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Traditional Knowledge of Milk Production, Processing and Utilization in Borena Zone, Ethiopia

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Abstract: The study was conducted to assess and document traditional knowledge of milk production, processing and utilization in Borena zone of Oromia regional state of Ethiopia. A total of 99 households were randomly selected from purposively selected nine *Kebeles* [small administrative units] for this survey study. A pre-tested questionnaire was administered to collect both qualitative and quantitative data from selected households. Focus group discussion was also made for cross check. Both quantitative and qualitative data collected during the survey were analyzed using Statistical Package for Social Sciences. This survey study found that all the respondents use traditional equipment for milking, storage and processing purpose. The majority of the respondents processed the milk to diversify products for consumption, to preserve products and sale for income generation of the family. The traditional milk processing products in the study area were *Ergo, Arerra,* Ghee and Butter. Different plant materials are used by the farmers to give the product good flavor and aroma and to increase the shelf life of the product.

Key words: Borena · Milk Production · Milk Processing · Pastoralist · Traditional Knowledge

INTRODUCTION

The livestock population of Ethiopia is believed to be one of the largest in Africa. The total cattle population for the country is estimated to be about 53.99 million. Out of this total cattle population, the female cattle constitute about 55.48 percent and the remaining 44.52 percent are male cattle [1].

Despite having the largest livestock population in Africa, Ethiopia's milk production is very low. But, this increasing demand for milk and milk products from a growing population offers an opportunity for milk producers and processing cooperatives to increase productivity. In 2007 as D'Haese *et al.* [2] reported demand for dairy products in the country exceeds supply which is expected to induce rapid growth in the dairy sector.

Despite the large dairy cattle population of Ethiopia, the per capita milk consumption in Ethiopia [18.68 liters] is very low as compared to the global average of 100 liters and even far below the average for Africa, 27 liter/year [3]. Livestock sector has been contributing considerable portion to Ethiopia's economy and still promising to rally round the economic development of the country. The contribution of the dairy sector to the total household income is substantial.

Yilma [4] reported that milk and milk products contributed 20-36% to the total farm income of smallholder farmers in Selale and Holleta areas in the central highlands. Beyene and Abrahamsen [5] also reported that milk and milk products to have up to 46% contribution to the household income in the Southern Ethiopia.

Dairying is one of the livestock production systems practiced in almost all over the world including Ethiopia, involving a vast number of small, medium, or large- sized, subsistence or market-oriented farms. Even though Ethiopia has the largest livestock population, productivity and production have remained low [6].

According to FAO [7] the world milk production increased by 150 million tons per year following the 2002 to 2007 analysis. Africa contributed to only 5 percent of the world's milk production and Ethiopia, in spite of its largest cattle population in the continent, is not among the four largest milk producing countries [Egypt, Kenya, South Africa and Sudan [7].

As reported by Pratt *et al*. [8], Ethiopia has a huge potential to be one of the key countries in dairy production for various reasons. Milk production systems can be broadly categorized into urban, peri-urban and rural milk production systems based on location [9]. However, this research mainly focused on rural dairy production system.

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Rural dairy system is part of the subsistence farming system that contribute up to 98% of the total milk production of in Ethiopia and includes pastoralists, agro-pastoralists and mixed crop-livestock producers [10-14]. Borena peoples are one of the pastoralists in Ethiopia.

Ahmed *et al*. [15] reported that rural dairy production system is not market oriented and most of the milk produced in this system is retained for home consumption. The level of milk surplus is determined by the demand for milk by the household. The surplus is mainly processed using traditional technologies and the processed milk products such as butter, ghee, *ayib* and sour milk are usually marketed through the informal market after the households satisfy their needs [11].

It is also reported that, raw milk is either kept at ambient temperature or kept in a warm place to ferment prior to processing [16]. Dairy processing in the country is basically limited to smallholder level and hygienic qualities of products are generally poor [17]. As reported by CSA [18] of the total annual milk production in rural areas, 85% is used for household consumption, 7% is sold, only 0.3% is used for wages in kind and the remaining 8% is used for other purposes such as production of edible and cosmetic butter and *Ayib*.

In the rural areas, only small volumes of milk are available daily at household level and to allow the milk to ferment requires that the collection should be done over a few days until a sufficient amount is available for further processing.

Milk and milk products play an important role in human nutrition throughout the world. It is also part of the diet for many Ethiopians. The consumption of milk and milk products vary geographically between the highlands and the low lands and even in the level of urbanization. In the lowlands, like Borena peoples where livestock keeping is the main occupation, milk is consumed by all groups of the society.

