



Review Article

Volume 13 Issue 5 - October 2019
DOI: 10.19080/JDVS.2019.13.555874

Dairy and Vet Sci J
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Review on Traditional Handling, Processing and Marketing of Milk and its Derivative in Ethiopia



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Submission: September 10, 2019; **Published:** October 10, 2019

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Abstract

In Ethiopia, dairy serves as a source of income, employment, nutrition and health for the smallholder rural Farmers. The objective of this senior seminar is reviewing on traditional handling, processing and marketing of dairy cattle products in Ethiopia. The seminar reviewed on the major emphasis of milk production in Ethiopia, traditional milk processing in Ethiopia, traditional milking and milk products handling, constraints of handling, processing and marketing of milk and milk products, utilization and consumption of milk and milk products, marketing system of milk and milk products in Ethiopia. Traditionally some forms of dairy production system exist in most part of Ethiopia. National level, 48.2 % of milk is consumed as whole fresh milk or in fermented form, 40 % is used for butter, 9% for cheese making where as only 5.2 % is marketed. Based on market orientation and land holding, milk production system can be broadly categorized in to three systems, such as rural milk production system, peri- urban milk production system and urban milk production system.

The handling and safety of milk and milk products is of great concern around the world , this is specially true in the developing country where production of milk and various diary products takes place under unsanitary condition and poor production sale must consider the health of consumer. Milk processing is usually designed to remove water from milk or reduce the moisture content of the product. Smallholder milk processing is generally based on sour (fermented milk). Each household in the country accumulates milk either from a single milk animal or large number of animals and it is processed into different products such as butter, cottage, cheese, whey. Dairy cattle products in Ethiopia are channeled both formal and informal marketing systems. According to the review, the constraints of handling and processing of milk and milk products includes unimproved of milk and milk processing utensils, lack of access and high price of cooling facilities, low milk production process (adulteration or milk quality problem). Adulteration is a problem of processing and marketing dairy products. Traditional processing methods require optimization through further studies. The effect of using different methods of preservation such as smoking, species different plant material in terms of health hazards calls further investigation.

Keywords: Milk; Milk product handling; Processing; Marketing

Abbreviations: CSA: Central Statistical Authority; DDS: Dairy development enterprise

Introduction

According to the Central Statistical Agency (CSA) & FAO [1,2], Ethiopia has the largest livestock inventory in Africa with the estimated domestic animals population of 52.13 million, 24.2 million sheep, 22.6 million goat, 2.5 million camel, 44.89 million poultry, 1.96 million horse, 0.37 million mules and 6.4 million donkeys. Among livestock production sector, dairy production is critical in Ethiopia where livestock and its products are important sources of food and income, however dairying has not been fully exploited and promoted in the country. Based on market orientation and land holding, milk production system in Ethiopia can be broadly categorized in to three systems such as rural milk production system, peri- urban milk production system and urban milk production system. Cattle have the largest contribution (81.2%) of total national animal milk output followed by goat (7.9%), camel 6.3% and sheep 4.6%. From the

national 3.3 billion of milk production in Ethiopia 32% is allocated for calf consumption and wastage and 68% is allocated for human consumption.

The handling and safety of milk and milk products is of great concern around the world, this is specially true in the developing country where production of milk and various diary products takes place under unsanitary condition and poor production sale must consider the health of consumer [3]. In most part of the countries milking container are normally made from woven grasses, calabash, hollowed wood, skin, clay pot, in which disinfection is difficult and rinsed with cold water, smoked by burning chip of clea Africana or acacia busia [4]. Milk processing is usually designed to remove water from milk or reduce the moisture content of the product. Generally milk processing is not well developed in Ethiopia [5]. Smallholder milk processing is generally

based on sour (fermented milk). Each household accumulates milk either from a single milk animal or large number of animal and that is processed into different products such as; butter, cottage, cheese, whey and concentrated fermented milk.

Ergo is one of the most common traditionally made fermented milk product in Ethiopia. As indicated by Desalegn [6], Arera is a local name for defatted butter milk in Ethiopia. Defatted butter milk is a semi-liquid product that remains after butter making. It has a thin consistency and basically contains the casein protein of milk. Ayib (Ethiopian traditional cottage cheese) is made from butter milk obtained after churning of sour whole milk. Aguat is amharic name for whey which remains after most of the fat and protein in the milk are removed during cheese making.

