



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(7): 1193-1196
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www.thepharmajournal.com

Received: 02-04-2021

Accepted: 07-05-2021

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Efficacy of clean milk production protocol on quality of milk in small holder production system

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Abstract

Milk quality is the result of a total integrated approach involving cleanliness at different phases of animal handling, processing and transport of milk and milk products. The main aspects of CMP are animal hygiene, milking hygiene, equipment hygiene and processing hygiene. Hence, an exploratory cross-sectional study was carried out to improve the level of knowledge of small holder dairy farmers on clean milk production protocol. The study also aimed to reduce the use of antibiotics in mastitis prevention by the use of cost effective teat dips. Significant difference between the treatments was analysed using SPSS software. The current study revealed that most of the dairy farmers possessed a herd size of 4-6 animals and the number of milch animals averaged between 1-3. Survey results portrayed that majority of the farmers were still reluctant to practice machine milking and relied upon the traditional hand milking for milking their animals. But method of milking was found to have no significant effect on the incidence of mastitis in the present study. Out of the different variables analysed, the cleanliness of cattle shed, washing of udder prior to milking and hygiene of milker's hands were found to have a significant ($P < 0.01$) effect on udder health of animals.

Keywords: Milk quality, clean milk production, udder health, mastitis

Introduction

In India dairying plays a major role in supporting the national economy as well as in socio-economic upliftment of millions of rural and urban households. Globally, our country ranks first in milk production with an average annual milk production of 198.4 million tonnes in 2019-20 (DAHD, 2020). Production increased tremendously during the last three decades, coinciding with the implementation of the national dairy development programmes through producer-owned cooperative structure. However, in spite of large volume of milk produced, the quality aspects of milk production has not received adequate attention owing to poor technical knowledge of farmers. The domestic production could be increased in terms of quantity and quality with adoption of good dairy farming practices (FAO, 2011) [7]. This obviously calls for a technological breakthrough in the field of animal husbandry and dairying and greatly depends upon the rate and speed of dissemination of such information to dairy entrepreneurs.

In the current scenario, along with the quantity produced, "milk quality" also has to be given prime importance as consumers are well aware about the impact of cleanliness and hygiene on health. Clean milk can be defined as milk coming from healthy milch animals possessing normal flavour, devoid of dirt and filth containing permissible limit of bacteria and essentially free from adulterants, pathogens, various toxins, abnormal residues, pollutants and metabolites (Ogale, 1999) [11]. Quality is the result of a total integrated approach from farm dairy environment to the consumer's door. Clean milk production involves cleanliness at different phases of animal handling, processing and transport of milk and milk products (Rathode *et al.*, 2014) [13]. The main aspects of CMP are animal hygiene, milking hygiene, equipment hygiene and processing hygiene. Clean milk production results in milk that are safe for human consumption, free from disease-producing microorganisms, holding high keeping quality, high commercial value and high-quality base suitable for processing, resulting in high-quality finished products.

To promote clean milk production, government of India had started schemes (run under animal husbandry, dairying and fisheries) to create necessary infrastructure for production of quality milk at the farmers level up to the points of consumption, improve milking procedure at the farmers level, training and creating mass awareness about importance of clean milk

production. Hence, it is the need of hour to strictly follow the clean milk production (CMP) practices at the farm level to achieve the quality standards. The present study was undertaken with the following objectives:

1. To reduce the incidence of mastitis (both clinical and subclinical) in small holder dairy production system.
2. To improve the level of knowledge of small holder dairy farmers on clean milk production protocol.
3. To reduce the use of antibiotics in mastitis prevention by improving cost effectiveness of teat dips.

Materials and Methods

This exploratory cross-sectional study was carried out as two phases; a survey and a field level experiment. Initially, a detailed survey was conducted among 60 small holder cattle farms selected randomly from different parts of Kerala. A well-structured questionnaire was prepared to assess the economic status, practices and knowledge level of farmers regarding clean milk production and udder health. Incidence of mastitis within one year of the study period was also accounted. Data on total number of animals reared, number of milch animals and the number of dry cows/heifers were collected from each farm. The significant effect of different variables *viz.* housing and hygiene of cattle sheds, type of flooring, ventilation inside the animal house, frequency of shed cleaning, drinking frequency of animals, method of

milking, washing of udder before milking, washing of milker's hands prior to milking *etc.* on incidence of mastitis were statistically analysed.

