Global Veterinaria 22 (3): 149-159, 2020
ISSN 1992-6197

DOI: 10.5829/idosi.gv.2020.149.159

Tradition Processing, Handling and Mitigation Systems of Milk and Milk Products in the Nekemte Milk Shed of Ethiopia

[1]Habtamu Abera and [2]Tesfaye Mideksa

[1]Ethiopian Biotechnology Institute (EBTI), P.O. Box: 5954, Addis Ababa, Ethiopia
[2]Bako Agricultural Research Center, Oromia Agricultural Research Institute (OARI), P.O. Box: 03, West Shawa, Bako,Ethiopia

Abstract: The huge livestock resources and vast climatic conditions in Ethiopia are prominent roles for dairy development. Milk spoilage is a major problem in the dairy sector in tropical countries. A previous study reported that small scale milk-producing households have been practiced in traditional processing, handling and mitigation system of milk and milk products to control post-harvest milk losses. Hence, there is no traditional processing, handling and mitigation system of milk and milk products have been reported in the Nekemte milk shed of Ethiopia. Therefore, this study was conducted to assess traditional production, handling and mitigation system of milk and milk products in the Nekemte milk shed of Ethiopia. Forty-five (45) milk producers were interviewed using a semi-structured questionnaire. The average household size was 5.4±0.34. The ranking indices were indicated that the purpose of keeping dairy cattle for milk production 1st, income generation 2nd, manure 3rd and draft power 4th, respectively. In this study, daily milk yield was determined by breeds, seasons and stage of lactation. The average quantity of daily milk produced per day, consumed per day, processed per week and sold per week were 9.5±2.1, 3.9±2.1, 22.6±7.3 and 78.5±26.3 liters, respectively. The study revealed that the plant materials of *Dabaqqaa* (*Deinbollo kilimandshorica*), *Ejersaa* (*Olea africana*), *Kefoo* (*Ocimum urticifoliu*) and *Kusaayee* (*Ocimum hardienes*) were used for fumigation milk and milk products containers to improve flavor and shelf life o f the milk and milk products. These results showed that improved breed (80%), feeds (83%) and diseases (72%) are the major constraints of milk production in the Nekemte milk shed of Ethiopia. From this result, it could be suggested that strengthening linkage with Artificial insemination (AI) services, veterinary services, improved forage, access to cooperative and marketing are improve milk production, handling, consumption and mitigation systems.

Key words: Fumigate · Milk · Milk Products · Value Addition · Processing

INTRODUCTION

Ethiopia is the highest cattle population in Africa, which is estimated to be 60.39 million [1]. This is indicated huge opportunities for dairy production. However, consumption of dairy product in Ethiopia is lower than the recommended level of WHO (175 kg) [2] as results of high human and livestock populations, land shortage, animal disease prevalence, feed scarcity and poor genetic potential of indigenous cattle breeds [3]. To meet the demand in consumption of milk and milk product, the genetic improvement cattle in the Ethiopia through crossbreeding has been initiated in the early 1950s when Ethiopia received the first batch of exotic (Holstein Friesian and Brown Swiss) dairy cattle from the United Nation Relief and Rehabilitation Administration [4]. However, an increase in the global population coupled with the increasing demands for milk and milk products, which is a vital role in increase dairy farms in peri-urban and urban cities of Ethiopia [5]. Furthermore, Staal [6] indicated that the development of the dairy sector significantly contributes to poverty alleviation and nutrition in Ethiopia.

Azeze and Haji [7] reported that milk required adequate care starting from production up to consumption specifically during handling, milking,

Corresponding Author: Habtamu Abera (Ph. D), Ethiopian Biotechnology Institute (EBTI), P.O. Box: 5954, Addis Ababa, Ethiopia.

collection, subsequent storage, transportation, chilling, processing and distribution due to highly perishable. As mentioned before spillage during milking and transportation and spoilage caused by poor hygiene and use of inappropriate containers for milk storage were major losses of milk and milk products in Ethiopia [7, 8]. On the other hand, the high temperature coupled with the absence of cooling facilities and adequate transportation means hasten the spoilage of the milk produced in tropical countries (9). In Ethiopia, the rural milk production system accounts for about 97% of the total milk production where it is difficult to transport the raw milk to the market areas or the processing plants due to poor infrastructure [10].

