



Manually Improved Milk Churning in Yabello Town and Around Area, Borana Zone, Oromia Regional State, Ethiopia

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Abstract: A formal survey was carried out from March 2021 to October 2021 in Yabello town and around area, Borana Zone of Oromia regional state using open and closed questionnaires. A semi structured questioner form was used to interview specific group of people about their habits, knowledge, and about milking and milk churning practices. Milking and churning were practiced in the study area using locally made resources. During the demonstration, the interviewed households stated that Okolee (calabash) and Gorfaa are used for milking and holding the collected items. According to the current study, cultural milk processing was solely the responsibility of females, and time spent processing dairy products was covered by women. Furthermore, traditional churning practices of most Ethiopian community have been adopting to give low yield butter per unit of sour milk and require high labor input. As a result, the currently implemented technology concisely explains the barrier of the community problem and finds a solution. The currently modified churning equipment is firmly attached to metal pillars that are 70 cm off the ground. At each churning cycle, it can handle about 25 liters of milk. So maintaining milk quality is enjoyable, and churning has evolved to be comfortable. The churning can revolve favorably because of the moderate height above the floor and the total amount of milk it able to hold at one time to agitating is auspicious to rotate. That is normally how it is mediated by human power in order to operate it. In addition, all members of the family, especially those who are disabled and children are welcome to participate. The present study sought to reduce the enormous workload placed on women. The main objective was to manipulating technologically improved manual milk churning with low effort in pastoral and agro-pastoral communities to produce high-quality butter.

Keywords: Churning, Livestock, Milk, Pastoral, Technology

1. Introduction

Butter is a traditional dairy product that dates back thousands of years. Domestic ruminant animals including cows, goats, camels, buffaloes, and sheep are used to make butter [8]. According to Anderson [4], affluent nations have far greater production capability than developing nations, and subsidies decreased between 1980 and 1984 and 2000 and 2004 for an unidentified reason. Kenya's milk output has increased by a factor of four since the 1970s. The amount provided varies by location and is determined by factors such as favorable climate, feed and water availability, and management techniques, particularly in small-scale dairy farms, which employ an estimated two million people [20, 19].

1.1. Worldwide Usage of Dairy Products and Churning Practices

Worldwide, both the demand and supply for milk and milk products are increasing every day. For instance, the Debara [9] reported in 2019 that the world's yearly production of butter was anticipated to reach 843 thousand tons in 2018. Similarly, the consumption of dairy products increased in China [22]. When compared to South America's likely output, global milk production is expected to increase by over 860 million tons in 2020, with modest increases also expected in Oceania, Central America and the Caribbean, and Africa. Furthermore, due to expected growth in several Asian countries such as India, Pakistan, China, and Turkey, milk production in Asia is expected to reach 362 million tons in

2020 [17, 10].

1.2. Ethiopian Using Dairy Product History and Indigenous Churning Practices

In Ethiopia, dairy product production systems can be classified as pastoral or agro pastoral, rural smallholder farmers, urban and peri-urban systems, and commercial private farms based on production and production purpose, scale, and production intensity. According to a recent CSA survey, in 2011, an average animal kept for milk production accounted for 12%, 2.8%, and 30% of the populations of cattle, goats, and camels, respectively. Approximately 53% of income is generated by dairy sectors from annual 2.8 billion liters and 165.12 million liters of milk produced from cattle and camels, respectively, and livestock production [14].

Ethiopia has the largest livestock population in Africa, ranking in the top ten globally by raising cattle, sheep, goats, camels, equines, and chickens [6]. Despite the fact that it kept various domestic animal species, butter in Ethiopia is solely made from cow milk. Half of the milk produced in the country was churned into butter and Ethiopian cottage cheese (Ayib) primarily using traditional equipment, primarily clay pots, and the quality of smallholder dairy products is generally substandard, but to a lesser extent in urban areas where modern electrical machines were used [25].

Traditionally milk churning is varied in Ethiopia, even in a region. As the research [11], Churning is accomplished by placing a clay pot on the floor, preferably a mat, and rocking back and forth until butter grains form. In the last ten years and before, the country has had a relatively favorable climate for improved, high yielding dairy cattle breeds with less animal disease-stress, resulting in a significant potential for dairy development. According to some studies conducted since 2015/16, Ethiopia had approximately 11.33 million milking cows [7]. However, the number of milking cows has decreased in many cases due to the recent drought in pastoral areas.

