Research & Reviews: Journal of Food and Dairy Technology

e-ISSN:2321-6204
p-ISSN:2347-2359

Implications of Introducing Improved Butter Churner on Churning Time and Butter Making Efficiency

Tsedey A[1]*, Bereket Z[2] and Genene T[3]

Southern Agricultural Research Institute, Hawassa Agricultural Research Center, Ethiopia

Research Article

Received Date: 10/07/2018
Accepted Date: 14/08/2018
Published Date: 20/08/2018

***For Correspondence**

Tsedey A, Southern Agricultural Research Institute, Hawassa Agricultural Research Center, Ethiopia.

E-mail: tseyoso@gmail.com

Keywords: Butter, Churner, Clay pot, Milk, Preference, Traditional.

ABSTRACT

Lack of churning equipment which can save time and enhance butter recovery is the major challenge for smallholders in Sidama zone, southern Ethiopia. This study was conducted to evaluate butter making efficiency, churning time and butter amount obtained from the traditional butter churner (clay pot) in relation to improved manual butter churner in Sidama zone. A total of 54 women farmers from three dairying potential districts were selected where milk processing for butter making has long tradition. The efficiency of both churners was evaluated by using five liter milk obtained from local breeds. The volume of both of the churning equipment was 20 liter. Significantly higher quantity of butter (0.41 kg/5liter) at P>0.5 was obtained from improved churner than traditional clay pot (0.26kg/5liter). Furthermore, the traditional mechanism of butter processing took significantly longer churning time (59 minute) than improved churner (26minute). The quality of butter obtained from improved churner was ranked from very good to excellent by 96% of respondents while the butter obtained from traditional churner was favored only by 15% of the respondents. In contrary, the butter milk obtained from improved churner was ranked from very good to excellent by about 48% respondents compared to 59% for the butter milk obtained from the traditional churner. The findings have also figured out that butter making efficiency of improved churner was almost double (82%) than the traditional churner (50%). In conclusion, improved churner was preferred to local one for its ability to yield better amount of butter, more butter making efficiency and shorter churning time it required. For rural areas of Ethiopia where women are responsible for feeding the family and investing almost all income to the family, obtaining more butter could enhance income and dietary diversity of the household. Moreover, the improved butter churner has saved workload and drudgery of rural women by reducing their churning time. Using improved churners could also contribute for reducing gender disparity through participating men in milk churning process Therefore, it is suggested that improved milk churner needs to be introduced, demonstrated and promoted to small-holder dairy farmers not only within the study region, but also beyond. Market linkage need also to be established between suppliers of improved churner machine and dairy farmers at reasonable cost.

INTRODUCTION

Butter making is an ancient practice in most parts of Ethiopia by using traditional equipment. The practice is mainly conducted in the rural parts of Ethiopia where butter is the major source for urban households. The study of ILRI reveled that about 97% of the total milk produced comes from the rural parts of the country where it is difficult to transport the raw milk to the market areas or to the processing plants due to poor infrastructure [1]. Only 5% of the milk produced reaches the terminal market area and the rest is processed at the farm gate into different dairy products [2]. Furthermore, there are post-harvest losses associated with poor handling and contamination. The study conducted by Felleke [3] also confirmed these together with low level of technology applied in the market.

The SNNP is the second highest region in milk production potential next to Oromia region in Ethiopia. It is not only becoming

e-ISSN:2321-6204
p-ISSN:2347-2359

the second milk producer region but also 54% of it is converted to other products rather than consuming it in the form of fresh milk. Although the types of materials used for milking, storage and processing vary from place to place, 50% of milk producers used clay pot for churning, 25% plastic containers, 6.3% aluminum cans and 18.3% used Oil (calabash) in southern Ethiopia [4]. Moreover, clay pot or bottle gourd (calabash) is used as a churner to make butter in Gurage zone, Southern Ethiopia [5] and the clay pot was used for churning fermented milk (100%) in West Shewa Zone, Oromia Region [6].

In recognition of milk producers' dependence on traditional and inefficient butter making tools, improved milk churner was introduced and promoted to beneficiaries in SNNP region. However, there is no adequate information on the effects of improved churner on churning time and butter making efficiency. The purpose of this study was therefore to bridge-up this gap and evaluate advantages of introducing improved butter churner equipment over the traditional processing devices. More specifically, the study intends to provide pragmatic evidences on time required for butter processing and efficiency of making for both improved and traditional butter making devices. It also draws recommendations on the best efficient and effective butter processing devise for small-holder milk producers.