Identifying of postharvest loss of milk and milk products is a prominent role to discover the key problems and interventions. However, small scale farmers have been practiced milk processing and smoking of milk handling equipment to mitigate post-harvest milk losses especially in areas where infrastructure is underdeveloped to sell raw milk [7]. Assessment of the quality of traded milk and milk products has shown that value addition through small-scale processing is important for income generation and reduction of post-harvest losses [11]. Besides fumigation of milk handling equipment using different herbs and adding plant materials directly to the milk products are another alternative for minimizing post-harvest losses to alleviate the problem of milk and milk products spoilage before consumption [7, 11].

However, there is no assessment of postharvest milk loss mitigation systems in the Nekemte milk shed of Ethiopia have been reported. Therefore, the present study was undertaken to assess traditional processing, handling and mitigation systems of milk and milk products in the Nekemte milk shed of Ethiopia.

MATERIALS AND METHODS

Study Areas: The study was conducted in the Nekemte milk shed of Ethiopia. The attitude of the study districts ranges from 1500-3000 meters above sea level. It is mostly known for the mixed agriculture production system, which is suitable for both crop and livestock production systems. About 352 km distance from Addis Ababa. The maximum and minimum temperature of the area was 22.4°C and 10.9°C, respectively. The mean annual rain fall of the area ranges from 800mm to 2400mm [12].

Study Design and Data collection: Forty-five smallholder milk producers were selected with the assistance of Oromia Zone and the district livestock Agency and interviewed using a semi-structured questionnaire. Smallholder farmers having one more milking cows or those who have good experience in milk production were purposively selected. Data collected were mainly focused on household characteristics, milk production and utilization, milk handling and processing methods, risk factors associated with production, transportation and consumption, traditional standards used by smallholder milk producers, retailers and consumers, status of standardized dairy products consumption, challenges in maintaining and consuming standardized dairy food, consumers views and preferences, post-harvest loss mitigation systems and preservation methods.

Statistical Analysis: Qualitative data were analyzed using Statistical Package for Social Sciences (SPSS) version 13.0 (SPSS, 2004). Indices were calculated to rank purposes of keeping, sale and plant materials used to clean milking and milk storage materials as first, second and third by respondents as described previously [13, 14].

RESULTS AND DISCUSSION

Socio-Economic Characteristics of the Households: The study is revealed that the majority (62.2%) of respondents were male. On the other hand, 33% and 28% of the respondents had attended secondary and elementary schools, respectively. In agreement with these findings, educations have been improving dairy production and marketing systems [3]. The results revealed that the average household size was 5.4±0.34. The average age of respondents was 39.53 years, implying that dairying is mainly done by people of the productive age group [3]. According to the results of Mwambene *et al*. [15], the involvement of an active working-age group is crucial for sustainable development and genetic improvement in dairy cattle.

Dairy Herd Size and Purpose of Keeping: Almost all interviewed farmers owned two or more dairy cows, both crossbred and local animals. The number of animals per household varied from 1 to 15 cows. Dairy cattle are mainly kept for milk production, income generation, manure, social status/prestige and production of males for draft power. From these results elucidated that dairy animals are plays a significant economic role in the Ethiopia, which is providing milk, meat, draft power, income generation, manure and social status/prestige. Consistent with this study, Abebe *et al*. [16] found that the main purpose of keeping crossbred dairy cows in

urban and peri-urban of central highlands of Ethiopia for milk and income generation. The study results revealed that the daily milk yields of crosses and local dairy breeds were affected by season. As shown in Figure 1 the higher milk is produced during rainy season. However, as illustrated in Figure 2 the daily milk yield of local cows was less affected by season compared to crossbred cows, indicating that local cows can produce milk even under the scarcity of feed. These results might be explained by Asfaw *et al.* [17] who reported that crossbred cows produce more milk during the rainy season likely due to relatively more available green fodder. On the other hand, conservation and utilization of crop residues and other byproducts during the dry season can alleviate the feed scarcity problems in the dry season. Indeed, shifting towards intensification of dairying through growing of improves fodder crops with "cut-and-carry" feeding systems and keeping of improved dairy breeds alleviate the scarcity of land available for agriculture [18].