Milk and milk products are economical important farm commodities and dairy farming is an investment option for smallholder farmers [19]. Moreover milk is used for rearing of calves and children and the surplus is soured for *Ergo* [Ethiopian naturally fermented milk], Butter, *Ayib* [Ethiopian cottage cheese] and *Arerra* making. Dairying is practiced almost all over Ethiopia involving a vast number of small, medium or large-sized subsistence or market-oriented farms.

It is well known that milk is produced, processed and utilized in different parts of Ethiopia. Many Ethiopians consume dairy products either as fresh milk or in fermented or soured form. Dairy processing plants are few in numbers, much of the milk produced by rural small holders is processed on farm using traditional technologies and milk processing is based on sour milk [20]. This might be due to high ambient temperature, small daily quantities of milk produced, consumer preference, the better shelf life of fermented milk, as well as the type and capacity of the locally available processing materials and methods used. Fellke and Geda, [21] estimated that 68% of the total milk produced is used for human consumption in the form of fresh milk, butter, cheese and yogurt while the rest is given to calves and wasted in the process.

The system of milk production, processing and utilization varies according to regions tribes and culture. This makes the traditional knowledge of milk production, processing and utilization practice peculiar to specific area. Alganesh [22] studied the traditional milk handling and processing practices and raw milk quality in Eastern Wollega; traditional handling practices, preservation, utilization and consumption of dairy products and marketing systems in East Shoa Zone was reported by Lemma *et al*. [23] and Lemma *et al*. [24]. Also Asaminew [25] studied the production, handling, traditional processing practices and quality of milk in Bahir Dar milk shed area. The main objective of this study was to asses and document traditional knowledge of milk production, processing and utilization in Borena zone of Oromia regional state.

MATERIALS AND METHODS

Description of Study Area: The study was conducted from November 10 to December 3, 2015 in selected *kebeles* of Borena zone, Oromia regional state. Borena zone is one of 18 administrative zones within Ethiopia's Oromia regional state. It is located in the Southern part of the region [Between 3°26' - 6°32' North latitude and 36°43'-40°46' East longitude] and borders Kenya. The altitude of the zone ranges between 1, 000m and 1, 500m above sea level. The semi-arid lowlands are predominantly flat, covered with bushes and shrubs [26]. Yabello is the capital town of the Borena zone and lies 567 km south of Addis Ababa. As a zonal administrative entity, it encompasses a total area of 45, 435 m sq., which is equivalent to approximately 200 km square area [27]. From the total area 75% consists of lowland.

Borena is known for its traditional *Gada* system, an indigenous and complex socio-political structure that governs the strategic interests that are reflected in all of

the day to day life of Borena society. Borenas are also well known for having some of the finest grazing land in Africa and by their cattle breeds that are hardy and possess good productivity characteristics. There are 19 urban centers, of which 10 have town administration. The region has a semi-arid savannah landscape, marked by gently sloping lowlands and flood plains vegetated predominantly with grass and bush land. People are pastoral, predominantly involved in small-scale subsistence agriculture production and mainly depend on livestock husbandry.

Data Collection: Primarily, overview of the area was perceived through preliminary survey conducted to gather information relevant for this study. Pastoral community of nine *kebele;* namely *Kersadenbi, Bokola, Algobisa, Chelqasa, Arbero, Arero, Afura, Buyagudo, Renji,* was selected based on their geographical location and socioeconomic characteristics for this study using purposive sampling procedures. A total of 99 pastoral dairy households, 11 from each *Kebele*, were selected using simple random sampling technique. Questionnaire-based survey was used to collect data needed for assessment of milk production system, processing and handling [28]. The questionnaire was administered by researchers working in Ethiopian Biodiversity Institute, microbial biodiversity sub-directorate; bacteria and fungus case team. Questionnaire survey was designed in a way for assessment of milk production, processing and utilization from sampled households in the area. The questionnaire was pre-tested and adjusted before its full administration.

The content of the structured questionnaire included households characteristics [Age, sex, family size, educational background], breed types of livestock owned, experience in dairying, milk production system, milk processing and handling practice, the amounts of milk produced and type of storage materials and how the milk is utilized including the traditional methods of butter, cheese, ghee making. Focus group discussion was made with members composed of representatives of each *kebele* who were selected based on their experiences in milk production, processing and utilization. For adequate breadth and depth of information, 10-15 focus group discussions wereincluded for this study [29].

Data Analysis: Descriptive statistics was used to evaluate all the variables including socio-economic characteristics, milk processing and products and volume of milk, processing frequency, churning, fermentation time and utilization using SPSS [30] software ver.20.