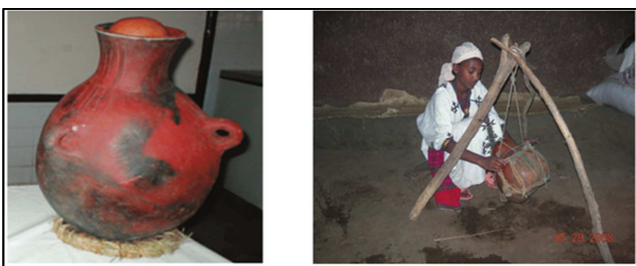


Figure 1. Traditional clay pot (left) and gourd (right) butter churners. Source [14].

Oromia region and South Nations and Nationality region are the largest milk producing region in the country. As some researchers states Ada'a district is of Oromia regional state which produces approximately 10,804,540 liters of milk per year [5]. Milk churning is an ancient civilization that has

been passed down from generation to generation. First and foremost, the local butter churns were made of animal materials such as animal skins. It was later replaced by other materials such as wood, metal, or glass. Although there have been some attempts around the world to automate the local churning process, such as in the research [13]. According to the author [3], the butter churning process was used to make butter by shaking up yogurt. Mechanical motion is used to agitate yogurt, which disrupts fat globules and changes the emulsion from oil in water to water in oil. The milk fat globule membranes are broken down to form butter grains. In Ethiopia, butter is extracted from yogurt and churned in a variety of traditional vessels such as gourds and clay pots. That equipment is inefficient in terms of both butter production and time and labor savings.

2. Statement of the Problem

A current research study area was discovered in a pastoral community whose livelihood is based on livestock production. The churning process used to collect butter in the study area is now considered an ancient one. The only way for indigenous knowledge to be passed down from generation to generation is verbally and through the transfer of equipment from family to offspring. Normal churning processes require a large amount of human labor and are time consuming. At each stage of churning, the amount of milk collected for churning may be excessive and subject to discard. The practices of storing and churning may distort the quality of butter and reduce average butter prices. As a result, the current issue or problem necessitates prompt action to improve the situation. Furthermore, the traditional belief of Borana society was that churning practices were only adapted by female family members. As a result of this practice, females are overburdened with work. As a result, the currently implemented technology concisely explains the barrier of the community problem and finds a solution. Current technology was a claim that outlines the quandary and focuses on reducing the burden of female work overload in any way.

3. Objective of the Study

3.1. General Objective

To manipulate technologically improved manual milk churning with low effort in pastoral and agro-pastoral communities to produce high-quality butter.

3.2. Specific Objective

- 1) To minimize overload burden of works on feminine.
- 2) To increase the production and productivity of dairy products.
- 3) To enhance participation of elders, disabilities and small micro enterprises on agro pastoralists in the study area.

4. Research Methodology

4.1. Description of Study Area

The study was conducted from March 2021 to October 2021 in Yabello town and around area, Borana Zone of Oromia regional state. The study area found at Southern Ethiopia. It's about around 570km from Addis Ababa. It has been the administrative center of the Borena Zone. According to YARDO [23], Yabello district is located astronomically between 3° 8' 46"-10° 09' 04" North latitudinal and 3°18' 03"-43°04' 24" East longitude. The district's elevation ranges from 1000 to 1700 meters above

sea level. Yabello is bordered to the northwest by the Regional State of Southern Ethiopia, to the west by the Teltele district, to the east by the Arero district, to the north by the Dugda Dawa district, and to the south by the Dire district. The district covers an area of 5550 km². Livestock is used for a variety of purposes in these areas, including as a store of wealth. Drought is the most serious climate risk, as it reduces crop and livestock productivity and increases livestock mortality rates [20]. The current studies concentrated on kebeles in the Yabello districts of Dharrito, Obda, Dida Yabello, Ganya, Yubdo, Areri, Dikale, Kukuba katelu, Denbela bora, Utalo, Dhaka Kake and Garbi Yabello.