According to respondents, the average daily milk yields of crossbred and local cows (indigenous Horro) were 7.3 and 1.5 liters/day, respectively. Consistent with this study, Negash *et al.* [19] showed that the overall daily milk production per cow was 1.71±0.08 liters from local breed (indigenous Arsi zebu) cows and 8.95±0.69 liters from crossbred cows in the Mid Rift Valley of Ethiopia. Furthermore Geleti *et al*. [20] revealed that the average daily milk yields were 1.79 and 9.79 liters per day for local (indigenous Horro) and cross-bred cows at Nekemte, respectively. In contrast, a study revealed by Gizaw *et al*. [21] found that the average daily milk yields were 9.4 and 4.3 liters/day for crossbred and local (Horro) cows that obtained from Bako Agricultural Research Center. Comparable to these results, the average daily milk yield of Horro cows were 2.41litter/day, under improved management conditions [22] and 0.4-0.8 liter/day under farmers conditions [23]. Habtamu *et al*. [5] reported that the daily milk and income of small scale farmers improved through crossbreeding of indigenous with exotic breeds with reasonable management of the animals. Corresponding to these results genetic improvement of local cattle through cross-breeding has been a major strategy for dairy development in the Nekemte milk shed [24]. On the other hand, technological interventions like on-farm improved forage production and improved management of the dairy cattle were among the factors which might contribute to variation in milk production [19]. Furthermore, the daily milk yields of crossbred and local animals were influenced by the stage of lactation (Figure 2).

Table 1: Livestock herd sizes and composition

Species	Producers (n=45) Herd sizes (number)
Local breed	
Calves	2.3±0.34
Heifers	2.3±0.25
Cows	2.3±0.22
Breeding bulls	1.9±0.26
Crossbred	
Calves	2.27±0.35
Heifers	2.57±0.49
cows	3.26±0.77
Breeding bulls	1.27±0.19
Local goats	4.43±0.81
Donkey	1.22±0.14
Mule	1.00±0.00
Poultry	4.6±0.64
Oxen	1.84±0.22
Beehives	16.12±8.5
Sheep	3.67±0.88

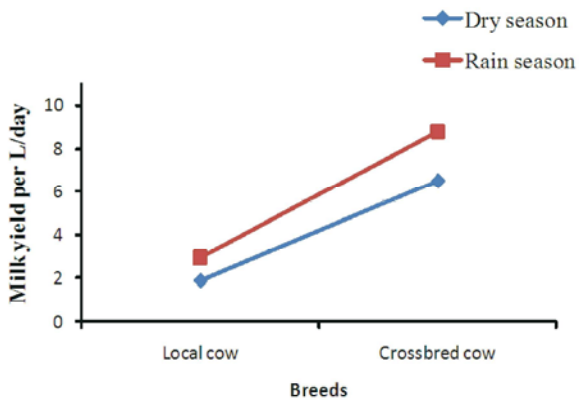

Fig. 1: Seasonal effects of on daily milk yield of local and crossbred cows

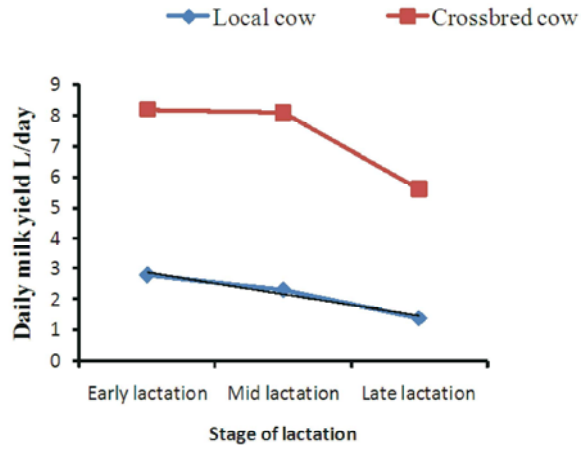

Fig. 2: Effects of stage of lactation on daily milk yield of local and crossbred cows

Production and Utilization of Milk and Milk Product: The average of daily milk produced per day, consumed per day, processed per week and sold per week were 9.5±2.1, 3.9±2.1, 22.6±7.3 and 78.5±26.3 liters, respectively. These results showed that 48.9% whole fresh milk was consumed by family members for nutrition purposes. Consistent with these results, Asfaw *et al.* [17] reported that majority of milk produced by smallholder farmers was used for household consumption while supplies of milk sold to the market. These results underscored that the family members were given priority of consumption of whole fresh milk to children (57.4%) and husband in male-headed households (6.4%) (Figures 3 and 4). Similarly, Asfaw *et al.* [17] indicated that fresh milk consumption is mainly limited to children [25]. The present results were in agreement with the previous work of Alganesh [26], who reported that milk is the major food for children in Ethiopia. Besides, Negash *et al.* [19] reported that the primary objective of dairy production in the Mid Rift Valley of Ethiopia is to satisfy the nutritional requirement of the farming society and the family. Moreover, Galmessa *et al.* [27] reported that priority in milk consumption is given for children and affected by the socio-cultural condition of the particular areas in Ethiopia.