Fig. 1: Discussion with *Aba Gada* of Borena Zone

RESULTS AND DISCUSSION

Socio-Economic Characteristics of the Respondents

Family Size and Age Group: The household's family sizes of the study area are shown in Table 1. The average family size per household in the study areas were 6.75 with a maximum of 13 and a minimum of two persons per family. The average family size per household observed in this study [6.75] is comparable with Adebabay [31] who reported the overall mean household size were 6.22 in Bure district. However, it is greater than Tesfaye [32] who found the overall mean family size of 5.7±0.134 persons/HH in Metema district. But, it is lower than the average household size of the target respondents [7.76] which was reported by Tollossa *et al*. [33] in Abaya district of Borena pastoral area. It is also smaller than the number reported by Solomon [34] who found the overall mean household size in Bale highlands to be 8.73 persons per household.

Out of the total interviewed household in the study area [N = 57], 57.58% were male and the rest [N = 42], 42.42% were female (Figure 2).

Age categories of respondents in the study area are presented in Figure3. The average age of the respondents were 46.21 years with a minimum age of 18 years and a maximum of 90 years in the interviewed household. The highest percentage [24.2%] of the respondent was aged between the intervals of 26-35 years in the study area. The average age of the respondents observed in this study was greater than Adebabay [31] who found that average age of the respondents were 45.08 years in Bure District.

Educational Status of Respondents: The educational status of the study areas are shown in Figure 4. In the present study, among the respondents 85.9% were illiterate followed by 6.1 % educated 1-6 grade, 3 % of the respondents were 7-8 grade educated, 3% are 9-10, 1% is College and the remaining 1% is university student.

Table 1: Family size of respondents

Family size group/Persons/	Number of respondents [N=99]	Percent [%]
1-3	11	11.1
4-6	39	39.4
7-9	29	29.3
10-12	19	19.2
13-15	1	1.0
Total	99	100.0