MATERIALS AND METHODS

Description of the Study Area

This experimental study was conducted in two agro-ecologies of Sidama zone, Southern Nations, Nationalities and People's Region (SNNPR). In the first step, two butter producing potential districts were purposely selected from the highland agro-ecology and one potential district from the lowland agro-ecology. Arbegona and Hagere Selam districts were selected representing the highland agro-ecology while lokka Abaya for the lowland agro-ecology. Arbegona district is located at 77kms south east of Hawassa town (which is also 352kms away from the city of Addis Ababa). Hagere Selam district is also located at a distance of 91kms from Hawassa town (which is also 366kms away from Addis Ababa). Arbegona district is located between 6047'00''-6082 00" N and 38059 00-38084 00" E while Hagere Selam between 6°.41'-6°.61'N and 38°.44'-38°.70'E. Similarly the altitude for Arbegona district ranges from 2001 to 3500 m.a.s.l while it is 2001 to 3000 m.a.s.l for Hagere Selam. Regarding the lowland agro-ecology, lokkabaya is located at 62 km from Hawassa town (337 km from Addis Ababa). The district is situated with latitude of 6°.42'-6°.83'N and 38°.01'-38°.36' longitude and elevation ranges from 1001-2000 m.a.s.l.

Selection and Experimental Data Collection

The total sample of 180 households with lactating cows was selected randomly from three of the districts (60 households from each of the districts) to collect information related to details of milk churning devices (both improved and traditional) including churning time, quantity of butter produced and other particulars. Out of these, a total of 54 women farmers were selected from three of the districts (18 women from each of the districts) based on the number of local lactating cows from early to mid-lactation period, stage of lactation, and butter making practice. The experimental evaluation of churning was made by using traditional equipment (clay pot) and improved churner (Plastic churner with metal base). Before starting experimental evaluation, practical training was delivered for the selected women farmers on the method of churning by using improved churner. Moreover 20 litter volume size clay pot was identified for processing butter since the improved churner volume size is with 20 litter capacities.

The experimental evaluation was conducted by using 5litter raw milk from local lactating cows from both morning and evening milking accumulated for two consecutive days. After the raw milk became yoghurt, the churning was undertaken in the morning at the third and fourth day in the lowland and highland agro-ecology, respectively. Thus, in this experimental study, different parameters such as churning time, butter yield, butter making efficiency and consumer preference towards butter and buttermilk were evaluated.

Butter Making Procedure

The traditional system of butter making differs from place to place and usually made from soured milk. Milk in this experiment is accumulated for two days in the lowlands and three days in the highlands to be churned in the third and fourth day in the lowland and highland agro ecology, respectively. In the process of churning by using the traditional equipment, the clay pot is pulled and pushed at 45° **(Figure 1)** until butter granules are formed. With the improved butter churner the process is undertaken by rotating the "plastic container" under iron made material.

During processing, the hole under the improved churner will be opened three to four times within one minute interval to let air out. Similar procedures were followed in the traditional clay pot though it is not through a hole but through the main opening of the clay pot.

e-ISSN:2321-6204
p-ISSN:2347-2359

Figure 1. Simultaneous churning by Improved and traditional churner (clay pot).

Butter Making Efficiency Calculation

Fat recovery is an important factor determining the efficiency and profitability of smallholder dairy producers. The efficiency interms of fat recovery varies across different types of butter processing materials. In this study efficiency of butter making is calculated as:

Butter making Efficiency (Y) = Amount of butter yield (X) * 100

Amount of milk processed/churned (Z)

In this study efficiency of butter making is denoted as Y, amount of butter yield as X and Z for the amount of milk used for processing (which is 5 litters). More over there is extension letter (i) for calculating for improved churner and letter (j) for traditional churner. Furthermore, the efficiency was converted in to gram per litter.

Consumer Preference Assesment Method

The consumer preference assessment for butter and butter milk was rated interms of excellent, very good and good category for products processed by using traditional and improved equipments. These criteria were decided on the panelist's level of preference on the test, aroma and observation scales which was agreed among all participants. Fofty-four panelists participated in the preference evaluation test. These panelists were served with samples in cups with coded numbers in a randomized order and were asked to choose butter milk of the color and amount of butter processed using the tow devices. The type of milk processed for the evaluation in this research was accumulated from local cows.

RESULTS AND DISCUSSION

Does Introducing Improved Butter Churner Guarantee Gender Equality in Dairying?

Dairying is one of the farming activities which include the procedures of milking, processing, bringing the milk products to market up to collection of income from the sale of milk. Based on this definition, interviewed households responded the division of their responsibility in dairying. The findings indicate that housewives are the ones shouldering the responsibility of milking (100%), processing (100%), marketing of milk for sale (97%) and income collection (95%) followed by daughters.

