Clean milk production practices and its impact on the prevention and control of mastitis in Tiruchirapalli district of Tamil Nadu

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Abstract: Mastitis is one of the major infectious diseases affecting dairy cows and causing economic loss. Majority of the rural dairy farmers are not aware of preventing mastitis through management practices. Lack of adoption of clean milk production practices is the major reason for mastitis. So the focus of study was imparting knowledge on clean milk production practices to dairy farmers from selected villages in Tiruchirapalli district along with management of mastitis in dairy animals through capacity building programme. After the adoption of clean milk production practices, there was remarkable reduction in the incidence of mastitis from 19.33 per cent to 2.4 per cent. The keeping quality of milk was also improved by enhancement in methylene blue dye reduction time (MBRT). This was an indirect indication of improved microbial quality of raw milk. The subclinical mastitis was monitored with somatic cell count (SCC) and the quarters of udder health by California mastitis test (CMT) respectively. The mastitic animal was treated effectively with suitable antibiotic by conducting antibiotic sensitivity test (ABST) and thereby protected the dairy farmers from huge economic loss.

Keywords: Capacity building, Clean milk production, Mastitis, Prevention, Control

Introduction

The bovine Mastitis is an economically important disease in lactating animals across the world followed by lameness and

infertility under field condition and causes considerable financial losses to Dairy industry (Green et al, 2004). The annual economic loss due to mastitis has been calculated to be Rs.7165.51 crores. Among this, subclinical mastitis has been estimated to account for 57.93 percent (4151.16 crores) of the total economic loss due to mastitis (NAAS, 2013).

Mastitis severely affects the milk quality and production of the cow and may spread to other cows in the herd. Deterioration of milk quality is a major sequel of Mastitis. Mastitis is characterized by inflammation of udder tissue causing pathological changes in udder parenchyma and characterized by physical, chemical and microbiological changes in milk (Radostitis *et.al*, 2000). Further, the mastitic milk is unsuitable for consumption and is one of sources of communicable diseases such as tuberculosis, brucellosis, staphylococcal toxemia, septic sore throat, gastroenteritis, etc., (Kalorey, 2001). Although notable progress has been made in prevention of mastitis by appropriate hygienic measures, enhanced control of milking techniques and antibiotic treatment of dry cow, but it is still necessary to treat a large number of cows which suffer from mastitis. The multiplicity of the cause and emergence of indiscriminate and prolonged use of antibiotics in absence of antibiogram is a major hurdle in the control of mastitis (Mathialagan and Kumaresan, 2015).

Hence, the proposed study is aimed to impart knowledge on clean milk production practices to dairy farmers through capacity building programme which will create awareness about subclinical, clinical mastitis, prevention and management of mastitis in dairy animals. The dairy cows suffering from mastitis are going to be treated with suitable antibiotics based on Antibiotic Sensitivity Test (ABST) so that the trained beneficiaries will be protected from huge economic loss by improving the raw milk quality.

Materials and Methods

Study area

The study was conducted in Tiruchirapalli district of Tamil Nadu. Three blocks which have recorded maximum numbers of case of mastitis were identified viz. Andhanallur, Mannachanallur and

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Manikandam, from the endemic record maintained at Animal Disease Intelligence Unit, Tiruchirapalli. Four villages from each block, totally twelve villages were selected for this field study. Fifty dairy farmers from each village, constitute a total of six hundred beneficiaries were selected on the basis of having at least two dairy animals out of which one should be in lactation.

Capacity building programme

The two day capacity building programme included both on farm and institutional training programme at TANUVAS-Veterinary University Training and Research Centre, Tiruchirapalli for the dairy farmers on clean milk production practices and the demonstrations on cleaning of dairy cattle, disinfection and sanitation of shed, milking methods, cleaning of udder, post teat dipping, strip cup test-mastitis detection were also conducted. Inputs like mastitis detection kit, post-teat dip container, povidone iodine, plastic hand sprayer, potassium permanganate, plastic bottles, test tubes for milk sample collection and reading materials in local vernacular were distributed to all the beneficiaries.

Assessment of raw milk quality and detection of mastitis

The Methylene Blue dye Reduction Test (MBRT) was performed in dairy farm since it is a quick method for determining the bacterial load, sanitary condition and keeping quality of milk. The test also indicates the hygienic condition of milk during its production and handling.