As shown in Table 2, about 61.7 % of the smallholder farmers ranked whole fresh milk as their first and fermented milk as their second priority for sale. The obtained results showed that cottage type cheese is not sold in and around Nekemte and it is in agreement with Alganesh [26]. Also, the results indicated that the butter was the most important market item among the different dairy products in the study area likely due to its shelf life and easy handling compared to whole fresh milk and sour milk. In agreement with these findings, East Wallaga Zone the smallholder's farmers do not sell fresh milk due to small daily production, cultural barrier, lack of demand to buy fresh whole milk and preferred to process milk into butter or cheese [26]. Indeed, Gizaw *et al.* [28] and Habtamu *et al.* [5] reported that the introduction of improved genotype to smallholder farmers improve in the areas where the change the attitude of the farmers. The results of this study also demonstrate that the estimated amount of milk used to the rearing calves was 1.9±0.15 litter/day. Farmers started milking of cows were 9±0.29 days after parturition. Respondents reported that normal milking places are barn (48.9%), near their barn (23.4%), under shade trees (10.6%), nearby their home shelter (8.5%) and in the open air (4.3%). Milking is done while calves are at the sight of the cow, in fact, they late the calves to their dams for milk late down. These results are in agreement with Kassahun *et al.* [29] who reported that milking of cows was done in shelters, under trees shade, in the homestead and barn. About 55.3% of the respondents reported that milk was consumed while 38.3% of milk produced is not consumed either due to fastening (29.8%) and economic reason/for sale (8.5%). According to most respondents (93.5%), there are no religious and economics reasons prevented consuming milk products in the study areas. Dairy by-products like whey are utilized for human consumption (27.7%), calves (74.5%), pet animals (31.9%) and to boil kinche (2.1%).

Milk and Milk Products Handling and Processing: According to the respondent revealed that 72.3% of wife, 8.5% of husband, 14.9% of daughter, 4.3% of son, 14.9% of hired male and 17% of hired females were responsible for milking cows in the household, respectively (Table 3). In the current study, handling, processing and marketing of milk and milk products were followed a similar fashion. The results are disagreement with these observations of Alganesh [24] who reported that women exclusively do milking and processing of milk into different products and men never milk the cows. However, the current results are in agreement with, Nicholson *et al.* [30] who indicated that women spent more than 70% of her time in processing dairy products. Similarly, Ayza *et al.* [3] reported that household wives or adult females were predominantly handled milking in Southern Ethiopia. In the Amhara Region, Fogera and Metema areas milking are entirely performed by males [31, 32]. Furthermore, Azeze and Haji [6] reported that milking, milk handling, processing and marketing was primarily handled by wives.

The containers used for milk and milk products were presented in the Table 4. The interviewed households used different milking equipment for milk, fermentation, churning, storing and transporting. The containers used for milking, storage/fermentation and processing are different and diversified in Ethiopia [19, 33]. The majority of respondents (72.3%) used a plastic bucket for milking while clay pot was used for storing milk (10.6%) and Ayib making (40.4%). Consistence with these results, Yilam [34] who reported that plastic jars (81%); stainless equipment's (3.4%) and clay spot (6.6%) were used for milking, processing and storage. The containers have been used for milking, processing and storage determined the quality of milk and milk products [35]. Furthermore, Abebe *et al*. [35] reported that the pay particular attention to the types and cleanliness of milk equipment, while aluminum and stainless steels were more preferred for milking and storage of milk and milk products.