With all these activities, children, particularly daughters assist their mothers particularly in milking and butter making. Alganesh and Fekadu [7] also reported that churning is exclusively done by women or children. Similarly Yonad [8] mentioned that women are responsible to process and sale traditional butter in pastoral area, such as in Borana. Particularly, Asres E. et al. [9] described that milking and milk processing are among the main livestock activities mainly performed by females in North West of Ethiopia **(Table 1)**.

Table 1. Gender division in dairying responsibility.

Household members	Milking		Processing		Marketing		Income collection	
	N	%	N	%	N	%	N	%
Husband	22	12	7	4	3	2	3	2
Wife	180	100	180	100	174	97	171	95

e-ISSN:2321-6204
p-ISSN:2347-2359

Son	0	0	1	0.6	1	0.6	0	0
Daughter	32	18	29	16	22	12	21	12
Housemaid	1	0.6	0	0	0	0	2	1.1

In this particular experimental study almost all of women's husbands were willing to help their wives during churning by using this improved churner **(Figure 2)**. This churning equipment might have a great implication in minimizing gender division in butter making and breaks the traditional norms restricting men's and son's acting on churning. Thus women's burden towards household responsibility and particularity churning might be minimized.

Figure 2. Men's practice butter processing by using improved churner.

Churning Time and Butter Yield

The study revealed significance difference between improved and local churner's interms of butter yield and churning time. The result indicated that 0.41kg and 0.27kg of butter was found from improved and traditional churner (clay pot), respectively, though similar volume of milk (5 liter) was churned. This result indicates that about 19 and 12 liter milk is required to prepare 1kg of butter from the traditional and improved butter churner, respectively. Similar study was conducted by Zelalem and Inger [5] where they reported that 17 litter of milk is required to produce 1.0 kg of butter by using improved technology while 20 liter of milk is required to produce the same quantity of butter by using internal agitator. Moreover, Gebremedhin et al. [10] revealed that 16.5 liter of milk is needed to produce 1 kg of butter by using traditional equipment. Though churning equipment is among the factors creating variation in the efficiency of butter making **(Figure 3)** and butter yield **(Figure 4)**, but it is not the only factor for the variation unless milk quality/milk chemical composition is indicated [11].

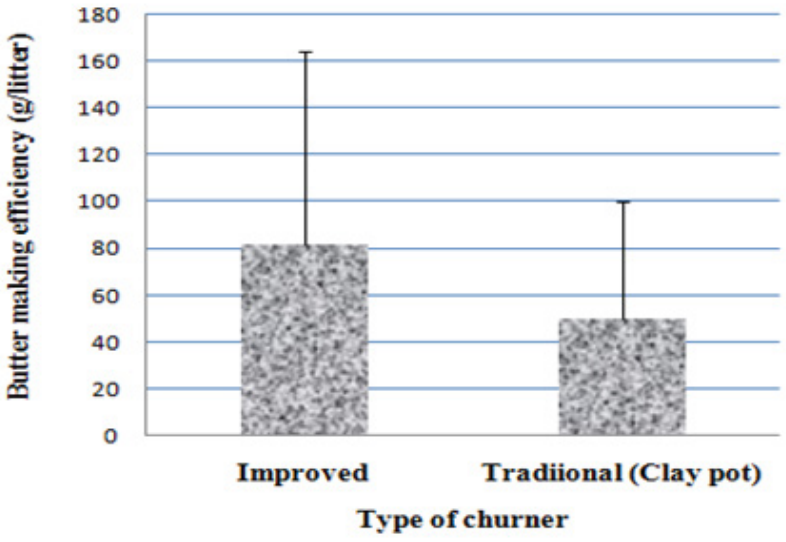

Figure 3. Processing time & butter yield from Improved and Traditional churner (Clay pot).

e-ISSN:2321-6204
p-ISSN:2347-2359

Moreover the study discovered longer churning time is required in traditional processing equipment (59 minute) than improved churner (26 minute). Similar result was also reported by Tsadkan [12] that traditional processing by using traditional equipment takes longer period than the improved churning equipment. Additionally the study conducted by Gebremedhin et al. [10] indicated that processing time of traditional butter-making varies between 2 to 5 hours depending on the technical devices used. Such time-consuming and labor intensive activities further hinder women's ability to improve their income-earning potential [13].

The longer processing time in this study through traditional equipment (clay pot) was due to the heaviness of the material that was reducing frequency of churning (forward and backward movement). This is due to the fact that the clay pot is made from clay soil by molding and drying it by burning. The burning not only takes time but also large amount of fire wood; the later have negative implication for the nearby forests as they collect firewood from the forests. Using fuel wood from the forest implies exacerbating carbon emission through false deforestation and burning. On the other hand, the improved butter churner is easy to operate and increased churning frequency by reducing the churning time.