The questionnaire was prepared using Google forms with the aim of assessing the awareness of dairy farmers on clean milk production and its protocol. An on-farm training (direct and in online mode) on clean milk production protocol was also organized for the farmers. Milk samples were collected individually from all the milch animals in each farm for quality analysis (somatic cell count, Solids not Fat (SNF), fat percentage and California Mastitis Test (CMT). Elevated SCC was used as an indicator of subclinical mastitis. The cows with an initial SCC of <100,000 cells/mL and SCC >200,000 cells/mL at the end of each 28-d period were considered to be at risk. However, cows with SCC >100,000 cells/mL at the beginning of any period were excluded as they may have been already developing or recovering from subclinical mastitis. Animals detected positive for mastitis during the study period were treated. Three teat dip solutions *viz.* lactic acid plus sorbitol, povidone iodine alone and 5% povidone iodine solution mixed with glycerine at 10% level (Glycerine was added in such a way so as to obtain active iodine at 0.35% level for effective germicidal action) were compared for their effectiveness in mastitis prevention. Significant difference between the treatments was analysed using SPSS software.



Fig 1: Teat dip cups

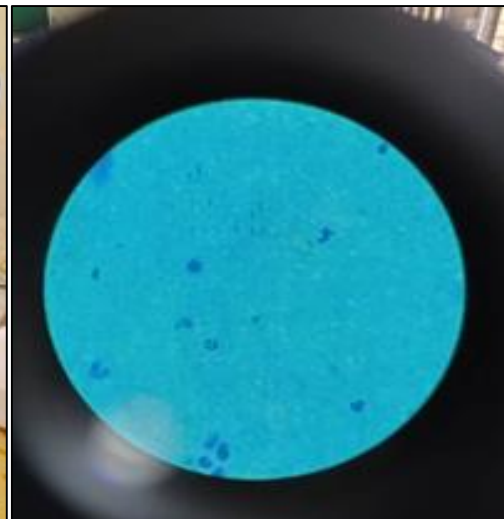


Fig 2: Somatic cell count for bacterial quality check

Results and Discussion

A. Socio economic profile of farmers and milking methods practiced in small holder production systems in Kerala (Table 1)

The current study revealed that most of the dairy farmers possessed a herd size of 4-6 animals and the number of milch animals averaged between 1-3. This result is contrary to the findings of George *et al.* (2020) [8] who reported that small sized farms were predominant with a share of 83.80 per cent, followed by medium (15.62 per cent) and large farms contributed merely 0.58 per cent to the total. Survey results portrayed that majority of the farmers were still reluctant to practice machine milking and relied upon the traditional hand milking for milking their animals. This was in agreement to Basheer and Vinod Kumar (2013) [2] who reported that 73.33% of dairy farmers of Kottayam district were practising full hand milking and only 8.33% followed machine milking.

The method of milking was found to have no significant effect on the incidence of mastitis in the present study. Similar results were obtained by Wirtz *et al.*, (2004) [16] while comparing incidence of mastitis with automatic and conventional milking methods in the same farm with similar environment and management. SCC obtained were also almost similar in both milking procedures (Abeni *et al.*, 2008) [6], although quarter SCC was lower in AM (Berglund *et al.*, 2002) [3]. But (Berglund *et al.*, 2002) [3] had observed that quarter SCC decreased when automatic milking (AM) was practiced in experimental animals. However, epidemiological studies have, in general, indicated deteriorating udder health among cows after the introduction of AM (Rasmussen *et al.*, 2006) [12]. Difficulty in automatic detection of subclinical and clinical mastitis as well as cleaning of teats before milking while using milking machines pose challenge to udder health in automated milking system.

