	82.06	17.94
Butter	56.19	33.13	10.68
Ghee	74.51	25.49	nu
Metata Ayib	47.13	27.63	11.96
Zure	nu	74.82	25.19

n = number of respondents; nu = not used.

Table-5. Plants used for smoking and cleaning of milk utensils in the study area.

Vernacular name (Amharic)	Scientific name	Purpose
Abalo	<i>Terminalia brownii</i>	Smoking
Cheba	<i>Acacia</i> spp.	Smoking
Kessie	<i>Ocimum hardiense</i>	Cleaning

Table-6. Sale and price^a of milk and milk products in the study area.

Product	N	Price (Mean ± SD)	
		Wet season	Dry season
Raw milk (Birr/liter)	37	1.9 ± 0.32 (0.21)	2.1 ± 0.33 (0.23)
Butter (Birr/kg)	74	19.9 ± 1.86 (2.20)	24.6 ± 1.36 (2.72)
Spiced butter (Birr/kg)	15	32.8 ± 2.49 (3.63)	37.8 ± 2.40 (4.19)
Metata Ayib (Birr/kg)	13	7.6 ± 0.48 (0.84)	9.3 ± 0.90 (1.03)

n = number of respondents; SD = Standard deviation; ^aThe exchange rate of US Dollar to Ethiopian Birr at the time of this study was 1 US \$ = 9.03 Birr; The values in parenthesis are the equivalent average prices in Dollar.

Table-7. Milk and butter sales outlets used in the study area (percentage of respondents, n = 150).

Sales outlets	Products	
	Milk	Butter
Cooperatives	52	ns
Individuals	50.5	62.6
Retailers	23.5	37.4

n = number of respondents; ns = do not sell.

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