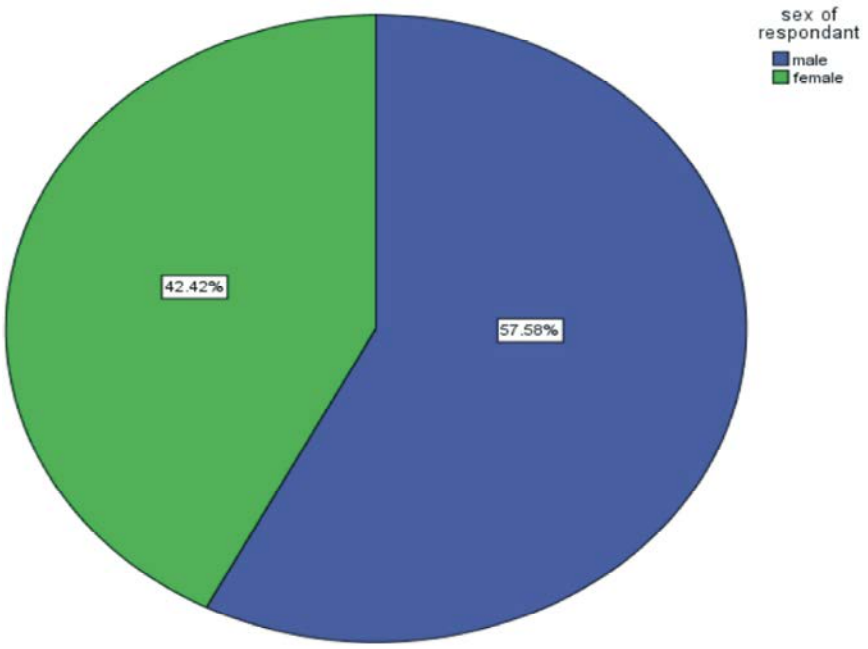

Fig. 2: Sex of respondents

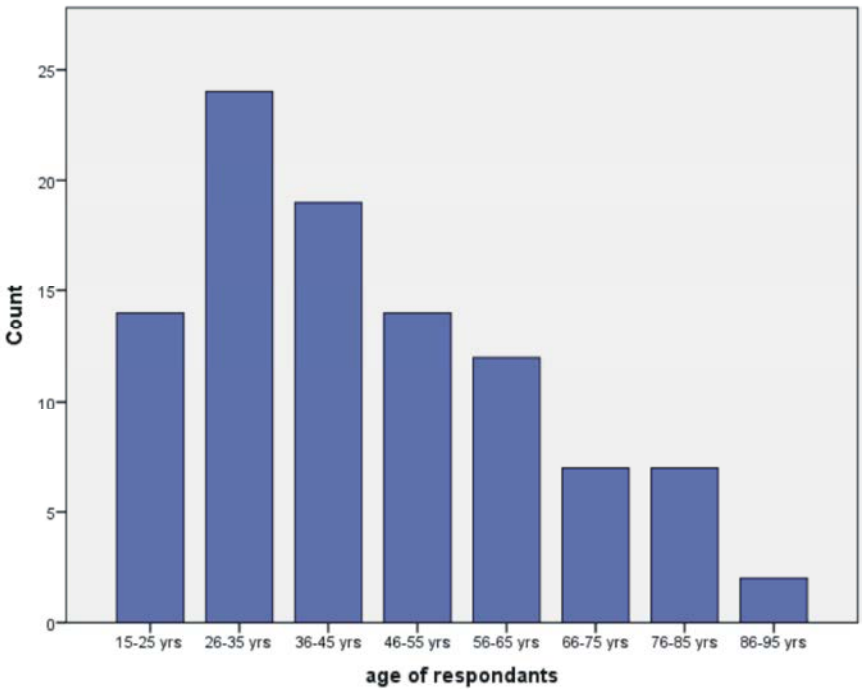

Fig. 3: Age category of respondents

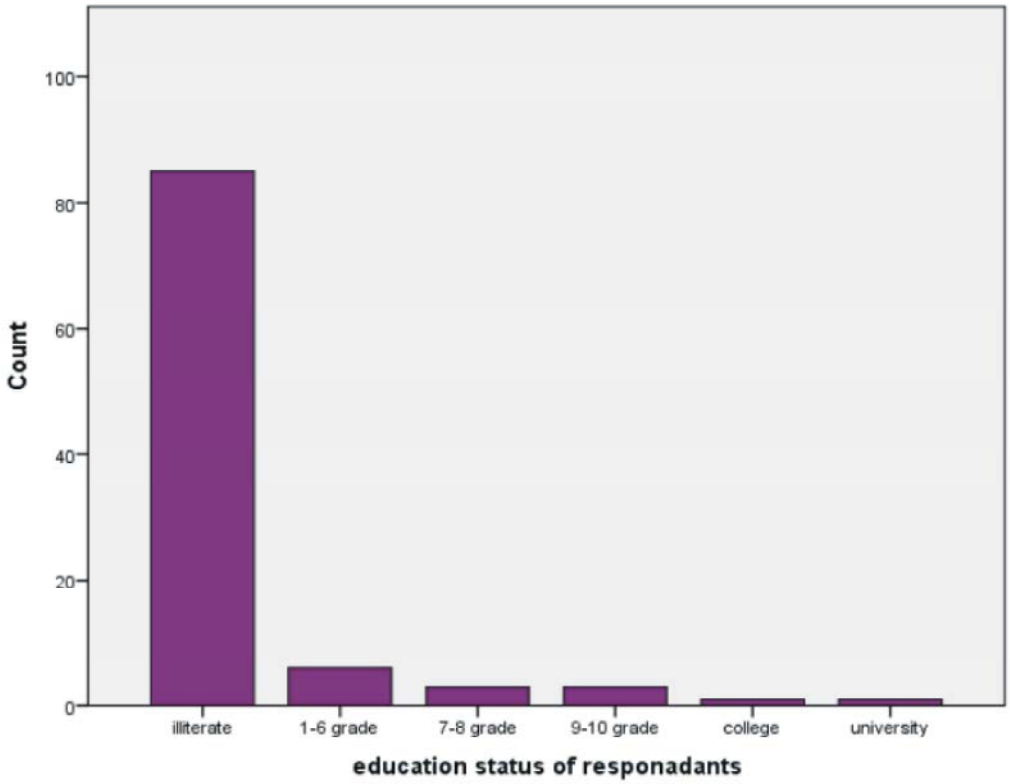

Fig. 4: Educational status of respondents

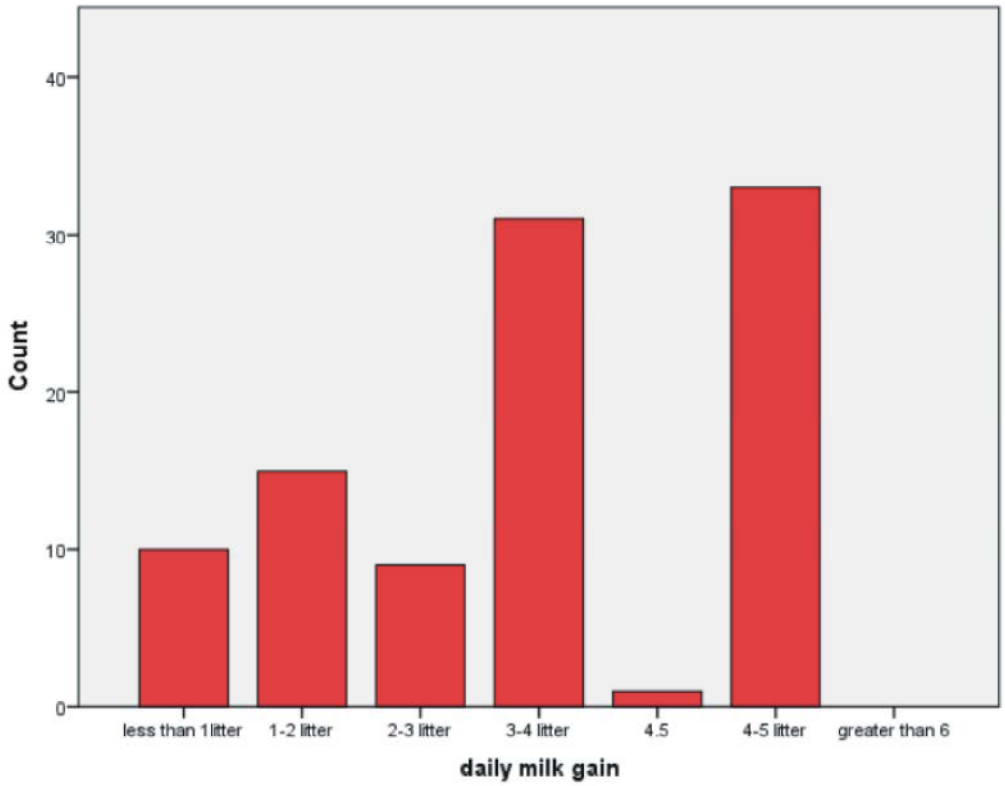

Fig. 5: Daily milk gain of respondents

The role of education is obvious in affecting household income, adopting technologies, demography, health and as a whole the socio-economic status of the family as well [35].

The percentage of illiterate family members [85.9%] reported in this study was greater than the reported figure by Berhanu *et al*. [36] which was 50% for Bure district. It is also greater than Kefyalew *et al*. [28] who reported the percentage of illiterate family members [71.11%] in Dawa Chefa District, Amhara Region. In the present study area proportionately there were more illiterate family members. This is because they are highly involved in the farming activity than proceeding learning due to their pastoral living system. In addition, this may be due to lack of schools and other infrastructure like road in the area.

Traditional Milk Production, Processing and Utilization:

Milk Production: In this finding, cow breeds of all the interviewed households were local or indigenous Borena breeds and none other breeds or cross breeds are reported. The amount of daily milk gain in the study area was shown in Figure 5. The average daily milk gain of the interviewed household is 3.64L. The majority [33.3%] of the respondents gain 4-5L of milk per day which is followed by [31.3%] who gain 3-4L per day. From the respondents 15.2% gain 1-2L of milk. 10.1% and 9.1% gain less than one liter and 2-3Lof milk respectively. The remaining 1% of respondent gain 5L of milk per day.

Milk Handling: All the households milk their cows by using hand milking after calf suckling. Milking practice of the current study were similar with Bekele *et al*. [37] who reported all of the respondents in both urban and peri-urban of Dangila town district practice hand milking.

In the study area none of the respondents practice hand washing and cow udder cleaning before milking. The result of the current study were in line with the result obtained by Abebe *et al*. [38] who reported proper sanitary milking practices were not followed by the majority of the respondents in Ezha district of the Gurage zone. In addition, the result also similar with Gatwech [39] who reported washing of teats is not practiced by almost all [98.7%] respondents in the crop-livestock and urban [96.2%] producers in Gambella.