Much of the milk produced in Ethiopia by rural stallholder farmers are either sold and/or consumed as fresh milk, fermented milk and milk product such as butter, ghee, cottage type cheese where it is processed on farm using traditional technology. The informal (traditional) market has remained dominant in Ethiopia. The traditional processing and trade of dairy products, especially tradition soured butter, dominate the Ethiopian dairy sector and only 5 percent is marketed as liquid milk due to underdevelopment of infrastructures in rural areas.

Therefore, this review provides organized information on milk production, traditional milking and milk products, traditional milk processing, utilization and consumption of milk and milk products, and marketing system of milk and milk products in Ethiopia.

Objective

To review on the traditional handling, processing and marketing of dairy cattle products in Ethiopia.

Literature Review

Milk Production in Ethiopia

In Ethiopia milk is considered one of the oldest kinds of food and many people depend on its product. The milk production in the country depends mainly on indigenous livestock genetic resource dominated by smallholder farmers; especially on cattle, goat, camel and sheep. Cattle has the largest contribution (81.2%) of total national animal milk output followed by goat (7.9%), camel 6.3% and sheep 4.6% [7]. The productivity of these indigenous breeds was low because of their inherent low genetic capability for milk production and poor management system.

The highly perishable nature of milk coupled with mishandling practice from production up to the consumption stage, the amount produced is subject to high post harvest loss. The estimated harvest losses of up to 40% of milk and its derivatives in Ethiopia have been reported from milk to consumption [8]. According to FAO [9] the value of annual milk and milk product losses due to mainly attributed to mishandling in the dairy chain from farm to fork. These include contamination during milking and further handling coupled with storage time temperature before consumption,

deliberate adulteration of milk, absence of substandard handling, transportation and distribution system, inefficient processing technology, inadequate fresh milk outlet and spillage losses during milking.

Milk production system based on market orientation and land holding, Tsehay reported that in Ethiopia can be broadly categorized into three systems such as rural milk production system, peri-urban milk production system and urban milk production system. The main source of milk production in Ethiopia is from the cow, but small quantities of milk obtained from goat and camel is also used in some regions particularly in pastoralist areas.

Rural milk production: This dairy system is part of the subsistence farming system. According to Setal and Shapiro, it is the dominant production system accounting for over 97% of national milk production. This system including pastoralists, agro pastoralists, and mixed crop-livestock production. Largely, the system is based on low producing indigenous breeds of zebu cattle. The livestock are kept under traditional management conditions and generally obtained most of their feed from native vegetation, after math grazing and crop residues.

Peri-urban milk production: This system includes small holder and commercial dairy farmers near Addis Ababa and other regional towns [10]. Most of the improved dairy stock is used for this type of dairy production. Currently small holder farmer milk marketing units, DDE (dairy development enterprise), Mama Agro industry and private dairy farmers in and around Addis Ababa supplying dairy products to the city market. Peri-urban dairy production system is mainly operational in areas where the population density is high, agricultural land is shrinking due to expanding urbanization, and labor cost is on the increase. Peri-urban dairy system occurs around cities, where demand for milk is high. Peri-urban milk production system includes smallholders and commercial dairy farmers working in the proximity of the city of Addis Ababa and other regional towns. Most of the improved dairy stock in Ethiopia is used for this type of production system.

Urban milk production: This system is developed in major cities and regional towns, which have high demand for milk, and they are a largest source of milk producer. A total of about 167 small-medium and large-scale dairies exist in and around Addis Ababa. Production system inside and around Addis Ababa consists of small, medium and large dairy farms producing about 35 million liters of milk annually.

Of the total urban milk production 73% is sold, 10% is left for household consumption, 9.4% goes to calves and 7.6% is processed into butter and ayib (cottage cheese). In terms of marketing, 71% of the producers sell milk directly to consumers. Although some farmers produce good quality milk, hygienic quality and composition of most milk marketed in such production systems is poor. Moreover, price is high even when quality of milk is low. No standards and quality control mechanisms or dairy policy exist to safeguard consumers.

