Food Science and Quality Management
ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online)
Vol.58, 2016

Participatory Evaluation, Demonstration and Verification of Sisal Foil Wrapped Milk Containers on Quality Parameters of Camel Milk Marketed in Borana Zone, Southern Ethiopia

Ahmed Mohammed Abdulla* Ibsa Aliyi and Feyissa Desiso
Oromia Agricultural Research Institute, Yabello Pastoral and Dryland Agriculture Research Center, P.O.Box. 85, Yabello, Ethiopia

Abstract
The research activity was carried out with the objective of evaluating and demonstrating performance of sisal foil wrapped milk containers on enhancing shelf life of the camel milk that was transported long distance at pastoralists' condition thereby create awareness about the technology. It was carried out for two years (2012/13-2014/15) in Yabello and Moyale Districts of Borana Zone. A total of 24 pastoralists as well as a research team composed of different disciplines were closely following up the progress of the activity. Regular visits, trainings and exchange visit were organized to create wider awareness and collect feedback from the pastoralists. The result of the study revealed that the camel milk samples transported with sisal foil wrapped milk containers have the lower temperature and microbial load than unwrapped milk containers and stayed negative for both alcohol and clot on boiling test at the terminal milk market, whereas, the unwrapped containers were positive for alcohol test and showed higher temperature and microbial load. In terms of cost, the only differentiating factor was sisal foil wrapping. Even if, sisal foil seems expensive, it compensates through relatively lesser loss, durability and accessibility. According to participants' opinions the technologies are easily manageable, cost effective and are very appropriate for improving the productivity of small scale pastoralists. However, to gain more impact from the technologies in the future, participation of pastoralists, coordination of different disciplines and reaching more target groups at larger scale should be taken as a strategy.
Keywords: Demonstration, participatory evaluation, milk container, camel milk and sisal foil

Introduction

Milk is a marvel of nature and a very nutritious biological fluid. Lactating animals are producing milk to feed their offspring naturally. Throughout the world, milk and milk products are indispensable components of the food chain. In most part of the world cattle milk is consumed much than other milk sources; Goats, camel, buffalo and sheep. Milk and milk products are also used as a raw material for agro industries in the form of milk powder, concentrated milk and cream (Bekele et al 2002).

Milk is composed of much of water and other chemicals different in their composition due to genetic and environmental factors. One of the parameters in milk quality is the accepted level of composition of these chemicals in the milk. Like the fatty acid content, protein content, the lactose, the pH level of the milk, its test and texture. The milk quality can be affected at different levels starting from the physiology of the cow, milking, collecting, transporting, processing and distribution (Dejene and Tamiru, 2014).

Ethiopia's camel population is estimated to be one million head. This number ranks the country third in Africa after Somalia and the Sudan, and fourth in the world (India included) (Tezera and Kassa, 2002). Because of its outstanding performance in the arid and semi-arid areas of south-east lowlands of Ethiopia where browse and water are limited, pastoralists rely mainly on camels for their livelihood. In these areas, camels are mainly kept for milk production and produce milk for a longer period of time even during the dry season when milk from cattle is scarce (Bekele *et al*, 2002). The annual camel milk production in Ethiopia was estimated to be 75, 000 tones (Felleke 2003). In most pastoralists, camel milk is always consumed either fresh or in varying degrees of sourness in the raw state without heat treatment thus, can pose a health hazard to the consumer. Camel milk is transported from central Borana to Kenya border using plastic containers.

Milk is a marketable commodity whereby consumers buy when they get satisfied by the quality of the product based on their perception. As milk is also highly perishable product its quality and handling will affect the market. Therefore, having a due attention to total quality aspects of milk production and consumption; quality detection and safety precautions became of paramount importance. Therefore, this study was designed to evaluate and demonstrate the effectiveness of sisal foil wrapped milk containers in reduction of microbial growth and increased shelf life of the camel milk, transported long distance exposed to sunlight in Borana pastoral area.