This could be the potential source for contamination of milk with microorganisms during milking. In the support of this idea, FSA [40] indicated that cleaning of the udder before milking is important to remove both visible dirt and bacteria from the outer surface of the udder. In addition, Getachew [20] also indicated that milk producers should follow hygienic practices [Clean utensils, washing milker's hands, washing the udder, use of individual towels] during milking and handling, before delivery to consumers or processors.

Milk Processing and Products: In the study area, naturally fermented milk is the basis for processing milk into more shelf stable and consumer preferences fermented milk products. All the respondents of this study processed milk in their home through traditional processing techniques.

The major traditionally fermented milk processing products produced in the study area were *Ergo* [Ethiopian naturally fermented milk], traditional butter [*Kibe*], traditional ghee [*NeterKibe*] and sour defatted milk [*Arrera*]. Traditional fermented products observed in this study were similar with Kefeyalew *et al*. [28] who found that the major dairy products found in the study area were yoghurt–like fermented/sour milk [*Ergo*], traditional butter [*Kibe*], traditional ghee [*NeterKibe*] and cottage cheese [*Ayib*], except that cheese was not prepared in the present study area. The preparation of major traditional fermented milk products produced in the study area described as follows:

Ergo Preparation: *Ergo* /Sour Milk/ is a traditional fermented milk product, which is made by natural fermentation of milk under ambient temperature with no defined starter culture, used to initiate the fermentation processes [41]. In the study area, ergo is prepared by collecting milk for 3 days for immediate use and 7 days for long term preservation in the *Gorfa*. At the same time they add a spice locally called *Urgo* for good flavor and aroma of *Ergo* and let it to ferment naturally. After sufficient fermentation days they consumed *Ergo*. As it is well known, production of *Ergo* is normally carried out by natural fermentation process, as the result different species of microorganisms involved and contributes a lot to basic final characteristics of *Ergo*. As described by Tamrat *et al*. [42], the quality and safety of a fermented product entirely depend on the spices and spices composition of lactic acid bacteria that are involved in fermentation process. *Ergo* is normally smooth and thick with consistence or uniform appearance and normally has a white color if prepared carefully. It is semi-solid, smooth and uniform appearance and usually has a white milk color with pleasant odour and taste.