Butter Making Efficiency

As indicated in **Figure 3** the efficiency of improved butter churner was 64% higher (82g/liter) than the local churner (50g/liter). This implies the possibility of extracting 32 gram extra butter from one litter of milk by using improved churner. If a given household has one milking cow from which 1.5 liter of milk on average would be obtained daily, about 13 kg of extra butter could be extracted by using improved churner in one lactation period of about 270 days. As the price of one kg butter is 200 birr, these households can obtain about 2600 extra birr per lactation. Given the traditional gender norms that assign women for the responsibility of feeding the family and controlling income collection from milk and milk products, obtaining extra money would play great role to enhance household dietary diversity and food security. In agreement with this, Kathleen and Charlotte [14] mentioned that women spend higher proportion of income they earn on food and other basic needs than men. A significant portion of the community (rural women, retailers and assemblers of butter) acquires their household expenditure from butter sales [15]. It is also a major dairy product marketed in different parts of the country as an income source mainly for women [16].

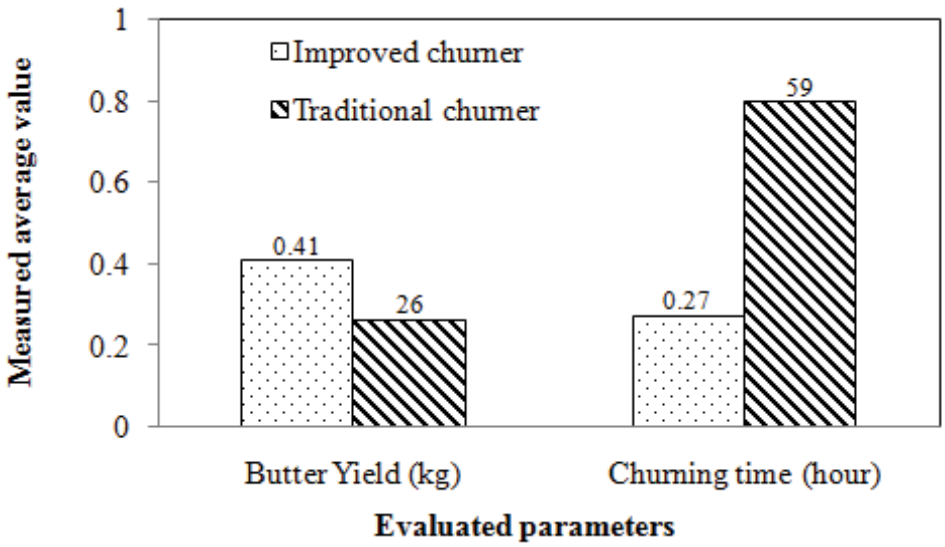

Figure 4. Butter making efficiency of improved and traditional (clay pot) churning equipments.

Consumer Preference for Butter and Buttermilk

Based on the agreed category, the panelists mentioned their preference for butter and buttermilk processed from improved and traditional equipment. The result indicated that butter preference was rated excellent (57%) for the butter processed with improved churner while there was not excellent scale for the butter produced from local churner **(Table 2)**. This implies that the butter from improved churner is preferred to the one produced from traditional equipment. This is mainly due to attractive color of butter resulted from the improved equipment. Gebremedhin et al. [10] also indicated that color is one of preference criteria and yellowish red color is the most preferred color.

On contrary, the preference for buttermilk was rated very well to excellent for the one produced from traditional devise 59% while 48% preferred buttermilk from improved churner though both of the equipment was smoked with Olea Africana. This could be related with the efficient fat recovery of the improved churner which reduced the thickness of the buttermilk (reduced fat content) and the flavor of the buttermilk. The other is related to smoke which is observed more in the clay pot than the improved one because of the rough and porous structure.

In spite of the lower preference of buttermilk from improved churner, it is still possible to compensate that from the increased butter amount **(Figure 3)** and income generated from the extra butter for purchasing different types of food items.

e-ISSN:2321-6204
p-ISSN:2347-2359

Table 2. Preference of butter & butter milk from different churners (Frequency/percent).