Methodology

Description of the study area

Yabalo is found in southern Ethiopian rift valley 575km away from Addis Ababa. It has an altitude of 1656masl. The area is characterized by erratic, low and unpredictable seasonal rain fall. Surupa is located about 50km from

Yabello town in northern part and Moyale town is located about 200km from Yabello town in the southern part that is about 570km south of Addis Ababa; the capital of Ethiopia. Surupa and Moyale town and the way to Moyale are found in similar weather condition of higher ambient environmental temperature.

Site and pastoralists' selection

Yabello and Moyale district were purposively selected based up on their potential. From Yabello District Surupa was selected purposively based on its potential for milk supply for Moyale District, particularly Moyale town. The pastoral communities are the ultimate beneficiary of the research result. Hence, the involvement of target group in the whole process of technology transfer is fundamental. One way to empower the community is to organize them in to groups and monitor to achieve the designed objectives of the project. In the process they may get some knowledge and develop some skill, so that they can effectively participate in the process and decide on their matters themselves. Ahead of participant selection an open meeting was held with the community at both the initial and terminal site so that the interested participant were assigned as the target group for this study.

For the purpose of this study 6 individual producers and 9 groups of producers who have the potential to fill the prepared container were deliberately selected as a target group. Similarly, 9 middlemen/collectors were purposively selected. The criterion for selection of the group is mainly based on their willingness to participate in the study, and their potential to be involved until the completion of the study. The sisal foil wrapped milk container were distributed for the target group in such a way that two from each of the 3, 5 and 10 liter sized container for the individual producer, group of producers and middlemen/collectors.

Research design

The 46 sisal foil wrapped milk containers were distributed for the target groups in such a way that 26,11,9 from the 10, 5 and 3 liter sized containers, respectively. The focus of the study was camel milk. Thus, samples of the milk were taken, transported and analyzed following standard procedure (Richardson, 1985). Fresh morning camel milk samples were collected at farm level. Pastoralists were pre-informed to prepare, as much as possible, clean and unadulterated milk. All the milk samples collected from the pastoralists were then tested for primary quality tests (Specific gravity, Organoliptic test and Alcohol test). Those which were negative for these tests were considered as good quality milk and mixed to make homogenous milk before transferring to treatment containers.

Technology evaluation and demonstration methods

The evaluation and demonstration of the trials were conducted with pastoralists to create awareness about the effectiveness of the particular technology in maintaining the quality of milk. The evaluation and demonstration of the trials was followed process demonstration approach by involving PRGs, development agents and experts at different evaluation stage of the container. The activity was jointly monitored by PRGs, researchers, experts and development agents.

Data collection

During life span of the activity data like temperature reading and microbial load and pastoralists preference toward the milk containers were collected through semi-structured questionnaire, data sheet, supervision, organizing mini field day and workshop by researchers and DAs of the respective sites.

Data analysis

The collected data (quantitative data) were analyzed by using average and frequency distribution while qualitative data were analyzed using descriptive statistics and preference ranking. The qualitative data from the group discussion, key informant interview and workshop feedback were analyzed partly on spot to avoid forgetting.

Results and Discussion

Training of pastoralists and other stakeholders

Prior to actual implementation of the study training was given for 24 female target group individual producers, middlemen and individuals within the groups. To have common consensus training and awareness creation was also given for particular client those involved in milk marketing process which is transported from Surupa to Moyale terminal market. In this case list of respective target group client were taken from target group at initial site (Surupa), so that the respective client was easily contacted at Moyale terminal market. The training focused on the issues like overall objectives of the study, the merits of wholesome milk, how to produce quality milk, effectiveness of the particular technology in maintaining the quality of milk, how to handle the hygienic condition of the container and the milk transported with this particular equipment, the benefits of provision of quality milk for consumers and in the process of research activities how to provide the required information.

As introduction to the principles and operation of the sisal wrapped container, midterm training was organized both for the pastoralists (24) and extension workers (5) involved in the activity. The training was followed by a field demonstration of the implementation to familiarize the trial pastoralists.

Pastoralists' and other stakeholders' participation in demonstration

A total of 24 pastoralists (6 individual producers, 9 groups of producers and 9 middlemen/collectors) as well as a research team composed of different disciplines were closely following up the progress of the activity. Pastoralists were pre-informed to prepare, as much as possible, clean and unadulterated milk.