Traditional Milk Handling and processing

Traditional milking practice in Ethiopia: The majority of rural household milking of cows done twice per day morning and evening. The dams suckled by the calves for a few minutes before milking and allowed for sometimes to stay with dam thereafter [11] the cows are milked in the shade graying field in front of the home stage none of which clean environment for milking [4].

Hand milking is performed by massaging and pulling down on the teats of the cow. Milking animals are kept with the rest of stock in the shade or enclosure during the night. Milking is done in the shade of grain feed in front of the homestead or under a tree, however, as this area are not kept clean except for dung removal milking cows usually become solid with dung urine and other. Good hand milking practice increase milk yield in dairy farm. These are milking environment milking must be carried out in shade or roofed milking place which is clean and dry [12].

Traditional handling practice of milk and milk products: Milk is the most easily contaminated and perishable product of animal origin. This is mainly due to its high nutritional value creating an ideal medium for the growth of spoilage as well as pathogenic microorganisms. The handling and safety of milk and milk products is of great concern around the world, this is especially true in the developing country where production of milk and various diary products takes place under unsanitary condition and poor production sale must consider the health of consumer [3]. These problems can sever in Ethiopia, where most of the milk produced is marketed to consumer without being pasteurized and where there is no functional official quality control standard. In most part of the countries milking container are normally made from woven grasses, calabash, hollowed wood, skin, clay pat, in which disinfection is difficult and rinsed with cold water, smoked by burning chip of clea Africana or acacia busia [4]. In most case the practice for limiting spoilage of milk in Ethiopia are limited to certain treatment that include immediate boiling of milk after its production and sanitizing methods, which include smoking of the vessels used to processing or storage of milk and milk product. This practice of smoking of vessel by burning wood chips of specific tree and shrubs has an advantage.

Traditional Milk Processing in Ethiopia

Milk processing is usually designed to remove water from milk or reduce the moisture content of the product. Generally milk processing is not well developed in Ethiopia. Smallholder milk processing is generally based on sour (fermented milk). Each household accumulates milk either from a single milk animal or large number of animals and that is processed into different products such as; butter, cottage, cheese, whey and concentrated fermented milk. In Ethiopia, butter milk is converted into local cheese which is reserved for home consumption and considered as a staple food by many smallholders.

Ergo (Ethiopian naturally fermented milk): Ergo is one of the most common traditionally made fermented milk product

in Ethiopia. As indicated by Desalegn [6], it is made by natural fermentation of milk under ambient temperature, without the addition of starter cultures using traditional utensils under non-hygienic environment. Ergo is the most natural milk preservation originated from the inability of livestock owner to control the keeping quality of the milk [13]. In Ethiopia, Ergo makes the base of further processing of milk into more stable fermented milk products. The relatively low pH of Ergo, ranging from 4.3 to 4.5 retards the growth of pathogens and spoilage bacteria enabling its further storage.

Traditional butter (kibe): Traditionally small holder butter making is based on sour milk. Milk for churning is accumulated over several days by adding fresh milk to the milk already accumulated. Since butter is always made from fermented milk there is no tradition of using cream. These traditional sold of butter by women is common in every community of the country. In traditional butter making milk is collected over period of 3-4 days in clay pot or other materials. The churn is then stopped with a plug, pieces of skin or leather or other similar materials stretched over the opening and securely tied. Then after the churn is vigorously agitated or churned in such a way that air is incorporated in the liquid [13].

Although different materials can serve as a churn for butter making, clay pot and bottle gourd are the most commonly used. The break point that is the point when butter starts to form, can be detected by a change in the sound of the milk upon agitation. After butter granules have coalesced into large grains, the churn is rotated on its base. This collects the grain in the center and forms lumps for butter; the butter is then skimmed off. Kneaded in cold water and washed to remove visible residual butter milk [14]. Of the total milk produced, around 40% is allocated for butter [15].

