Indian Journal of Animal Sciences **91** (1): 69–72, January 2021/Article

Model of convergence of stakeholders for mastitis control in Murrah buffaloes

V B DIXIT[1✉], R CHHABRA[2], H TRIPATHI[3], S KHURANA[1], N SAXENA[1], G SHRINET[2] and S SINGH[1]

ICAR-Central Institute for Research on Buffaloes, Hisar, Haryana 125 001 India

Received: 1 July 2020; Accepted: 6 April 2021

ABSTRACT

A model of convergence was developed and tested for mastitis control at village level in Murrah buffaloes. Village Chindar of Fatehabad district of Haryana was selected purposively. For this study 100 farmers who were registered members of the milk cooperative society and were contributing milk daily, were purposively selected. Freshly calved buffaloes (100) from December, 2018 to February, 2019 owned by these farmers were selected randomly for this study. As per the plan of work for testing the model, different types of interventions were made by multiple agencies collaborating together for testing the model. In this study, 400 milk samples of 100 healthy buffaloes were tested for somatic cell count (SCC) by california mastitis test (CMT) and milk culture analysis. Culturally positive samples were treated according to antibiotic sensitivity test (ABST) report. Besides interventions like trainings, public health campaigns, demonstration of CMT to the farmers was done individually. The experiment was repeated after 60 days by testing the milk samples for SCC and treating culturally positive samples according to ABST report which lead to decrease in SCC to the tune of 32%.

Keywords: Convergence, Innovative model, Mastitis, Murrah buffaloes

Many livestock extension organizations are working in Haryana in public, private, cooperatives and NGOs sectors. There is duplication of efforts with multiplicity of agencies in extension work without convergence or coordination, resulting in loss of precious resources, money, manpower, material, etc. The convergence of multi agencies aimed at promoting integrated approaches is the need of the hour. It has to be noted that without convergence of efforts by various public, private and other agencies, it is difficult to reach a large number of dairy farmers with new and improved knowledge of dairying effectively. Poor health of livestock causes economic losses while these are more serious in case of poor and landless farmers.

Mastitis is a serious disease particularly of high yielding milch buffaloes. An economic loss of over ₹ 7615.51 crores has been estimated annually because of bovine mastitis (Bansal and Gupta 2009); and mastitis has been identified as one of the major economically important diseases of dairy animals in India (Sasidhar *et al.* 2018). Prevalence rate of mastitis as reported from Tamil Nadu was comparatively higher, i.e. 12.93 and 13.09% in case of buffaloes (Thirunavukkarasu and Prabharan 1999). Clinical mastitis is characterized by overt changes in the udder or milk; however, in sub-clinical mastitis (SCM) such changes are not obvious. Sub-clinical mastitis (SCM) also accounts for severe economic losses to the dairy industry (Mdegela *et al.* 2009). However, the dairy farmers lack information about the disease, and its prevention and control at farm level causing heavy economic losses. It is therefore, essential to have strong measures for controlling mastitis working in a synergistic manner which requires the convergence of all the dairy development related organizations. Thus, a model was developed for this purpose and present study was undertaken to test this model in village conditions.

Present address: [1]ICAR-Central Institute for Research on Buffaloes, Hisar; [2]Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar; [3]ICAR, KAB-II, New Delhi. ✉Corresponding author e-mail: vbdixit @mail.com

MATERIALS AND METHODS

In Haryana, various extension services are delivered by several agencies like ICAR-Central Institute for Research on Buffaloes (CIRB), Krishi Vigyan Kendras (KVK), State Agriculture and Veterinary Universities (LUVAS & CCS HAU), Department of Animal Husbandry, Haryana and Haryana Dairy Cooperative, etc. Institutions like Veterinary University and CIRB are responsible for the generation of scientific technologies for dairy development. While agencies like Department of Animal Husbandry, KVK and Haryana Dairy Cooperatives are mainly responsible for extension services and milk collection. A model of convergence was developed. It was envisaged that all the above mentioned agencies would work together for development of technologies and mobilization of farmers for dissemination of technologies on mastitis control. Different types of interventions were introduced and their impact was studied on mastitis control. This model was tested in village Chinder of Haryana purposely as it had one of the most vibrant and profitable milk cooperative society in Haryana and the members of this society were having close interaction and shared their experiences and information with one another very frequently.