It is unquestionable that only provision of training may not be sufficient for successful completion of the project. Thus, memorandum of understanding (MOU) was signed between the target group and the implementer of the project, i.e., Yabello Pastoral and Dryland Agriculture Research Center, particularly Agricultural Extension Research team, and regular monitoring was made by researchers.

The individuals around Modjo area of Eastern Shoa, who are engaged in wrapping local containers with the Sisal foil were visited, check list were prepared and discussion was made thoroughly on issues like, their skill of wrapped container preparation; cost of sisal foil, local container and completely wrapped container, and the time required for wrapping each container. On the top of these the discussion included recognizing the advantage of the sisal foil wrapped plastic container for maintaining the quality of milk transported in warmer environmental condition. Finally, agreement was made and memorandum of understanding (MOU) was signed between the skilled persons and the implementer of the project in providing the container in the desired order and required number for the purpose of the study.

At the end workshop was arranged and the final result of the study was presented to the target and non target community group, and different stakeholders. The workshop was held in the presence of zonal and districts' research-extension-pastoralists-linkage advisory council (Z/DREPLAC). The workshop participants were livestock expertise, DA, veterinary health workers, public health officers and public health extension of the respective districts. This created a forum for wider consultation and consensus building on all issues that may be contentious, and for wider adoption of the milk cooling technology by the community and created an opportunity to get further feedback from participants to modify the shortcomings of the technology.

Quality performance of milk at producer and terminal market

The quality test for camel milk collected from producers and after it reached a terminal market (Moyale) during dry season of the area were conducted as presented in Table 1 and Table 2, respectively. The smell of milk was smoky since all the pastoralists in the study area have been smoking their milk containers for various purposes (Table 1). For instance, smoking milk containers has been reported to exert anti-microbial properties and prolong the shelf life of milk (Ashenafi, 1996). It was clearly observed from the physical derbies in the milk that pastoralists produce their milk under none hygienic environment. According to (Abdurrahman, 1995), poor management and unhygienic milking practices prevalent in the traditional husbandry systems, which include tying the teats with soft barks to prevent the calf from suckling, tick infestations and cauterization of the udder and skin, are few of the factors responsible for contamination of milk. At initial point all the samples collected were negative for alcohol test that was evidence for no or very low production of acid at farm level which indicates the freshness of the milk. Significant temperature variation was observed ($p<0.01$) for the milk in the wrapped and unwrapped containers mainly due to the unwrapped containers' absorption of the environmental temperature.

The rise in temperature was relatively lower for wrapped containers and it was possible to observe that the samples with higher temperature were positive for alcohol and clot-on-boiling test (Table 1 and Table 3). This result is in line with the report of (Kurwijila, 2006) which states that temperature is the most determining factor for milk fermentation and hence quality deterioration.

Table1: Primary quality tests of camel milk at producers of Borana zone

Sample No	Smell	Color	Appearance	Specific gravity	Alcohol (68%)
1	Smoked	Yellowish white	Physical Derbies	1.020	-Ve
2	Smoked	Yellowish white	Physical Derbies	1.021	-Ve
3	Smoked	Yellowish white	Physical Derbies	1.022	-Ve
4	Smoked	Yellowish white	Physical Derbies	1.021	-Ve
5	Smoked	Yellowish white	Physical Derbies	1.020	-Ve

Table 2: Temperature of pooled sample of camel milk within the three treatments at the initial point

Type of Container	Code for Container	Temperature (26°C)
Wrapped New Container	WNC	21°C
Unwrapped New Container	NC	24°C
Local Container	LC	25°C

Test for various Organoleptic and temperature measurement of milk at the terminal market (Moyale town) revealed that there was some similarity and discrepancy for wrapping and not wrapping the containers. All the wrapped containers stayed negative for both alcohol and clot on boiling test at the terminal milk market (Table 2). The exposed milk containers had significantly higher temperature than less exposed containers ($p<0.01$).