The performance of the clay pot churn was compared with those of a locally made and an imported wooden churn. The locally made churn is static, cylindrical, has a hand-operated revolving beater and a capacity of 30 liters. The imported wooden churn is also cylindrical but is fitted with fixed beaters and is rotated by hand. Its capacity is 31 liters. The traditional earthenware churn has a capacity of 24 liters, the churning action is achieved by rocking the churn back and forth [16].

Arera (Defatted Butter): Defatted butter milk is a semi-liquid product that remains after butter making. Arera is a local name for defatted butter milk in Ethiopia. It has a thin consistency and basically contains the casein protein of milk. Its taste and odor are similar to those of ergo. It is either consumed in that form or cooked to produce ayib. The consumption of defatted butter milk depends on the standard of living of the family. In contrast to other traditional dairy products, Arera comprises 91.5% moisture, 3.1% protein, 1.4% fat, 3.4% carbohydrate and 0.6% ash. A hundred gram of Arera gives 95 milligram calcium, 84 milligram phosphorus, 1 milligram iron, 0.03 milligram of thiamine, 0.21 milligram riboflavin and 0.10 milligram niacin [17].

Ayib (Ethiopian traditional cottage cheese): Ayib (Ethiopian traditional cottage cheese) is a white, softcurd type of cheese in which it is produced in many regions of the country. It is made from butter milk obtained after churning of sour whole milk (Ochner, 2007). For the production of this traditional Ethiopian cottage cheese called ayib, butter milk is heated in a low fire to about 50

°C. When the curd and whey separate, the heating is stopped and the whey separates, the heating is stopped and the content of the pot are allowed to cool, straw is introduced into the milk pot to serve as a sieve. The whey is drained off and the cheese curd is kept in a clean bowl or pot. From the total milk produce 9% is allocated for cheese making (Table 1).

Table 1: Total Cheese production (Metric Tons) in different African countries [26].

Country	Production 1994	Production 2003
Algeria	1045	2000
Angola	1007	1007
Botswana	1498	5000
Egypt	333950	498000
Eritrea	216	Na
Kenya	210	Na
Mauritania	2664	2000
Morocco	6947	8000
Namibia	70	Na
Niger	12064	1500
Nigeria	7022	8000
South Africa	38000	38000
Sudan	72479	152000
Tanzania	1200	3000
Ethiopia	4600	6000

Whey (Agate): Aguat/whey is the liquid that remains after most of the fat and protein in the milk are removed during cheese making. Whey should be fed to animals; calves, cows and dogs or consumed by humans. Aguat contains valuable nutrients, 0.6 to 0.65 whey proteins, 0.5 to 0.7 minerals and about 0.75% protein

[18]. The whey from cheese making varies according to the type of cheese made and, therefore, the content of protein, salts and lactose also vary. Whey proteins extracted from whey by ultrafiltration have also found many uses in the food industry (Figure 1).

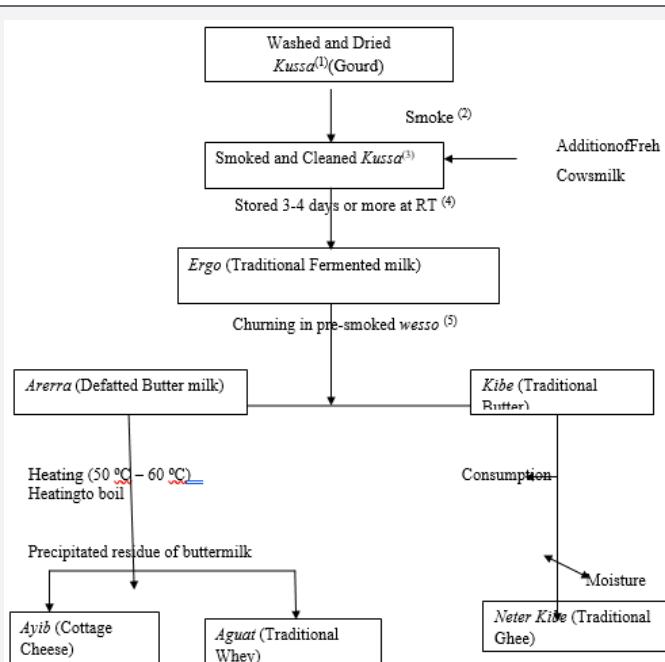


Figure 1: Flow scheme for processing of various traditional fermented milk products [27].