Plan of work undertaken for testing of model: To initiate the work, 100 farmers who were members of the cooperative society and were contributing milk daily were purposively selected and registered for this study. The institute registered the farmers and their animals while the cooperative society helped in identifying the buffaloes. One hundred freshly calved buffaloes owned by these farmers from December 2018 to February 2019 were selected randomly for this experiment. Further, teat-wise milk samples were drawn from 100 selected animals for this study. This work was jointly undertaken by CIRB, LUVAS, Cooperatives and Animal Husbandry Department. Farmers were individually explained about the numbering of teats as 1, 2, 3 and 4 for proper identification of samples of milk (Fig.1). Sterilized containers were distributed to all the respondents and these were also numbered as 1, 2, 3 and 4 so that the milk samples of different teats are taken in their respective containers (Fig. 2). Farmers were also allotted identification number to identify the buffaloes selected for this study.

Thus, 400 samples of 100 apparently healthy buffaloes were collected and screened for sub-clinical mastitis. Each sample was analysed for SCC by CMT and milk culture analysis was done. Culturally positive animals were treated according to Antibiotic Sensitivity Test (ABST) report. Besides this, different types of activities were jointly undertaken by CIRB, LUVAS, SDAH Cooperatives and KVK like sensitization of farmers about symptoms of mastitis, training on udder health management, improved buffalo husbandry and on some special days like women's day, Kisan Diwas, public health campaigns about cleaning of animal sheds, milker, milking and storage utensils were organized (Fig. 3). Farmers who constituted the study sample were also demonstrated individually about Calfornia Mastitis Test (CMT) by scientists of CIRB and Veterinary University.

The owners of buffaloes having higher count of somatic cells were sensitized again about mastitis management and udder health. They were also distributed 28 CMT kits for increasing their awareness and knowledge and to detect an early infection of mastitis using the kit. They were further motivated to test milk samples for sub-clinical mastitis initially, weekly, fortnightly and ultimately as and when suspected and recommended by the veterinarian. This intervention transformed awareness of farmers about mastitis and every farmer in the study sample started testing their milk samples regularly and exchanged the kits among themselves for testing the milk. Further the milk samples were analysed for SCC, CMT and milk culture analysis. Culturally positive animals were treated as per the ABST report. This procedure was repeated after about 60 days by drawing the samples from same buffaloes. These activities were also undertaken by different agencies jointly. The literature for farmers on mastitis control, improved buffalo husbandry practices was provided by LUVAS and CIRB respectively. At the end of the experiment impact analysis was done.

RESULTS AND DISCUSSION

Among animal diseases which affect the profitability of rearing animals, mastitis is considered to be one of most expensive diseases in terms of production losses. Further the affected milk is unsuitable for human consumption and is one of the sources of communicable diseases (Bardhan 2013). Mastitis is diagnosed by several methods (Emanuelson *et al*. 1987); however, CMT is the preferred test at the field level (Sharma *et al*. 2011). Early diagnosis of mastitis helps in the reduction of economic losses (Sharma *et al*. 2010). Milk drawn from affected quarters showed elevated somatic cell counts (SCC) comprising of macrophages, lymphocytes, neutrophils and epithelial cells (Sordillo *et al*. 1997). Thus, SCC was analyzed in all the samples before and after the interventions by CMT.

Therefore, in this experiment which was conducted under field conditions the efforts were made to reduce the number of SCC for mastitis control in the buffaloes. Teat wise milk samples of 100 buffaloes were drawn and analyzed for SCC. Mean somatic cell counts of all the 100 animals were calculated. The milk samples were analysed for SCC per ml of milk and their numbers ranged from 40,000 to 840,000 and mean SCC was 305,396. After duration of about 60 days and interventions as mentioned in the plan of work, teat-wise 400 milk samples of 100 animals were again drawn and were analysed for SCC. Mean SCC value was 207,619 in the milk samples (Table 1). Thus, there was reduction to the tune of 32% in the SCC after the interventions undertaken in the study. According to Smith (1996) SCC in milk from individual

Figs 1–3. Sensitizing the farmers about numbering the teats. **2**. Arranging collection of milk samples teat-wise in sterile containers. **3**. Training of farmers about clean milk production in convergence mode.

cows of less than 200,000/ml are almost always considered physiologically normal while cell counts greater than 300,000/ml generally considered indicative of the presence of inflammation. Thus, through the interventions conducted during the study quality of milk was definitely improved. The data could not be subjected to statistical analysis due to large range of SCC. Thus, log transformation of SCC values was done and in order to find out significant difference in pre and post interventions, log values were used for the application of t-test. The t-value was 4.4 and it was found to be significant. This suggested that the SCC were significantly reduced in the milk samples which were taken after the interventions. Thus, the quality of milk was improved and it ultimately helped in controlling mastitis. In a study conducted by Karabasanavar *et al*. (2019) reported that due to three field level interventional strategies post intervention period showed 77.7% reduction in Sub-Clinical Mastitis (SCM). Tanwar *et al.* (2018) reported that to control sub-clinical mastitis, measures like milkman's cleanliness regular cleaning of udder and floor are necessary. Thus, the findings are in line with the earlier studies undertaken in this regard.