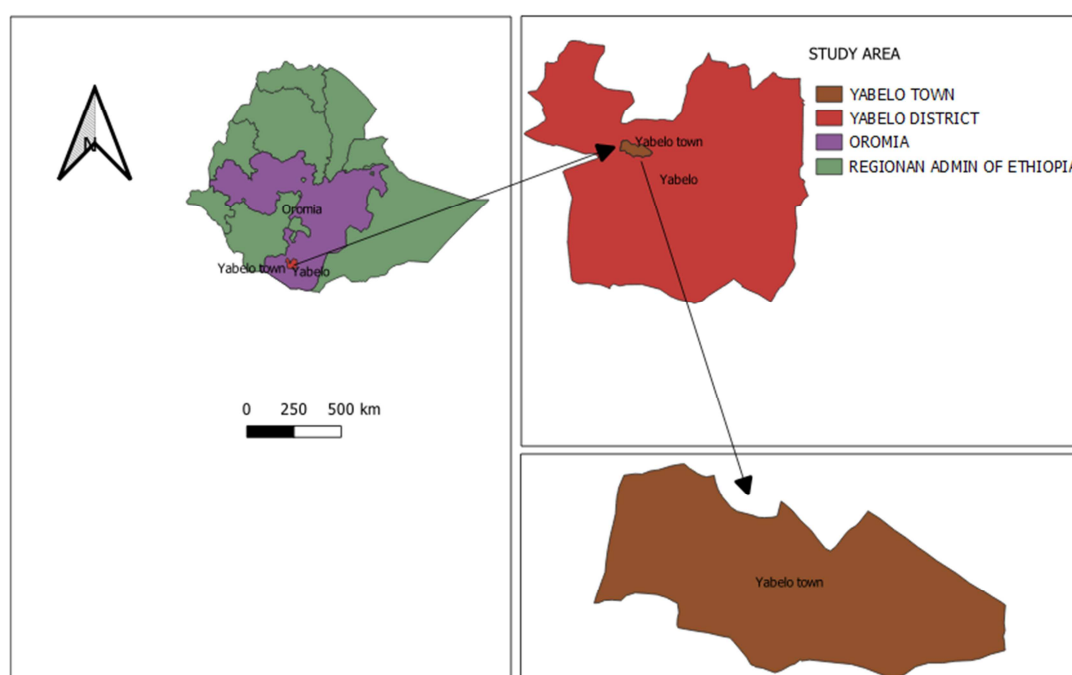


Figure 2. Map of study area.

4.2. Data Collection

A formal survey was carried out in twelve kebeles using open and closed questionnaires. And information was gathered from a specific group of people about their habits, knowledge, and practices using a questioner that included

questions about milking and milk churning practices. In addition, with the assistance of district authorities, face-to-face interviews were conducted with owners of businesses that sell milk and milk products at the local market, as well as focus groups, particularly at the meeting panel. A semi-structured questioner form was used to interview 218 people.

5. Result and Discussion

Table 1. Gender and age of those who were interviewed.

No.	Kebeles of participants	Age										Percentage
		17-25		26-35		36-50		51-70		≥71		
		Sex										
		M	F	M	F	M	F	M	F	M	F	
1	Garbi Yabello	1	2	3	8	5	4	3	2	2	0	13.8%
2	Dhaka Kake	2	4	4	9	2	2	5	6	2	1	17%
3	Dharrito	1	3	2	5	1	2	2	4	2	0	10.1%
4	Obda	1	3	0	2	1	2	0	2	2	0	6%
5	Dida Yabello	3	6	2	4	2	2	4	3	2	5	15.1%
6	Ganya	0	1	0	3	1	0	2	0	2	1	4.6%
7	Yubdo	1	3	0	3	1	2	1	1	1	0	6%
8	Areri	0	3	1	3	1	0	0	2	1	0	5%

No.	Kebeles of participants	Age										Percentage
		17-25		26-35		36-50		51-70		≥71		
		Sex										
		M	F	M	F	M	F	M	F	M	F	
9	Dikale	0	2	1	2	0	2	2	1	2	0	5.5%
10	Kukuba katelu	1	4	0	3	1	1	1	0	1	0	5.5%
11	Utaló	0	2	1	2	1	0	0	2	1	0	4.1%
12	Denbela bora	1	3	2	4	2	0	1	2	1	0	7.3%
Total		11	36	16	48	18	17	21	25	19	7	218

The result shows that age of interviewee was a range of 17 to 90, with the largest numbers of informants are between the age of 26-35 (29.4%) and the highest average number respondents was from Dhaka Kake (17%) and the lowest from Utalo 4.1% (Table 1). The total number of interview participant male and female are 85 (39%) and 133 (61%) respectively.