N.B (1) Kussa is a traditional storage utensil made up of calabash, clay pot or hollowed wood. (2) Smoking is done using burned stems of selected plants. (3) Cleaning is done using plant fiber materials commonly known as foxso. (4) RT – room temperature (5) Wesso is a traditional utensil, which may be either a calabash, larger clay pot, hollowed wood or animal skin for the purpose of churning.

Additives in milk that gives flavors

Flavored milk is milk that has sugar, coloring and mostly (inexpensive artificial) flavorings added to make it more appetizing, especially to children (prominent example can be found in the artificial strawberry flavor and glaciate (can be sold as powder) to beaded to plain milk or bought pri-mixed alongside other milk product [19]. Savory flavors are showing up in yogurt and cottage cheese .dairy processed should be taking not consumers showing interesting savory flavors. When peoples think of yougurt.they usually associated with sweet flavors. The most popular flavors remain the standards are strawberry, blubbery, chocolate, salt and banana. But the worlds of yogurt flavor innovation are become quite diverse as consumers interesting unique flavor combinationcontinious to grow .and now savory flavors are on consumer's radar. While the majority of eleadingyogurt flavors are sweet the spread of savory offerings at food device and retailmayportend.salt is

added to butter to decrease the perishability [20]. Chocolate milk :is sweetened coca-flavored milk .it can be created by mixing chocolate syrup(chocolate powder)with milk fromcow.it can be purchased pri mixed with or made at home by blending milk with cocoa powder and a sweetener such as, sugar or sugar substitutes,meltedchocolate,chocolatsyruporpowderedchocolat milk mix.

Utilization and Consumption of Milk and Milk Products in Ethiopia

Milk and milk products are part of the diet of many Ethiopians. However, the importance of milk in the diet of the people in the country is different according to the farming systems and the socio-cultural setups. In the lowlands, especially where livestock keeping is the main occupation, milk is consumed by all groups of the society. In the highlands, the rural people are sedentary farmers raising both livestock and crops, with their diet consisting mainly of cereals. Moreover, the consumption pattern of milk and milk products produced at home varies depending up on the amount of milk produced per house hold, dairy production system and market access, season of the year and fasting period (particularly for the followers of orthodox Christian. Fresh milk, ergo, whey, Ethiopian cottage cheese (ayib) and traditional butter are the most common milk products produced and consumed by different part of the country.

Table 2: Utilization of milk at different regions of Ethiopia (2009/10) [25].

Region	Utilization (%)				Total
	Household consumption	Sale	Wage in kind	Others	
Tigray	91.8	1.34	0.42	6.43	100
Afar	87.29	4.69	0.3	7.72	100
Amhara	92.62	0.38	0.24	6.76	100
Oromia	86.36	6.31	0.29	7.05	100
Somali	67.79	29.68	0.17	2.36	100
Benshangule-Gumuz	63.89	0.89	0.12	35.1	100
SNNP	88.63	2.29	0.36	8.73	100
Gambella	85.63	11.15	0.44	3.28	100
Harari	47.47	47.21	-	5.32	100
Dire Dawa	63.65	35.65	0.24	0.24	100
Ethiopia	85.2	6.86	0.29	7.62	100

The consumption of milk and milk products vary geographically between the highlands and the low lands and level of urbanization. In the lowlands, all segments of the population consume dairy products while in the highlands major consumers include primarily children and some vulnerable groups of women. The limited statistical data available on potential milk demand suggest that demand for milk will increase, at least in the urban centers and among the people with high purchasing power. In Ethiopia, butter milk is converted in to locale cheese which is reserved for homeconsumption and considered as a staple food by many smallholders (Table 2).

Marketing System of Milk and Milk Products

Like other African countries (Kenya and Uganda), dairy products in Ethiopia are channeled both formal and informal dairy marketing systems [21]. According to Van der Valk and Tessema report, 98% of milk produced in rural area was sold through informal chain whereas only 2% of the milk produced is reached the final consumers through formal chain in Ethiopia. Similarly Muriuki and Thorpe showed that the share of milk sold in the formal market is insignificant in Ethiopia, which is less than 2% as compared to 15% share in Kenya and 5% in Uganda.