Table 1. Impact of Interventions on SCC in the milk sample of respondent

Somatic cell count	Mean SCC	Transformed log values	SD	t-value
Before intervention	305,396	5.55	0.29	4.4
After intervention	207,619	4.95	0.21	

Table 2. Impact of Interventions on SCC of respondent's milk samples

Somatic cell count	Frequency of respondents before intervention	Frequency of respondents after interventions	% change in frequency of respondent
>5 Lakhs	22.0	14.00	36.36
2–5 Lakhs	46.0	36.00	21.73
< 2 Lakhs	32.0	50.00	36.10
Total	100.0	100.00	
X^2	6.9	(0.031)	

Table 3. Teat-wise effect of intervention on SCC in the milk samples of respondent

Mean somatic cell count	Mean log transformed values						
	Fore teats	Hind teats	Log value		SD		Paired t-value
Before Intervention	148889	162063	4.9	4.3	0.75	1.7	2.585**
After Intervention	106031	95079	4.5	4.5	0.76	1.4	2.354*

Changes in frequency of respondents with respect to their SCC after intervention: Respondents were categorized according to the SCC in milk samples. It was observed from table 2 that 22, 46 and 32 respondents were having >5 lakhs, 2–5 lakhs and less than 2 lakhs SCC in their milk samples respectively. While after the interventions the frequency was 14, 36 and 50. In order to find out association of interventions with the frequency of respondents having a particular level of SCC, χ^2-test was applied which was found to be significant. This suggested that there was significant change in the frequency of respondents having different range of SCC. The table revealed that there was 36.36, 21.73 and 36% change in the frequency of respondents having more than 5 Lakhs, 2–5 Lakhs and less than 2 Lakhs SCC in their milk samples. Thus, there was association between the frequency of respondents and their SCC.

Change in awareness of respondents about mastitis: Mastitis detection kit was distributed to 28 farmers having higher counts of SCC. The members were asked to exchange the kit among them for mastitis detection. Thus, each member was educated to perform the test and was asked to test weekly, fortnightly, as and when some problem was observed and finally on the recommendation of the veterinarians. Before the experiment all the respondents got it done in veterinary university on the recommendations of the doctor. But after this intervention in particular and sensitization 24, 22, 51 and 3 respondents did testing of milk samples for mastitis weekly, fortnightly, as and when some problem was identified and on the recommendations of the veterinary doctor, respectively (Table 3). Thus, it can be inferred that farmers' awareness about regular testing of milk samples for mastitis increased tremendously.

Impact of interventions on SCC teat wise: In order to see the impact of interventions on the SCC of fore-teats and hind teats, paired t-test was applied (Table 4). Mean counts of fore teats before and after interventions were compared. The mean values were 148,889 and 106,031 before and after interventions respectively. Mean SCC counts of hind teats were 162,063 and 950,79 before and after interventions respectively. The values of these SCC,

Table 4. Frequency of use of CMT before and after Intervention

Frequency of use	Before kit Intervention of CMT	After Intervention of CMT kit
Weekly	–	24
Fortnightly	–	22
As and when some problem of milk	–	51
On the recommendations	100	3
Total	100	100

Table 5. Prevalence of sub-clinical mastitis based on IDF criteria before and after intervention

No of buffaloes (n=100)/ quarters studied	Animals culturally positive	Animals showing SCC > 5 lac/ml	Quarters culturally positive	Animals showing SCM		
				SCC > 5 lac/ml and culturally positive	SCC < 5 lac/ml and culturally positive	SCC > 5 lac/ml and culturally negative
Before Intervention	42	21	85	17	25	4
After Intervention	15	4	32	2	13	2

were transformed into log values which were used to calculate t-values. Paired t-test was applied with the values of fore teats with fore teats and hind teats with hind teats before and the after interventions were calculated and were found to be significant (2.5 and 2.36 respectively). Thus, SCC was significantly reduced in fore and hind teats after the intervention. However, Tanwar *et al.* 2018 found that hind quarters were more susceptible to sub-clinical mastitis than forequarters. This suggested that these interventions definitely led towards mastitis control as the SCC were reduced after the interventions.