Table 1: Socio economic profile of farmers and milking methods practiced in small holder production systems in Kerala*

Particulars	Flock distribution			
	1-3 animals	4-6 animals	7-10 animals	>10 animals
Total no of animals/farm (%)	28	32	22	18
Avg. no of milch animals (%)	49	29	9	13
	Milking machine	Hand milking	Machine/Hand milking	
Method of milking practiced (%)	27	66	7	

B. Influence of clean milk production procedures on udder health of animals

Out of the different variables analysed, the condition of cattle shed, washing of udder before milking and washing of milker's hands before milking was found to have a significant ($P < 0.01$) effect on udder health of animals as indicated by the reduced incidence of mastitis.

Condition of cattle shed

No incidence of mastitis was reported in animals housed in clean sheds. Thus, it could be inferred that condition of cattle shed has a significant ($P < 0.05$) correlation with incidence of mastitis in animals. Moisture and manure in the environment of the cow were the primary sources of environmental pathogens causing mastitis (Schreiner and Ruegg, 2003) [15]. Thus there is a strong negative association between barn hygiene and incidence of mastitis in dairy cattle indicated by higher SCC (Dohmen *et al.*, 2010) [15].

Washing of udder before milking

About 20% of the farmers were found to use various antiseptic solutions to wash udder before milking, 66.7% used plain water and rest of them used either of these to wash udder. Incidence of mastitis was significantly lower ($P < 0.01$) in animals washed with antiseptic solutions when compared to antiseptics/water and plain water. Medeiros *et al.* (2011) [9] observed that the lack of teat washing before the milking was the most important factor behind the occurrence of subclinical mastitis in bovines. Drying the teat with individual towel paper and the teat disinfection before and after milking also caused considerable reduction. Reneau *et al.* (2005) [14] found that udder hygiene scores, lower leg hygiene scores and udder-lower leg composite score were significantly associated SCC when study was conducted in lactating dairy cows from 8 farms. Neja *et al.* (2016) [10] reported that highest quality milk ($< 200\ 000$ somatic cells/ml) was produced by clean cows. Also the proportion of cows with mastitis (both subclinical and clinical) was found to increase with decreasing cleanliness of the udder, especially in the loose housing system. Overall, the proportion of clinical mastitis was lower in clean cows (2.51%) in comparison to dirty cows (14.29%).

Teat dipping

Three teat dips; lactic acid plus sorbitol, povidone iodine alone and povidone iodine 5% solution mixed with glycerine at 10% level were tried for treatment groups with control group with no post milking dips. The CMT didn't show any significant difference between the groups but somatic cell counts were significantly more ($P > 0.05$) in control group. Adding glycerine at 10% level did not change the germicidal value of povidone iodine and hence is recommendable because of long term emollient action on teat ends.

Washing of Milker's hands prior to milking

Almost all farmers (98.33%) practiced washing their hands

prior to milking. Prevalence of mastitis was significantly ($P < 0.01$) lower when hands were washed. Bhakat *et al.* (2017) [4] opined that thorough washing of milkers hand with clean water and trimming of nails to prevent injuries to teat caused reduced incidence of sub-clinical mastitis.

Other variables analysed *viz.* type of flooring, air circulation inside the shed, frequency of shed cleaning, drinking frequency and method of milking had no significant effect on udder health of animals (as indicated by the incidence of mastitis in the present study).

Conclusion

Milk quality is the result of a total integrated approach involving cleanliness at different phases of animal handling, processing and transport of milk and milk products. The main aspects of CMP are animal hygiene, milking hygiene, equipment hygiene and processing hygiene. Adoption level of clean milk production practices as full-fledged protocol is very low among dairy farmers of Kerala bringing forth the huge gap between the desired and achieved milk quality. Clinical and subclinical mastitis being the most important threat of dairy farming, cost effective and practically feasible technology is the need of the hour. So the present study even though at a small scale opens up researchable issues and technology renovation opportunities in the fast growing dairy sector.

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