Formal marketing systems are usually controlled by the government which include organized collection, processing and distribution of fresh milk and other dairy products at official government controlled prices. The dairy development enterprise of Ethiopia is an example of formal marketing system in Africa. In the informal marketing systems, the small holder sell their surplus supplies to neighbors or in the local market, either as liquid milk or in the form of butter or cottage type of cheese (Ayib). The informal market involves direct delivery of fresh milk by producers to consumers in the immediate neighborhoods, and sells to itinerant traders or individuals in near by towns. It is also milk may pass from producer to consumer directly or it may pass through two or more market agents. The informal marketing system is characterized by no licensing requirement to operate low cost operations high producer price compared to formal market and no regulation of the operation. The advantage of the informal system is low cost, with short marketing channels and potentially good price for producer and consumer possibility. This helps to the small farmer to participate in milk production and marketing and limited competition with imported products. Whereas the disadvantage are no payment for quality and fat content. In addition, possibilities for adulteration problems with seasonal fluctuations in production and no public health control.

Among the traditional fermented milk products butter, ayib, Ethiopian cottage cheese and Ergo (Ethiopian fermented milk) represent the most marketed product next to whole milk. It is therefore important to look into their process in relation to hygienic condition practiced during handling.

Constraints of Milk Processing Handling and Marketing

The major constraints pertaining and processing of milk and milk products is lack of clean water for cleaning purpose. In this case washing the udder of the animal, the hands of milkers and milk containers are decisive factor in production of clean milk. In different part of the country, water used by smallholder farmer was found to contain bacteria including pathogens. The other constraints of handling and processing of milk and milk products are unimproved of milk and milk processing utensils and lack of access and high price of cooling facilities [22-25]. Due to the low milk production in the country one of constraints of milk and its products, This mainly due to unhygienic condition at one more of the dairy chain from production up to consumption which in turn might be attributed to inadequate dairy infrastructure coupled with limited knowledge of hygienic production and handling of milk and milk products [26,27].

Conclusion

Although Ethiopia holds large population dairy cattle the total milk production remain along the lowest in the world, even by African standard. Cattle have the largest contribution (81.2%) of total national animal milk output followed by goat (7.9%), camel 6.3% and sheep 4.6%. Generally traditional handling, processing and marketing of dairy products are mostly practiced in large

parts of Ethiopia. The highly perishable nature of milk coupled with mishandling practice from production up to the consumption stage, the amount produced is subject to high post harvest loss. Milk processing is usually designed to remove water from milk or reduce the moisture content of the product. However, milk processing is not well developed in Ethiopia, traditional fermented milk products like, butter, ayib, Ethiopian cottage cheese and Ergo (Ethiopian fermented milk) represent the most marketed products next to whole milk. Dairy products in Ethiopia are channeled both formal and informal marketing systems. The major constraints for handling, processing and marketing of milk and milk products are lack of clean water for cleaning purpose, use of unimproved milk and milk processing utensils, lack of access and high price of cooling facilities and adulteration. From the total 3.3% billion milk production 32% is allocated for calf consumption and wastage and 68% is allocated for human consumption. 98% of milk produced in rural area were sold through informal chain whereas only 2% of the milk produced is reached the final consumers through formal chain. Share of milk sold in the formal market is insignificant in Ethiopia, less than 2%, compared to 15% share in Kenya and 5% in Uganda.

Totally the high perishable nature of dairy product needs further process to increase the shelf life or to resist the spoilage. But most of the Ethiopian people processed and handle the dairy products traditionally. As a result the perishability of the dairy product does not perfectly control. Therefore, there are many constraints that affect the dairy products when the processing and handling is traditional. Rural people in Ethiopia sold high amount of milk through in formal chain but little amount of milk is sold through the formal market chain.

Acknowledgements

I would like to express my heart full thanks to staff department of animal, who arranges all this things to me.

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DOI: [10.19080/JDVS.2019.13.555874](https://doi.org/10.19080/JDVS.2019.13.555874)

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