Table 2: Spices used for *Niter Kibe* preparation

Kebele	Spices used for preparation of *Niter Kibe*
Kersadenbi	*Urgo*, Barely Powder
Bokola	*Urgo, Urgodada*, Sorgum, Barely Powder
Algobisa	*Urgo, Korerima*
Chelqasa	*Urgo*
Arbero	*Urgo, Nichazmud, Tikurazmud*
Arero	*UrgoLoni, UrgoLera*
Afura	*Urgo, Nichazmud, Tikurazmud*
Buyagudo	*Dola*
Renji	*Urgo*

Butter Preparation: Butter /*Kibe*/ is a traditional Ethiopian butter always made from *Ergo* and not from cream [43]. *Kibe* is white to light yellowish colour and semi-solid at room temperature. It has a pleasant taste and odour. *Kibe* is prepared by churning *Ergo* /accumulated milk/ in traditional utensils. In the study area all the respondents produced traditional butter from naturally fermented whole milk. For the preparation of butter they transferred sufficient amount of accumulated milk /sour milk/ in to a churning material /*Gorfa*/. Before churning, sour milk is gently disturbed by finger like staek/*Mesbekiya* in Amharic/ to break the curd and to mix the sour milk.

Locally made *Gorfa* is the only Butter making material used in the study area. For churning, *Gorfa* is placed on a grass on the floor and rocked it back and forth until milk fat is recovered in the form of butter. Final rotating of the churn on its base would lump the fat grains together into *Qibe*which is then skimmed off. After churning completed, the churning *Gorfa* will be opened and large butter grains will be collected together by hand to make butter and finally they wash the butter with cold water. According to the respondents washing butter with water is important to remove debris/residual buttermilk and to avoid bad smell of the butter.

Ghee Preparation: Ghee [*Niter Kibe*] is commonly made by melting butter together with different spices available in the area. Different spices are used during ghee making which varies from one area to another area. According to the respondents of the present study butter is placed into a dish and put on open fire to melt to make ghee. Heating and stirring continue until foam is formed and a clear liquid is obtained. Along with heating the butter, different spices and powders are added to induce good aroma and taste. The commonly used spices during the preparation of *Niter Kibe* with their corresponding kebele are shown in Table 2. The dish is removed from the fire and the liquid is filtered through piece of cloth into a container to remove the herbs and spices added. Similar procedures have also been reported by Asamnew [25] in Bahir Dar milk shed area.

Almost all *kebele* except Buyagudo used a spice called *Urgo* to give good flavor and taste during the preparation of *Niter Kibe*. Buyagudokebele used a spice *Dola* for Niter Kibe preparation. As the respondents, Sorgum and Barely powder were added to remove the butter debris formed during the preparation of *Niter Kibe*. Spices used in ghee preparation differ from one area to another due to the availability of the spice. This could be the result of geographical difference between the areas. Some spice may not grow in one area.

Milk Utilization: The primary objective of dairy production is to satisfy the nutritional requirement of the family. Since milk and milk products form part of the diet for many Ethiopians. Milk and milk products are economical important farm commodities and dairy farming is an investment option for smallholder farmers [19]. Moreover milk is used for rearing of calves and children and the surplus is soured for *Ergo* [Ethiopian naturally fermented milk], Butter, *Ayib* [Ethiopian cottage cheese] and *Arerra* and Ghee/*Niter Kibe*/ making. Mogessie [44] described that in Ethiopia a considerable proportion of milk is consumed in a fermented state as "ergo". In the study area, milk is used in a variety of ways: as fermented milk [*Ergo*], as Butter [*Kibe]*, as Buttermilk [*Arrera*] and as Ghee [*Niter Kibe*].The majority [60.6%] of respondents used the milk for rearing of calves, family consumption and sale for income generation. The remaining 39.4% utilize the milk only for calves and family consumption. Generally, all interviewed household used the milk primarily for rearing calves followed by family consumption.