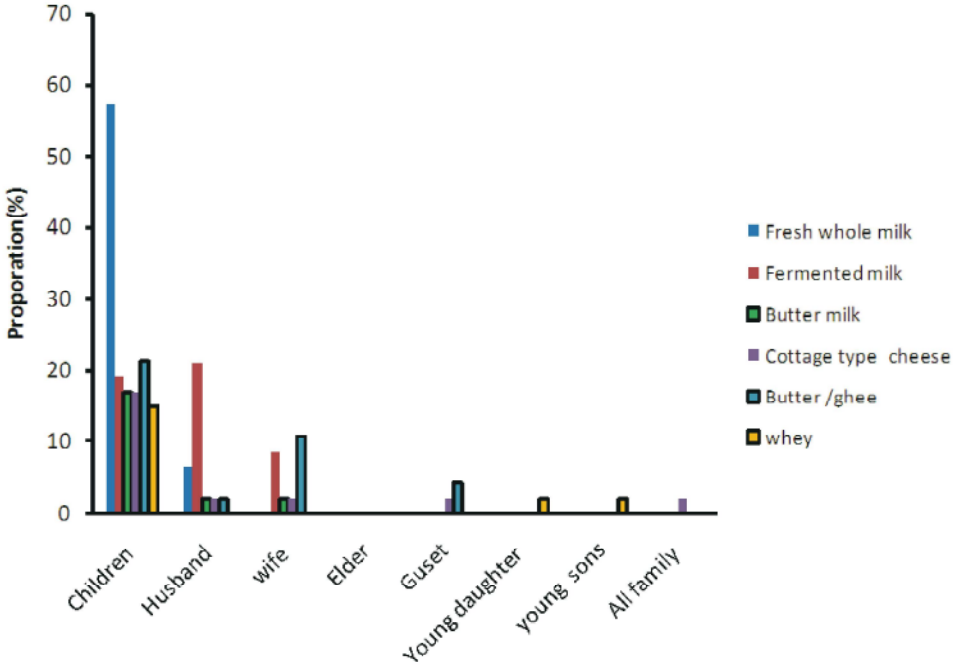

Fig. 3: Family members' priority to consume milk and milk products

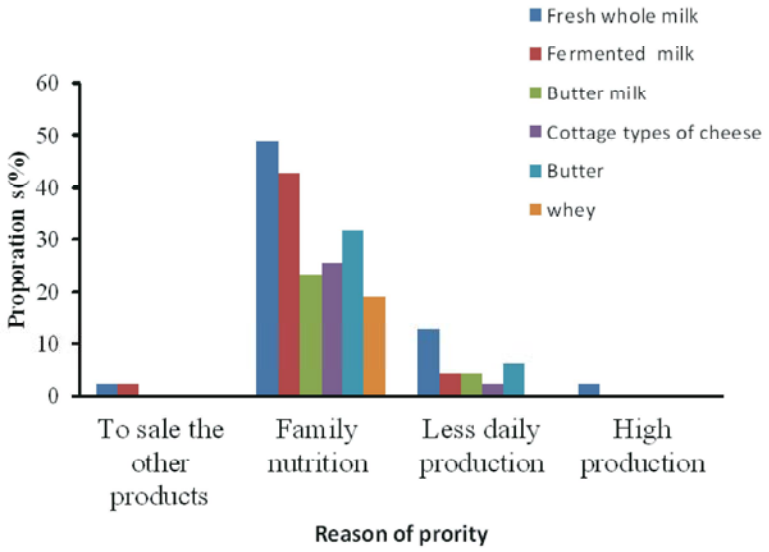

Fig. 4: The reasons for priority in consumption of milk and milk products

Table 2: Priority of ranking for different milk products for sale

	Prioritize ranking (N=45)								
Product	1st	2nd	3rd	4th	5th	6th	Sum	Index	Rank
Whole fresh milk	61.7	8.5	-	-	-	-	412.7	0.386	1
Fermented milk	-	19.1	29.8	4.1	-	-	227.0	0.212	2
Butter milk	-	12.8	4.3	2.1	21.3	-	130.1	0.122	4
Cottage types cheese	-	2.1	4.3	29.8	4.3	-	125.7	0.118	5
Butter/traditional ghee	10.6	12.6	6.4	2.1	2.1	10.6	173.3	0.162	3
Whey	-	2.1	-	-	-	19.1	29.6	0.028	6

Table 3: Gender analysis (division of labor among family members) on milking, milk handling, processing and marketing

Activity description		Location (Nekemte)
Milking	N	%
Husband	4	8.5
Wife	34	72.3
Daughter	7	14.9
Son	2	4.3
Hired male	7	14.9
Hired female	8	17
Milk handling		
Husband	7	14.9
Wife	33	70
Daughter	9	19.1
Son	6	12
Hired male	9	19.1
Hired female	8	17
Milk processing		
Husband	3	6.4
Wife	38	80.9
Daughters	8	17
Son	3	6.4
Hired male	4	8.5
Hired female	6	12.8
Marketing		
Husband	10	21.3
Wife	36	76.6
Daughter	6	12.8
Son	5	10.6
Hired male	2	4.3
Hired female	4	8.5

Table 4: Equipment used for milking, storing, churning and fermentation milking products