The most significant abnormality found in milk due to subclinical mastitis is the increase in Somatic cell count (SCC). Since cell numbers in milk are closely associated with inflammation of udder health, these somatic cell counts currently constitute an important criterion for the measurement of milk quality as an international standard (Hillerton, 1999). The milk from suspected animals were collected and examined for somatic cells count using Ekomilk Horizon Milk Analyzer.

The California Mastitis Test (CMT) was extremely used to identify the specific quarters infected with clinical and subclinical mastitis. The test was conducted on a white plastic paddle with four cups corresponding to four teats. Milk from each teat is flown directly into the cups and equal amount of reagent added along with bromocresol purple as an indicator. The positive case revealed gel formation and in negative case there was no precipitation (Sandholm, 1995).

Antibiotic Sensitivity Test

The milk sample from suspected mastitis animals were collected aseptically and sent to the laboratory at Veterinary University Training and Research Centre, Tiruchirapalli for antibiotic sensitivity test using Muller-Hinton agar plates and Antimicrobial sensitivity discs. Based on zone of inhibition, suitable antibiotic

therapy was suggested by the specialists to cure the animal suffering from mastitis (Erskine et al, 2003).

A teacher made knowledge test was developed in a simple vernacular language and the same was employed thrice viz., before training, immediately after training and 90 days after training to assess their retention of knowledge learned during the training. The enhancement in the knowledge level is the difference between knowledge retention score and the pre-training knowledge score. A semi-structured interview schedule was prepared and employed for data collection. Descriptive statistics were employed to interpret the findings.

Results and Discussion

Status of clean milk production at field level

General Cleanliness

Table 1 shows that 75.83 per cent of respondents were cleaning their cattle shed daily. Similarly, 60.00 per cent of them were cleaning their dairy cows daily. Most of the respondents were cleaning their milch cows ranged from daily basis to five days interval. Each and every respondent was cleaning the milk utensils before milking. These findings were in accordance with Gautam and Mohammad, 2019.

Clean milk production practices

The Pre-exposure and post-exposure knowledge tests were conducted to all the 600 beneficiaries focusing on the objectives of clean milk production before the commencement and immediately after completing the training programme. The retention level of gained knowledge was tested 90 days after the completion of capacity building programme.

Table 2 shows that only 5.33 per cent the dairy farmers were following the practice of Cleaning of udder with potassium permanganate solution before milking. In contrast, Patel et al. (2014) revealed that splashing of water on udder or teats and washing of hand before milking was followed by most (97.50%). After washing the udder, around 4.33 percent wipe it with clean cloth. Only 8.17 per cent knew that cleaning of hands of milkman before milking was important. Patil et al. (2009) also suggested that majority of the dairy farmers did not know that the milker should be healthy and free from bad habits. This might be because of their ignorance about milker's personal hygiene and spreading of zoonotic diseases through human.

There are various types of cleaning and sanitation agents that have been specially designed to clean and disinfect milk-handling equipment (Lore et al. 2006). The study revealed that only 12.17 per cent were practised cleaning agent for milking utensils. Few respondents (10.83%) were sun drying their utensil after cleaning and most of them were not practicing the same. Majority of the

respondents were not giving concentrate feed at the time of milking except 2.5 per cent.

Full hand milking method was practiced by 15.33 per cent and majority them 84.67 per cent preferred stripping and knuckling method of milking, because of small size of their animal's teats and shorter milking time. Similar finding of high rate of Knuckling practice (74.4%) was also reported by Sinha et al. (2010). A very few dairy farmers (1.83%) had knowledge regarding knuckling method leads to teat injury. Post teat dipping with Iodine solution was practiced only by two dairymen out of six hundred.

Not even a single dairy farmer had the knowledge regarding animal should stand for 15- 20 minutes after milking so that teat canal gets closed and the soil bacteria could not enter teat canal which leads to mastitis. Nearly half of the famers (47.67 %) were providing roughage feeding material to their animals and rest of the respondents were not even conscious about the benefits of providing roughages to animals since it made the animal to stand for half an hour and during that time teat canal got closed.