Table 3: Smoking plant used in the study area

Kebele	Smoking plant
Kersadenbi	*Beden, Burbukie, Ejerse*
Bokola	*Beden, Tatesa, Ejerse*
Algobisa	*Beden, Beresa, Dansie, Ejerse*
Chelqasa	*Beden, Beresa, Dansie, Ejerse, Korkorie*
Arbero	*Beden, Beresa, Debeqa, Ejerse*
Arero	*Beden, Beresa, Debeqa, Ejerse, Tatesa, Dansie, Korkorie, Satawe*
Afura	*Beden, Ejerse*
Buyagudo	*Beden*
Renji	*Beden, Tatesa, Beresa, Maiera*

Fig. 6: Traditional milk utensils [A= Okkole; B= Gorfa] used in the study area

Traditional Milking, Storage and Processing Equipment: The interviewed household used different type of utensils for milking, storage and processing of milk. All of the respondents reported to use equipment made from animal skin locally called *Okkole* for milking, while equipment locally called *Gorfa* was used for storage and processing of milk. This result were in contrast with Abebe *et al.* [38] who reported all of the respondents reported to use plastic jar for milking, while clay pot was the only material used for churning [Butter-making] in Ezha district of the Gurage zone.

All the respondents practice washing of milk equipment used for milking, storing and processing of the milk prior to milking. The procedure for cleaning milk vessels was washing milking and storage containers by water and followed by smoking with embers of wood sprinters of plants specifically used for this purpose. This result was in line with Bekele *et al*. [37] who reported all the respondents practice washing the milk utensils used for milking, storing and processing of milk in Dangila town district.

Smoking Plant: The plant species that are used for smoking purpose in the study area are shown in Table 3. The major smoking plant used was *Olea africana[Ejersa], Terminalla brownie [Biressa], [Beden]*. All studied kebele were used *Beden* as their smoking plant and only two kebele [Buyagudo and Renji] are not used *Ejerse* for smoking purpose. This may be due to unavailability of specific smoking plant in the area. In addition smoking of equipment may vary between tribes kebele. Mogessie [44] reported that smoking of the equipment with *Olea africana* had an inhibitory effect on microbial growth in milk. The smoking plant of the present study is not comparable with the result of Bekele *et al*. [37] who reported *Cheba [Acacia spp.], Woyira [Olea Africana], Dokima, Embuay [Solanum incanum]* and Maize cob are common plants used for smoking milk vessels Dangila town, western Amhara region.

Smoking of equipment by burning wooden chips of specific trees and shrubs is important not only to give good taste and odor to the product but also to disinfect the vessels and reducing the numbers of unwanted micro-organisms. The reason for smoking in the current study was in line with the report of Tesfaye [32] stated that nearly all inhabitants of Metema district were smoked milk vessels as a traditional preservative method to improve the taste and quality of milk and milk products.

Milk Fermentation Time, Volume of Milk and Frequency of Processing

Fermentation Time: Milk was collected in storage *Gorfa* until sufficient amount is accumulated and repeatedly fresh milk added to the sour milk with removed water from the sour milk. In the study area, differences in the fermentation time of the milk were observed. However, the majority [96%] of the respondents described that the fermentation time for immediate usage is three days. The current finding was comparable with the result of Lemma [45] who reported the duration of milk fermentation in Lume district were [2.4 days/57.6 hours. However, for long term preservation the milk was fermented up to one month. Among the respondents, the remaining 4% ferment the milk for six days. The difference in fermentation time could be the result of difference in the temperature of the area and their preference for consumption. Generally, Belete *et al.* [46] described that the traditional Ethiopian practice is to accumulate the milk for two to three days until it sours.