	Milking		Fermentation		Churning		Storing milk		Ayib making	
Milking equipment's	N	%	N	%	N	%	N	%	N	%
Clay pot	2	4.3	4	8.5	1	2.1	5	10.6	19	40.4
Stainless steel	7	14.9	10	21.3	3	6.4	5	10.6	5	10.6
Plastic bucket	34	72.3	23	48.9	-		21	44.7	7	14.9
Wooden container	4	8.5	2	4.3	8	17	4	8.5	-	-
Metallic container	1	2.1	2	4.3	1	2.1	-	-	-	-
Calabash (Qil)	5	10.6	4	8.5	30	63	10	21.3	3	6.4

The plants materials used for the cleaning of milking and fermenting utensils are shown in Tables 5 and 6. The smallholder milk producers in the Nekemte milk shed of Ethiopia was used different traditional methods to reduce milk spoilage and post-harvest loss. The current results are indicated that more than half of the respondents fumigate the milk and milk products containers to improve flavor and increase shelf life. Flavoring and smoking by using different parts of plant materials were the means for prolonging the shelf life of milk and milk products [7]. These results were confirmed by different scholars and the farmers were used plants materials for smoking of utensils to give the product good flavor and aroma, to increase shelf life of the milk [19, 34, 36-38]. Apart from these results, Amenu *et al.* [39] showed that the smoking of milk containers which may help reduce microbial growth, processing milk through fermentation, consuming milk in boiled tea and a recent trend towards boiling milk for babies were identified potential risk mitigation practices. Regarding this, Gonfa *et al.* [40] further stated that smoking slowed souring, improved flavor and slowed the growth of coliforms.

These results revealed that the major plant materials used for fumigation of the milk and milk products containers were *Dabaqqaa* (*Deinbollo kilimandshorica*),

Table 5: Plant materials used for cleaning and fumigation of milk and milk products containers

		Prioritize choice (%)						
Local name	Scientific name	1	2	Sum	Index	Rank	Part used	Container
Watto	Undefined	40.4	19.1	99.9	0.999	1	Wood splinter	Fresh milk
Kefoo	*Ocimum urticifoliu*	6.4	14.9	27.7	0.277	4	Leave & stem	
Kussaye	*Ocimum hardienes*	12.8	12.8	38.4	0.384	3	Leave &stem	
Dabaqqaa	*Deinbollo kilimandshorica*	27.7	4.3	59.7	0.597	2	Wood splinter	
Baahaa	Undefined	2.1	-	4.2	0.042	6	Wood splinter	
Ejersaa	*Olea africana*	-	19.1	19.1	0.191	5	Wood splinter	
Watto	Undefined	25.5	10.6	61.6	0.616	1	Wood splinter	Souring/ fermentation
Kefoo	*Ocimum urticifoliu*	12.5	8.5	33.5	0.335	3	Leave & stem	
Kussaye	*Ocimum hardienes*	6.4	4.3	17.1	0.171	7	Leave & stem	
Dabaqqaa	*Deinbollo kilimandshorica*	27.7	4.3	59.7	0.597	2	Wood splinter	
Baahaa	Undefined	2.1	-	4.2	0.042	6	Wood splinter	
Ejersaa	*Olea africana*	-	4.3	4.3	0.043	5	Wood splinter	
Tanaadamii	*Ruta graucolence*	-	23.4	23.4	0.234	4	Leave & stem	
Watto	undefined	25.5	10.6	61.6	0.616	2	Wood splinter	churners
Kefoo	*Ocimum urticifoliu*	4.3	6.4	15	0.15	4	Leave & stem	
Kussaye	*Ocimum hardienes*	2.1	6.4	10.6	0.106	5	Leave & stem	
Dabaqqaa	*Deinbollo kilimandshorica*	29.8	4.3	63.9	0.639	1	Wood splinter	
Baahaa	Undefined	2.1	-	4.2	0.042	6	Wood splinter	
Ejersaa	*Olea africana*	2.1	23.4	27.6	0.276	3	Wood splinter	
Watto	Undefined	27.7	10.6	66	0.66	1	Wood splinter	Butter milk
Kefoo	*Ocimum urticifoliu*	4.3	4.3	12.9	0.129	4	Leave & stem	
Kussaye	*Ocimum hardienes*	2.1	6.4	10.6	0.106	5	Leave & stem	
Dabaqqaa	*Deinbollo kilimandshorica*	25.5	2.1	53.1	0.531	2	Wood splinter	
Baahaa	Undefined	2.1	-	4.2	0.042	6	Wood splinter	
Ejersaa	*Olea africana*	-	21.3	21.3	0.213	3	Wood splinter	
Watto	Undefined	23.4	10.6	57.4	0.574	2	Wood splinter	Cottage type cheese
kefoo	*Ocimum urticifoliu*	-	4.3	4.3	0.043	5	Leave & stem	
Kussaye	*Ocimum hardienes*	2.1	6.4	10.6	0.106	4	Leave & stem	
Dabaqqaa	*Deinbollo kilimandshorica*	27.7	2.1	57.5	0.575	1	Wood splinter	
Baahaa	Undefined	2.1	-	4.2	0.042	6	Wood splinter	
Ejersaa	*Olea africana*	-	19.1	19.1	0.191	3	Wood splinter	
Watto	Undefined	23.4	10.6	57.4	0.574	1	Wood splinter	Butter
kefoo	*Ocimum urticifoliu*	2.1	2.1	6.3	0.063	5	Leave & stem	
Kussaye	*Ocimum hardienes*	-	6.4	6.4	0.064	4	Leave & stem	
Dabaqqaa	*Deinbollo kilimandshorica*	25.5	2.1	53.1	0.531	2	Wood splinter	
Baahaa	Undefined	2.1	-	4.2	0.042	6	Wood splinter	
Ejersaa	*Olea africana*	-	19.1	19.1	0.191	3	Wood splinter	
Watto	Undefined	23.4	8.5	55.3	0.553	1	Wood splinter	Traditional
kefoo	*Ocimum urticifoliu*	-	4.3	4.3	0.043	5	Leave & stem	
Kussaye	*Ocimum hardienes*	2.1	6.4	10.6	0.106	4	Leave & stem	
Dabaqqaa	*Deinbollo kilimandshorica*	21.3	2.1	44.7	0.447	2	Wood splinter	
Baahaa	Undefined	2.1	-	4.2	0.042	6	Wood splinter	
Ejersaa	*Olea Africana*	-	17	17	0.17	3	Wood splinter	