5.1. Milk Churning Components and Family Participants

Milking and churning were practiced in the study area using locally made resources. During the demonstration, the interviewed households stated that Okolee (calabash) and Gorfaa (which is sewed with the bark tree) are used for milking and holding the collected items, respectively. [19] Reported that all of the respondents reported using equipment made from animal skin locally known as Okolee for milking,

while Gorfaa was used for storage and processing of milk. Some urban residents use plastic material to a limited extent. This result was in line with the results [1], who reported that in the Gurage zone, all household respondents used a plastic jar for milking and a clay pot for milk churning. Similarly, Hussien, B. [16] reported in his findings that the majority of respondents (79%) used Okolee, which is locally known as (Okolee), for milking utensils, while some respondents (6%) used plastic containers for milking. According to the current study, cultural milk processing was solely the responsibility of females, and time spent processing dairy products was covered by women or the female headed household. In many Ethiopian districts, women bear the entire burden of milk processing. The majority of milk is processed by women and young girls. Adult males in the study area were not involved in milk processing or marketing milk products.

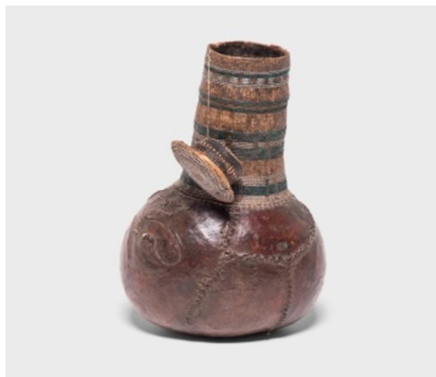


Figure 3. Borana's traditional materials used for storage and processing of milk (Gorfaa).

5.2. Domestic Animals That Are Bred for Milk Production

In the current study, all respondents used milk and milk products from ruminants (cattle, sheep, and goat) and pseudo ruminants (camel), but dairy cattle milk products dominated, followed by camel milk. Similarly, Hussien, B. [16] discovered that out of 180 households interviewed, 65%,

16%, 14%, and 5% used milk animals such as cows, camels, goats, and sheep, respectively. Camel milk is the second most popular milk in the study area, after cow milk, which is the primary source of milk in the area. According to the survey findings, the majority of milk produced is consumed by households, with the surplus sold to the market as a source items.





Figure 4. Borana's livestock (hint: all pictures were captured prior to 2020 G.C).

5.3. Project Description and Its Scope

The manually improved milk churning was designed with the goal of producing a large amount of butter from a large amount of milk. The current study sought to reduce the enormous workload placed on women. Technically, it worked and could be used without any training or expertise. The previously available churning was made of a small plastic water tank that was securely fastened to metal on each side. The scope of the current study refers to how thoroughly the research topic was covered in the work and describes the constraints under which the study operated. Gender discrimination was used in some commonly used churning techniques, which may subject women to overwork. The scope of the supplied manually changed churning is also beyond the scope of the current study, under which our research endeavor was conducted. Residents of both urban and rural areas can buy items from a local market and use them at home because they have fixed prices, are not dependent on raw material availability, and are not powered by electricity. The equipment is securely fastened to metal supports 70 cm above the ground. Each churning cycle can process approximately 25 liters of milk. It is pleasant to maintain its quality, and it has become comfortable. The height above the floor is moderate as well as the total amount it can hold at one time to churning cycle is auspicious to rotate. That is typically how human power to run it is mediated. Furthermore, everyone in the family, especially

those with disabilities, is invited to participate. It can be churned by both adults and children.



Figure 5. Photo of manually improved milk churning.

The steps of operating the manually improved milk churning are as follow:

- 1) First, newly acquired milk was gathered and stored for a specific amount of time.
- 2) The tanker jack was tightly secured to the stand.
- 3) The tanker was packed securely with 25 ml of milk that had been prepped for churning.
- 4) It should be key-locked to prevent its tie from coming undone during churning.