Table 1 General cleanliness of dairy farm (n=600)

S. no.	Parameter	Daily (%)	2 days interval (%)	5days interval (%)	More than week (%)
1.	Cleaning of cattle shed	455(75.83)	140(23.33)	5(0.83)	0
2.	Cleaning of dairy cow	360(60.00)	125(20.83)	115(19.17)	0
3.	Cleaning of milking utensils	600(100.00)	0	0	0

Usage of sieve during transfer of milk from one can to another was practiced moderately by 37.17 per cent and rest were not aware that sieve could prevent the entry of dirt and extraneous matter. Only (16%) were used steel utensil for milking purpose and remaining (84%) were using plastic or aluminium cans or brass utensils. Out of 600 respondents only four persons were able to detect subclinical mastitis by making milk strip in their hand palm and examined with taste buds, revealed sour taste since chloride content was more in subclinical mastitis.

During this project, we have encountered only seventeen (2.83%) well informed farmers who employed milking machine in their farm. The majority of the dairy farmers were told that milking machine was costlier and it could cause damage to udder. But in practical, milking machine is safe and faster and convenient when compare to human hand milking as it minimize milk contamination through milker and at the same time cleaning and maintenance also simple. Nowadays, Government subsidy is available in some states and farmers can make use of it and avoid dependency of milkmán.

Table 2 Knowledge level of dairy farmers on clean milk production practices (n=600)

S.No.	Technologies / practices	Pre-exposure (%) adoption	Post-exposure (%) knowledge	Retention (%) of knowledge
1	Cleaning of udder with Potassium permanganate solution before milking	32(5.33)	535(89.17)	485(80.83)
2	Wiping the udder with clean cloth	26(4.33)	502(83.67)	433(72.17)
3	Cleaning of milkman hands before milking	49(8.17)	514(85.67)	449(74.83)
4	Usage of cleaning agent for utensils	73(12.17)	547(91.17)	496(82.67)
5	Sun drying of utensil after cleaning	65(10.83)	529(88.17)	471(78.50)
6	Providing concentrate to animal during milking	15(2.50)	510(85.00)	478(79.67)
7	Knowledge of Full hand milking method	92(15.33)	524(87.33)	469(78.17)
8	Knowledge regarding Knuckling method leads to teat injury	11(1.83)	547(91.17)	493(82.17)
9.	Post teat dipping with Iodine olution	2(0.33)	538(89.67)	476(79.33)
10.	Knowledge regarding animal should stand for 15- 20 minutes after milking so that teat canal gets closed	0(0.00)	501(83.50)	482(80.33)
11.	Provision of roughages after milking	286(47.67)	559(93.17)	502(83.67)
12.	Usage of sieve during transfer of milk from one can to another	223(37.17)	543(90.50)	498(83.00)
13.	Usage of stainless steel utensils for milking purpose	96(16.00)	526(87.67)	487(81.17)
14.	Detection of subclinical mastitis	4(0.67)	510(85.00)	473(78.83)
15.	Usage of milking machine	17(2.83)	508(84.67)	462(77.00)

Constraints faced by the dairy farmers pertaining to mastitis

The results of Table 3 revealed that only 5.33 per cent of the dairy farmers were aware of mastitis prevention methods and none of them were aware about subclinical mastitis detection test. The dairy farmers revealed that if a cow was affected with mastitis, they had to spend more money for the treatment because it was costlier (83.50%). They also perceived that most of the time the animal was not responded to treatment (77.17%) and if the mastitis was not cured, then the particular quarter could become dormant (31.17%), thereby they used to get huge economic loss (90.33%). Similar results were reported by Byarugana et al. (2008) and also Mathialagan and Kumaresan (2015) who stated that none of the dairy farmers knew about subclinical mastitis and most of them considered mastitis was a major constraint for wealth creation through milk production.

Impact of clean milk production training on incidence of mastitis and raw milk quality

The analysis of benchmark survey revealed that 116 (19.33%) of the beneficiaries had faced the problem of mastitis and the same has been controlled through the implementation of the project. Table 4 shows the impact of the adoption of mastitis

detection and prevention technique as perceived by the scheme beneficiaries. The beneficiaries reported that there was a drastic reduction in the occurrence of mastitis cases from 19.33 per cent to a level of 2.4 per cent after adoption of the mastitis detection, prevention and control techniques. This indicates that the mastitis prevention and control training methodology was highly effective. Riekerink et al. (2010) reported that most of Canadian dairy farms adopted important mastitis prevention practices such as clean milk production practices since mastitis was highly related to farm management activities.