Table 6: The constraints associated with milk production, marketing, processing and consumption

Constraints	Production	Marketing	Processing	Consumption
Low milk yield (%)	61.7	40.4	34	48.9
Poor quality of feeds (%)	89.4	21.3	10.6	25.5
Feed shortage (%)	83	25.5	8.5	23.4
Low price of milk (%)	10.5	44.7	23.4	12.8
Poor market infrastructure (%)	12.8	55.3	27.7	12.8
Labor shortage (%)	46.8	38.3	34	17
Low milk quality/rejection (%)	14.9	38.3	27.7	25.5
Availability of small scale milk processing equipment's (%)	34	40.4	55.3	19.1
Higher price of milk products (%)	21.3	27.7	23.4	29.8
Unavailability of breeds (%)	80.9	25.5	17	36.2
Disease/health problem (%)	72.3	21.3	12.8	38.3
Cultural/religious taboo (%)	23.4	4.3	6.4	19.1

Ejersaa (*Olea africana*), *Kefoo* (*Ocimum urticifoliu*) and *Kusaayee* (*Ocimum hardienes*) in the Nekemte milk shed of Ethiopia. Correspondingly, Olea africana was the most important plant material used for the smoking of milk products equipment [19, 33, 36, 37]. On the other hand, Lemma (33) reported that cleaning plants differ from place to place and from household to household-based upon preferences. For instance, *Eucalyptus globulus* [19], *Juniperous procera* [33], *Ensete ventricosum* [7], *Otostegia integrifolia)*, *Thymus vulgaris* and *Juniperous procera* [36] were the most frequently used plant materials for smoking milk and milk products containers.

Constraints of Milk Production, Marketing, Processing and Consumption: The constraints associated with milk production, marketing, processing and consumption were elucidated in Table 6. Correspondingly, Kassa *et al.* [41] showed that the number of children below 6 years, types of dairy breeds, number of dairy cows owned, milk yield and marketing are the significant factors affecting participation in dairy value addition. Furthermore, availability and costs of feeds, land shortage, problems related to waste disposal (for urban producers), discouraging seasonal marketing systems, shortage of genetically improved dairy animals, poor animal health services, poor extension services and knowledge gap regarding improved dairying were the major problems and constraints dairy production and marketing [3]. Constraints affecting milk production potential of dairy cattle in most parts of Ethiopia including shortage of grazing land, disease and parasites, shortage of land for cultivation of improved forage, inadequate veterinary service, low milk production potential of local zebu cattle, inadequate Artificial Insemination (AI) service and labor shortage [42-45]. In this study, more than 60% respondents were suggested to improve dairy production, handling, consumption and marketing through access to improved breeding, efficient AI services, veterinary services, improved forage, developed infrastructure, credit, trained on milk production and handling, concentrate mix, cooperative and marketing in our locality.