- 5) The rotation took place for 10 to 20 minutes in either a clockwise or anticlockwise manner.
- 6) The duct was opened with a cannula to let the obstructed foam out.
- 7) Then it became packed once more.
- 8) The process was continued until butter grains, or clumps of fat, could form when individual fat droplets joined together.
- 9) The porous was opened once more to let the foam that had been trapped within out, and then the key was released.
- 10) The churned product was poured into an open bucket, and butter was taken out of the buttermilk using a clean tablespoon.
- 11) The butter and buttermilk were packaged separately and prepared for the following procedure.
- 12) The tiny plastic water tank was thoroughly cleaned and saved for the subsequent churning.

5.4. Some Benefits of Enhanced Milk Churning

The existing manually improved milk churning may pose a problem by reducing the societal burden of female employment and eliminating sexual discrimination in social work. The modified milk churner has a higher yield and faster churning speed than the standard one, producing 25 mL in 30 to 40 minutes, whereas most informants claimed that 25 liters of milk could be churned in one to one and a half hours. Similar result was reported [9] that the efficiency of both churners was evaluated by using five-liter milk obtained from local breeds. The volume of both of churning equipment is 10 liters. In this activity to make comparison of traditional clay pot milk churner and the new technology, assessment was made through interviewing the participating farmers during the training time and on average to churn a five liter of milk it took them up to 1 hrs.

To churn the same amount of milk using the new technology, the average time was around 30 minutes (half of the traditional clay pot). The results show that traditional milk processing churners require more churning time (60 minutes) than improved churners (30 minute). This finding is also consistent with Tesfaye Lemma et al. [18], who reported on a farm trial conducted in the Adami Tulu area of Ethiopia's central rift valley, where the average time taken by a traditional milk churner was 65 minutes and the modified wooden milk churner was 43.545.06. Similarly traditional method of churning is time consuming, perhaps, taking more than an hour [12]. Likewise, Yilma Z. et al. [24] reported 191 minutes for traditional clay pot churner while Feyisa Hundessa et al. [12] reported 65 min on average when using the traditional clay pot churners in central rift valley areas of the country.

Additionally, Getachew, F. and Asfaw, T. [15], showed that time required for improved plastic milk churner of the same volume of milk was decreased by 26 minutes instead of traditional one. The same reported [21] indicated that milk processing by using traditional equipment clay pot that is locally known as (Okkotee) takes longer time (59min)

duration than the improved churning equipment (27min). As the interviewed stockholder told, milk churning time was determined by different factors like season and churning speed that segregate butter and buttermilk. It agrees with the research [2] which reported churning causes these grains to fuse with each other and form butter and the liquid that left out without fat is called buttermilk. Traditional clay pot churners give low yield butter per unit of sour milk and require high labor input.

Table 2. Supplies required for the project.

No	Rudimentary resources	Measuring system	Quantity
1	tiny plastic water container	litre	25l
2	metal 25/25	inch	25 inch
3	metal sheet 40/40	inch	40 inch
4	metallic hollow	radius	3cm
5	turning wheel	calliper	medium
6	security key	pc	small
7	needle for foam	size	medium
8	lock latch	size	small

6. Conclusion and Recommendation

- 1) The demonstration's outcome shows that, with the same amount of fermented milk used, the upgraded milk churner lowered (saved) churning time by 30-40% compared to the traditional churning equipment.
- 2) The upgraded churner significantly produced more quality and quantity butter than the conventional.
- 3) It is accessible and simple to obtain from the local market.
- 4) It is easy for any local producer to use and does not require any special training, requires little human power to operate, is inexpensive to maintain, and can preserve a high level of product quality.
- 5) As compared to conventional machinery, all the raw materials required for its manufacture are simple to get.
- 6) The volume of milk that can be processed is known to be utilized to calculate daily revenue as the total capacity of the butter churn barrel was known.
- 7) It was created with the intention of serving communal needs in both urban and rural settings.
- 8) It should be able to provide disabled people with employment opportunities.
- 9) Host and invited farmers at the field day indicated interest in the enhanced plastic churner.
- 10) It is available for purchase from woodworkers and metalworkers by all pastoral farmers, dairy farm owners, and small microbusinesses.
- 11) Tightly covering the mouth area with soft plastic if milk drops unexpectedly.

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