Prevalence of sub-clinical mastitis based on IDF criteria before and after intervention: Before intervention, on the basis of International Dairy Federation criteria, 17 animals (SCC above 500,000/ml of milk and culturally positive), 25 animals (SCC below 500,000/ml of milk but culturally positive) and 4 animals (culturally negative and SCC above 500,000/ml) were found to suffer from sub-clinical, latent and non-specific mastitis, respectively (Table 5). This indicates that 45% of the animals were showing SCM before the intervention. However, after intervention, the overall animal wise prevalence of sub-clinical mastitis was reduced to 17%. Before intervention, out of 85 culturally positive quarters, 51 were *Staphylococcus* spp. and 30 were *Streptococcus* spp. and 04 quarters were showing mixed (*Staphylococcus* + *Streptococcus*) infection. After intervention, out of 32 culturally positive quarters, 23 were *Staphylococcus* spp. and 08 were *Streptococcus* spp. and 01 quarter was showing mixed (*Staphylococcus*+ *Streptococcus*) infection. Karabasanavar (2019) reported prevalence of SCM in crossbred dairy cows and showed that out of 116 cows screened for mastitis using CMT and SCC, 22 showed SCM in at least one of their quarters: cow-wise prevalence of SCM in crossbred cows was 18.96% of the 88 quarters tested, and 51 showed SCM (quarter-wise infection 57.9%).

Presently all the agencies involved in dairy development are working in isolation. There is duplication of efforts by various agencies/organizations which is resulting in precious loss of resources, money, man power, material, etc. Therefore, convergence of all the concerned agencies/ organizations aimed at promoting integrated approach for dairy development is essential. It would help in reaching large number of farmers and providing specialized services at a lower cost. As result, it would hasten the process of dairy development in the country. Ultimately, it would help in increasing the milk production and income of farmers as minimum level of efforts/costs.

REFERENCES

Bansal B and Gupta D K. 2009. Economic analysis of bovine mastitis in India and Punjab-A review. *Indian Journal of Dairy Science* **62**(5): 337–45.

Bardhan D. 2013. Estimates of economic losses due to clinical mastitis in organized dairy farms. *Indian Journal of Dairy Science* **66**(2): 168–172.

Emanuelson U, Olsson T, Holmberg O, Hageltorn M and Mattila T 1987. Comparison of some screening tests for detecting mastitis. *Journal of Dairy Science* **70**(2): 880–87

Karabasanavar N S, Radder S K and Sivaraman G K. 2019. Field level interventions on subclinical mastitis and detection of Staphylococcus in crossbred dairy cows. *Indian Journal of Animal Science* **89**(7): 711–17.

Mdegela R H, Ryoba R, Karimuribo E D, Phir E J and Loken T 2009. Prevalence of clinical and subclinical mastitis and quality of milk on smallholder dairy farms in Tanzania. *Journal of South African Veterinary Association* **80**(3): 163–68.

Sasidhar P V K, Ramana Reddy Y and Sudhakar Rao G V. 2002. Economics of mastitis. *Indian Journal of Veterinary Science* **72**(6): 439–40.

Sharma K, Singh S P and Gautam P 2011. Personal attributes affecting training needs perception of buffalo farmers. *Indian Research Journal of Extension Education* **11**(1): 57–61.

Sharma N, Pandey V and Sudhan N A. 2010. Comparison of some indirect screening tests for detection of subclinical mastitis in dairy cows. *Bulgarian Journal of Veterinary Medicine* **13**(2): 98–103.

Smith K L. 1996. Standards for Somatic Cell in milk: Physiological and regularly mastitis newsletter. *International Dairy Federation* **144**: 7–9.

Sordillo L M. Shafer-Weaver K and De Rosa D. 1997. Immunobiology of the mammary gland. *Journal of Dairy Science* **80**(8): 1851–65.

Tanwar R S, Sarsar V, Soni N and Ahuja A. 2018. Prevalence and severity of sub-clinical mastitis in lactating cows: Detection by surf field mastitis test. *International Journal of Advance Research* **6**(2): 976–85.

Thirunavukkarasu M and Prabharan R 1999. Prevalence of clinical mastitis in bovines—A survey in Tamil Nadu. *Cheiron* **28**(3): 55–61.