Milk and Milk Products Transportation and Marketing: About 51.1% of respondents reported that they sell milk at different palaces. For instance, 21.3% at farm gate, 21.3% to restaurants and 14.8% to hotels. The income from the sale of milk was controlled by husbands (23.4%, n=11) in male-headed households. Nevertheless, in female-headed households, about 53.2% of the income was controlled by the household head (mother), 10.6% by sons and 2.1% by daughters. More than 68.1%of the income from selling milk was used for household expenditure and about 38.3% was used for saving. The major purpose of saving was used to buy additional or replacement animals (44.7%) and feed and other inputs (57.4%). The price of milk and milk products in the Nekemte milk shed Ethiopia was varied throughout the years. The milk price were determined in local by customer (17%, n=8), producer (61.7%, n=29), processors (2.1%, n=1) and retailer (12.8%, n=6), but in the present report about 93.6% (n=44) respondents there is no interference government authorities. Comparable to these results, Ayenew *et al.* [36] found that the prices of milk and dairy products affecting by season, fasting and non-fasting days and access to urban sites, quality and sources of dairy products.

The factors determined the price of butter at market were availability (63.8%, n=30), quality (40.4%, n=19), original sources (31.9%, n=15), big festival (53.2%, n=25), market demand (36.2%, n=17) and number seller in the market (27.7%, n=13).The parameter used to determine good quality butter in market was freshness/age of butter (odor/rancidity) (70.2%, n=33), color and texture of butter (72.3, n=34), consistency/uniformity of butter (25.5%, n=12), cleanliness of butter (51.1% n= 24) and development of mould on the surface of butte (25.5%, n=12). The color of good quality butter indicators were 91.5% (n=43) respondent revealed yellowish and 2.1% (n=1) white and yellowish white, respectively. About 51.1% (n=24) confirmed that there are the price difference between fresh and rancid butter, fresh butter higher prices (55.3%, n=26).

Milk Transportation, Rejection and Loss: Pints of milk was transported to marketing places on foot (70.2%), by a cart, bicycle and by public transports. About 93.6% and 74.5% of smallholders do not use any kind of additive to preserve milk and butter during transportation to market places, respectively. According to respondents (66%), the spillage of milk during production is very low. About 83% of respondents reported that milk loss due to mastitis was high. Respondents indicated that infected udder is treated traditionally (4.3%), by veterinary services (76.6%) and both (8.5%). About 55.3% of the respondents indicated that they dispose of milk from infected teats, 21.3% reported that they use to feed other animals and about 10.8% used for human consumption either after processing or without processing.

Standardized Dairy Products: Most respondents (93.6%) do not know standardized dairy products. They have no information about milk quality parameters utilized for standardized dairy products. About 48.9% of respondents followed proper standard during milking: such as cleaning of barn, using separate milking places, keeping clean milking environments and the cleanliness of milkers. About 44.7% of respondents do know a good manufacturing process. Moreover, more than 90% of respondents reported that there are not know Hazard analysis critical control point system (HACCP). Greater than 80% of the respondent dairy producers are not observed the kind of diseases or pathogens (Anthrax, tuberculosis, mastitis and brucellosis) can be transmitted from cattle or milk to humans.

CONCLUSIONS

Family members were given priority of consumption of whole fresh milk to children and husbands in male-headed households. Butter is the most important market item among the different dairy products in the study area likely due to its shelf life and easy handling compared to whole fresh milk and sour milk. To mitigate post-harvest milk and product losses small scale dairy producers were used processing and herbs and/or plant materials. Constraints associated with milk production, marketing, processing and consumption were improved breeds, disease, feeds and low quality of feeds. There is a division of labor among family members on milking, milk handling, processing and marketing; however, more than 70% of the time spent in processing dairy products was done by women or the female-headed household.

Therefore, from this result, we suggested that strengthening linkage with Artificial insemination (AI) services, veterinary services, improved forage, access to cooperative and marketing are improve milk production, handling, consumption and mitigation systems.

Funding: This research was funded by East African Dairy Project Program (EADPP).

ACKNOWLEDGMENTS

We thank Researchers of the Dairy Research Team of Bako Agricultural Research Center for data collections. Also thank the Proceedings of the 22nd Annual Conference of the Ethiopian Society of Animal Production (ESAP) for allowed us to reuse the published data.

Author Contributions: Habtamu Abera and Tesfaye Mideksa data entry, data analysis, interpretation and designed the original protocol.

Conflict of Interest: The authors declare no conflict of interest

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