Interestingly, the keeping quality of raw milk was also improved by increase in Methylene blue dye reduction time (MBRT) from 2-3 hours to 4-5 hours. This is an indirect indication of improved microbial quality of raw milk.

Sub clinical mastitis is characterized by increase in Somatic cell count without any observable changes in milk and udder and it is a chief cause of heavy monetary losses to dairy farming (Jadav et al. 2010). The original limit for Somatic cell count of a healthy quarter as suggested by the International Dairy Federation is 5,00,000 cells per ml (Jadhav et al. 2013) From Table 4, the microscopic examination of the milk samples revealed that there was significant reduction in the somatic cell count

Table 3 Constraints faced by the dairy farmers pertaining mastitis (n=600)

S.No.	Constraints	Yes (%)
1	Not aware of the subclinical mastitis detection test	596(99.33)
2	Treatment is costly	501(83.50)
3	Lack of training on mastitis prevention methods	568(94.67)
4	Animal not responded to treatment	463(77.17)
5	Awareness that affected quarter becomes dormant	187(31.17)
6	Heavy economic loss	542(90.33)

Table 4 Impact of training on incidence of mastitis and raw milk quality

Incidence of mastitis in milch cows		Methylene Blue dye Reduction Test (MBRT) n=86		Somatic Cell Count (SCC) n=86		California Mastitis Test (CMT) n=61	
Before adoption	After adoption	Before adoption	After adoption	Before adoption	After adoption	Fore quarter mastitis	Hind quarter mastitis
		hours	hours	lakhs /ml	lakhs /ml		
116 (19.33%)	14 (2.4%)	2-3	4-5	6-8	4-5	23(37.7)	38(62.3)

Table 5 Sensitivity of antibiotics towards mastitis organism based on ABST (n=14)

Type of reaction	Name of the antibiotics					
	Enrofloxacin	Tetracycline	Gentamicin	Ciprofloxacin	Penicillin	Cephalosporin
Sensitivity	9	12	13	10	7	11
Resistance	5	2	1	4	7	3
Sensitivity(%)	64.28	85.71	92.85	71.42	50.0	78.57

after implementing clean milk production strategies in dairy farm.

The California mastitis test is used to identify the specific udder quarter infected with clinical and sub clinical intra-mammary infection and is an indicator of mastitis as well as heard monitoring programme (De, 2010). The present study revealed that around 62.3 per cent of mastitis was diagnosed in hind quarters and 37.7 per cent in fore quarters of udder.

Sensitivity of antibiotics towards mastitis organism based on ABST

The dairy farmers were started to follow the clean milk production practices after the training programme which eventually leads to reduction in the incidence of mastitis from 116 to 14 during the one year period of study. Table 5 shows the antibiotic sensitivity pattern of infected milk samples. The results indicated that the mastitic pathogens were sensitive to Gentamicin, Tetracycline, Cephalosporin, Ciprofloxacin, Enrofloxacin and Penicillin as descending order of sensitivity. These results were communicated to the training beneficiaries and the concerned veterinarians who have treated the affected animals. The affected cows were treated at the earliest with specific antibiotic based on antibiogram and thereby saved the farmers from huge economic loss.

Conclusions

The capacity building programme was conducted in the selected villages pertaining to clean milk production practices which had great impact in reduced incidence of mastitis in dairy cattle. The dairy farmers were trained on mastitis detection and inputs were supplied for the detection of mastitis in the initial stage itself. The keeping quality of raw milk was improved with enhanced methylene dye reduction time. There was also considerable reduction in the somatic cell count in raw milk by the adoption of clean milk production practices and it was an indirect indication of improved microbial quality of raw milk. The study revealed that there was a drastic reduction in the occurrence of mastitis cases from 19.33 per cent to 2.4 per cent after adopting knowledge and skills on the mastitis detection and control techniques. The affected animals were treated with suitable antibiotic based on Antibiotic Sensitivity Test and saved the dairy farmers from economic loss. It was concluded that imparting knowledge on clean milk production practices to dairy farmers will eventually lead to prevention and control of mastitis under field condition.

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