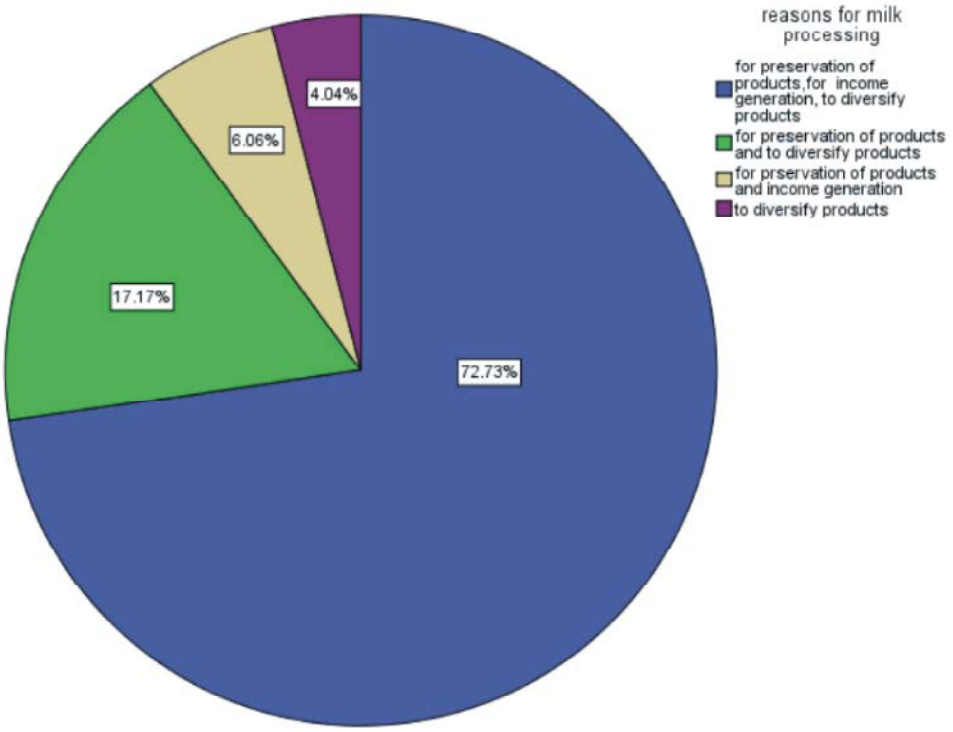

Fig. 7: Reasons of processing milk in the interviewed households

All respondent were aware of factors affecting fermentation time. According to their respond, temperature and smoking of storage equipment are the factors that affect fermentation time. They respond that temperature can decrease fermentation time but smoking equipment increase fermentation time. Smoking inhibits the growth of microbes in the milk hence, increase fermentation time. This result was supported by Mogessie [44] who reported that smoking of the equipment with *Olea africana* had an inhibitory effect on microbial growth in milk.

Volume of Milk Processed: The average volume of milk processed at each processing time is 7.82 liter in the study area. Among the respondents, 37.4% process ten liter of milk each processing time, while 35.4% of the respondents processed five litter of milk. Among the remaining respondent 19.2% and 8% process seven and greater than ten liter of milk at each time respectively. The average volume of milk in the present study [7.82 L] is greater than [6.4 L] of Zelalem and Ledin [47] in the central highlands of Ethiopia. It is also greater than [2.1 L] and [1.97 L] reported by Ayantu [48] and Rahel [49] respectively in Wolayta zone. The greater volume of milk processed each time observed in the study area may be due to the milk production performance of cows and the availability of grasses which increase milk yield of cows in the area.

Frequency of Milk Processing: In the present finding, all the respondents process the milk once per week. Among the interviewed household the majority of the respondents [92.9%] process the milk more frequently during summer season. This is because during this season there is plenty of grass available for animals as they respond. The remaining [7.1%] respondents described that season is not a factor for milk processing frequency. Frequency of milk processing observed in the present study is the reverse of Abebe *et al*. [38] who reported, the majority of the women [70%] process the milk twice per week followed by once per week [30%] in the Woina Dega area of Ezha district of the Gurage zone.

Churning Time: The average churning time of the study area is 1.2 hours with a minimum of one hour which comprising the majority [79.8%] of the respondents and a maximum of two hours [20.2%] among the respondents. Milk churning time can be determined by different factors. In the present study, volumes of milk followed by season

are the major factors [90.9%] that determine churning time. The remaining 9.1% of respondents described that only the volume of milk was the factor for determining churning time.

Reasons for Processing Milk: Reasons of processing milk in the study area are shown in Figure 7. The majority of the respondents [72.73%] processed the milk to diversify the products, for preservation of products and for income generation. The result is similar with Ayantu [48] who reported that milk is processed in order to increase the family's income, to diversify the products for consumption and to increase the shelf life of the products in Delbo water shed area of Wolayta zone. Meanwhile, 17.17% of the respondents processed milk for preservation of products and to diversify products for consumption followed by 6.06% who processed milk for preservation of products and to increase income of the family. The remaining 4.04% processed the milk only to diversify products for consumption.

Involvement of Family Member in Milk Processing Activity: As this survey result showed, milk production processing and utilization activity in the study area is done by both female and male family members. All the respondents described that they have mechanisms to transfer their indigenous knowledge of milk production processing and utilization to their children. Hence all family members do have this indigenous knowledge.

CONCLUSION

As a pastoral community, milk is the main diet of the society in Borena Zone. This survey study found that all the respondents use traditional equipment's for milking, storage and processing purpose. Although they practice washing and smoking those traditional equipment's they didn't practice hand washing and cow udder cleaning before milking. The majority of the respondents processed the milk to diversify products for consumption, to preserve products and sale for income generation of the family. The traditional milk processing products in the study area were *Ergo, Arerra*, Ghee and Butter.

In the study area, there are different plant materials that are being used by the farmers to give the product good flavor and aroma and to increase the shelf life of the product. In addition they used different spices for *Niter Kibe* preparation. The study also found that all the interviewed households transfer traditional milk production, processing and utilization knowledge to their children.

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