Category	Preference for butter (N=54)		Preference for butter milk (N=54)	
	Improved churner	Clay pot	Improved churner	Clay pot
Good	2 (3.7)	46 (85.2)	28 (51.9)	22(40.7)
Very good	21 (38.9)	8 (14.8)	22 (40.7)	4(7.4)
Excellent	31 (57)	-	4 (7.4)	28 (51.9)

CONCLUSION

The traditional butter processing method is different from place to place based on the type of material used for churning in Ethiopia. Traditionally milk is churned after frequent accumulation of raw milk. The current finding revealed that improved butter churner reduced churning time, provides better amount of butter yield and improves butter making efficiency than the traditional churning equipment (clay pot). Moreover, better preference for butter from the improved churner by valuing the amount of butter and observing the color. Regarding the preference for buttermilk, the preference was fallen more to the traditional device than improved one. This was probably due to smoke holding capacity of clay pot (due the porous nature of the material) resulting flavored nature of the buttermilk increasing the palatability. Thus the improved churners was preferred interims of better butter amount, more butter making efficiency, shorter churning time and it invites men's to help their wives churning breaking their culture.

RECOMMENDATION

Since the feedback in this experimental evaluation and demonstration showed that the technology has acceptance & very high demand was created, capacity building by providing practical training for both male & female households is required in the future. Promotion of this technology should be expanded in pre-scale up form in other dairy cattle population and butter processing trend areas. The promotion should be in collaboration with Extension. In non-tested woredas, to show the efficiency of the technology initial cost (either directly in material or in cash) should be supported (as input supply). The safety and quality aspect of butter and buttermilk from the traditional and improved butter churner still is subject for further investigation. Besides, there butter test preference should also be investigated for cooked butter.

REFERENCES

1. Azage T, Berhanu G, Hoekstra D, et al. Smallholder dairy production and marketing systems in Ethiopia: IPMS experiences and opportunities for market-oriented development. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project- International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia. Working Paper 31. 2013.
2. Ahmed MAM, Ehui S, Yemeserach A. Dairy development in Ethiopia. Washington, DC, USA: IFPRI (International Livestock Research Institute). 2004.
3. Getachew F. A Review of the small scale dairy sector in Ethiopia. FAO prevention of food losses programme. Milk and milk products, post-harvest losses and food safety in Sub-Saharan Africa and near East. 2003.
4. Tsedey A, Bereket H. Assessment of post-harvest loss of milk and milk products and traditional mitigation systems in Southern Ethiopia. Food Sci & Qual Manage. 2016;48:85-96.
5. Abebe B, Zelalem Y, Ajebu N. Handling, processing and utilization of milk and milk products in Ezha district of the Gurage zone, Southern Ethiopia. J Agric Biol Sust Dev. 2013;5:91-98.
6. Debela B, Lemma F, Alganesh T. Assessment of traditional butter production and preservation techniques in West Shewa Zone, Oromia Regional State, Ethiopia. 2016;6:23.
7. Alganesh T, Fekadu B. Traditional milk and milk products handling practices and raw milk quality in Eastern Wollega, Ethiopia. In: Laura Dean (edn.) LAP LAMBERT Academic Publishing. Saarbrücken, Germany. 2012.
8. Yonad. Value chain analysis of milk and milk products in borana pastoralist area. Yonad Business Promotion and Consultancy PLC, Addis Ababa, Ethiopia. 2009.
9. Asres E, Makoto N, Kumi Y, et al. Does gender division of labor matters for the differences in access to agricultural extension services? A case study in North West Ethiopia. J Agric Sci. 2015;7:138-147.
10. Gebremedhin B, Tegegne A, Hoekstra D, et al. Developing the butter value chain in Ethiopia. LIVES Working Paper. 2014.
11. Alganesh T, Ofodile LN, Fikadu B. Microbial quality and chemical composition of raw whole milk from Horro cattle in East Wollega, Ethiopia. Ethiop J Educ & Sc. 2008;3.
12. Tsadkan Z, Amaniel T. Assessment of post-harvest loss of milk and milk products and traditional mitigation systems in mekelle milk shed, Northern Ethiopia. Food Sci & Qual Manage. 2016;48:27-34.

e-ISSN:2321-6204
p-ISSN:2347-2359

13. Nahusenay A. An investigation of gender division of labor: The case of Delanta district, South Wollo zone, Ethiopia. J Agric Ext Rural Dev. 2017;9:207-214.

14. Kathleen MK, Johnson-Welch C. Enhancing women's contributions to improving family food consumption and nutrition. Food and Nutr Bull. 2001;22:443-453.

15. Alganesh TG, Yetenayet BT. Traditional butter and ghee production, processing and handling in Ethiopia. Afr J Food Sci. 2017;11:95-105.

16. Eyassu S, Asaminew T. Small-scale milk processing, utilization and marketing of traditional dairy products in Bahirdar zuria and Mecha districts, North Western Ethiopia. J Food Technol Res. 2014;1:122-132.