Table 3: Primary quality tests of camel milk at terminal point (Moyale town) of Borana zone(30°C*)

Sample code	Alcohol Test	Clot on boiling	Smell	Color	Appearance	Milk Temperature
WME C	-ve	-ve	Smoked	Yellowish white	Physical derbies	27°C
WLE C	-ve	-ve	Smoked	Yellowish white	Physical derbies	25°C
LME C	Turbid/ Sediment	+ve	Smoked	Yellowish white	Physical derbies &Minor curdling	33°C
LLEC	Sediment	+ve	Smoked	Yellowish white	Physical derbies	30°C
NME C	Clear sedimentation	+ve	Smoked	Yellowish white	Viscous	34°C
NLEC	Sediment	+ve	Smoked	Yellowish white	Viscous	30°C

WMEC: Wrapped container exposed to Sun light; WLEC: Wrapped container less exposed to Sunlight; LMEC: Local container exposed to sunlight; LLEC: Local container less exposed to sunlight; NMEC: New container exposed to sunlight; NLEC: New container less exposed to sunlight.

Milk of other treatments with unwrapped was remained positive for alcohol and clot-on-boiling test. That might due to the development of lactic acid from milk fermentation because of exposure of the containers to sun light. The result was proved according to the report of (Kurwijila, 2006) which states that alcohol test is an alternative method of measuring the acid accumulation of milk since it is more sensitive for acid than clot-on-boiling test.

Pastoralists' opinion/perception

In terms of cost, the only differentiating factor was sisal foil wrapping. Even if, sisal foil seems expensive, it compensates through relatively lesser loss, durability and accessibility. The pastoralists who got the opportunity to visit the wrapped milk containers were very much surprised to see milk being transported for longer period than they traditionally do with almost no loss. They were also explained that by proportionally increasing the size of the containers, more quantity of milks can be transported even for marketing purpose. According to participants' opinions the technologies are easily manageable, cost effective and are very appropriate for improving the productivity of small scale pastoralists.

Conclusion and Recommendation

Conclusion

The result of the study enabled us to conclude that wrapping the container has an importance in maintaining the quality of milk transported long distance exposing to sun light, as the test gave us a clearly observed results for all the treatments evaluated at community level.

Recommendation

Although there had been shortage of cow milk during the season of this study, it is valuable if the study will be repeated for cow milk at the season of its excessive supply to market. On the top of this all the stakeholders responsible for milk quality monitoring and development enhancement should strengthen and scale up the technology found to be effective in maintaining the quality of milk involved in market transporting long distance. To gain more impact from the technologies in the future, participation of pastoralists, coordination of different disciplines and reaching more target groups at larger scale should be taken as a strategy.

References

Abdurrahman, O. A. , 1995. The detection of sub clinical mastitis in the camel (Camelus bactrianus) using

somatic cell count and California mastitis tests. Veterinary Research Communication 20: 9-14.

Ashenafi, M., 1996. Effect of container smoking and incubation temperature on the microbiological and some biochemical qualities of fermenting Ergo, traditional Ethiopian sour milk. *International Dairy Journal 6: 95-104*.

Bekele, T., Zeleke, M. & Baars, R. M., 2002. Milk production performance of the one humped camel (Camelus dromedarius) under pastoral management in semi-arid eastern Ethiopia. Livestock Production Science 76: 37-44.

Dejene, T. & Tamiru, A., 2014. Study on the effect of sisal foil wrapped milk containers on quality parameters of Camel milk marketed in Borana zone, southern Ethiopia.

Felleke, G., 2003. FAO Prevention of Food Losses Programme: Milk and Dairy Products, Post-harvest Losses and Food Safety in Sub-Saharan Africa and the Near East. A Review of the Small Scale Dairy Sector - Ethiopia.

Kurwijila, L.R., 2006. Hygienic milk handling, processing and marketing: reference guide for training and certification of small-scale milk traders in Eastern Africa. ILRI (International Livestock Research Institute), Nairobi, Kenya.

Tezera, G. & Kassa, B., 2002. Camel husbandry practices in Eastern Ethiopia: The case of Jijiga and Shinile Zones. Nomadic Peoples, Volume 6, 2002.