RESEARCH ARTICLE

Herbal Approaches to Enhance Udder Health, Milk Quantity and Quality in Lactating Dairy Cattle: A Comparative Study

Deepthi Vedamurthy[1], Malathi Venkataramaiah[2], Pramod Dodamani[1]*, Anil Kumar Gopalpura Kadegowda[3], Madhura Yadava Reddy[1], Abhishek Mahadev Jolapure[1]

Abstract

This study evaluated the efficacy of various herbal agents as post-milking teat dips on somatic cell count, milk yield and milk composition in lactating dairy cattle for 28 days. A total of 25 lactating HF crossbred cows of 6 to 8 years of age maintained under a loose housing system were divided into five groups each having five cows; T1 (Control fresh clean water), T2 (1% potassium iodide), T3 (*Aloe vera* gel), T4 (turmeric paste) and T5 (neem oil). Among the treatment groups, *Aloe vera* gel and neem oil were significantly ($p \leq 0.05$) effective in reducing somatic cell counts and increased the milk compositional parameters, *viz.,* SNF, lactose and protein, whereas fat% did not vary between treatment groups. There was no consistent increasing trend seen in milk yield, though there was a significant ($p \leq 0.05$) difference on days 7 and 14. On days 21 and 28, milk yield did not show any significant difference between the treatment groups. The aforementioned results primarily conclude that among the herbal agents used as teat dips, *Aloe vera* gel and neem oil performed better compared to other treatment groups as they reduced somatic cell counts and positively influenced milk composition parameters. Further, studies can be conducted to explore the bacteriological cure and teat condition improvement with these teat dips.

Keywords: Herbal agents, Milk composition, Milk yield, Somatic cell count, Teat dips.

Ind J Vet Sci and Biotech (2023): 10.48165/ijvsbt.19.6.20

Introduction

Mastitis is the major economical disease in India incurring an approximate loss of Rs. 7165 crores per year (Bansal and Gupta, 2009). The primary concealed cause of disease incidence is that the teat canal remains open for at least 15-30 min after milking, allowing bacteria to enter. Cutting this passageway considerably minimizes the risk of pathogens entering the teat canal (Vavrova *et al.,* 2014). Teat dipping is one such easy, practical, and cost-effective approach to reducing the pathogen entry and burden on teats (Oliver *et al.,* 1994). It helps in keeping teat skin healthy and heals skin lesions, thus contributing to mastitis control (Hillerton, 1997). Post-milking teat dipping helps in the removal of infectious mastitis causing pathogens that might have deposited on the teat surface and those at opened teat canal that are transferred during milking from infected residues (Woolford, 2001). Teat dips available commercially are creating concern about animal welfare as they are usually made of chemicals such as chlorhexidine, hydrogen peroxide, iodine, hypochlorite, etc. The growing popularity of natural and herbal medications, their easy availability and reduced cost have led to the formulation of many polyherbal teat dips, e.g., mastidip liquid comprising *Berberis lyceum, Curcuma longa* and *Eucalyptus globulus* as chief ingredients (Waghmare *et al.,* 2013). A herbal combination of *Aloe vera,* turmeric powder, and lime is also proven effective in reducing mastitis (Thangadurai *et al.,* 2017). Though it has been known that herbal agents such as turmeric, *Aloe vera* and neem oil are effective in reducing mastitis incidence, information is scant on the effect of individual herbal agents that the farmers could directly use at their doorstep. The present study was conducted to study the effect of commonly used herbal agents that could be used as post-milking teat dip on milk yield, milk composition, and somatic cell count in lactating dairy cattle.

[1]Department of Livestock Production Management, Veterinary College, Bengaluru, Karnataka Veterinary, Animal and Fisheries Sciences University (KVAFSU), Karnataka, India

[2]Department of Poultry Science, Veterinary College, Bengaluru, KVAFSU, Karnataka, India

[3]Department of Animal Sciences, University of Agricultural Sciences, Dharwad, Karnataka, India

Corresponding Author: Pramod Dodamani, Department of Livestock Production Management, Veterinary College, Bengaluru, Karnataka Veterinary, Animal and Fisheries Sciences University (KVAFSU), Karnataka, India, e-mail: pramodkdodamani@gmail.com

How to cite this article: Vedamurthy, D., Venkataramaiah, M., Dodamani, P., Kadegowda, A. K. G., Reddy, M. Y., & Jolapure, A. M. (2023). Herbal Approaches to Enhance Udder Health, Milk Quantity and Quality in Lactating Dairy Cattle: A Comparative Study. Ind J Vet Sci and Biotech. 19(6), 99-103.

Source of support: Nil

Conflict of interest: None

Submitted 23/08/2023 **Accepted** 8/10/2023 **Published** 10/11/2023

Materials and Methods

Animals and Experimental Design

Following approval from the Institutional Animal Ethical Committee (VCH/IAEC/ 2019/99), a total of twenty-five HF crossbred dairy cows were selected from the Livestock Farm Complex, Veterinary College, Hebbal, Bengaluru (India). All the animals selected for the trial were about 6 to 8 years of age, in the fourth to sixth lactation, and had an average milk yield of 6 kg/day. These cows were randomly assigned to 5 treatments (T1- Control-Fresh clean water, T2- 1% Potassium Iodide, T3- *Aloe vera gel*, T4- Turmeric paste, and T5- Neem oil) with five animals per treatment. The post-milking teat dips were applied within one min after milking as per Oliver *et al.* (1990) . The experimental trial was conducted for 28 days.

Management of Animals

The selected cows were housed under a loose housing system and maintained under standard managemental conditions. Every day each cow was offered 3 kg of concentrates during milking time. Each cow was given 20 kg of maize and Napier as green fodder and 5 kg of ragi straw as dry fodder. Fodder was fed twice a day. The experimental animals were left to graze in the fields for 3 h a day. Clean, safe drinking water was provided *ad libitum*. The cows were milked twice a day throughout the experiment, once at morning 5.15 a.m. and the second at afternoon 4.45 p.m., through machine milking in a milking parlour. Cows were washed once daily after morning milking. Cleaning of the shed including the manger was done every day. Dung and fodder residues were cleaned regularly. Before milking, the legs were tied with a rope to prevent kicking, wiped the teats with a clean cloth, placed the teat cup on the teats, and then started the milking machine. All the utensils used for milk collection and machine milking were washed after every milking session regularly. The milking parlor was also washed and dried.

Parameters Studied

Daily recording of milk yield in kg was done. Milk samples collected on days 1, 7, 14, 21, and 28, were subjected to analysis of milk composition viz. lactose, fat, protein, and SNF, using an automatic milk analyzer (Ksheeraa-270A). Somatic cell count (SCC) was determined using direct microscopic count as per the procedure detailed by Schalm *et al.* (1971). Each animal was considered as one experimental unit for the statistical analysis. Pair-wise comparison of estimated marginal means of data was done using Univariate tests in the General Linear Model by including the data of the observations of day one as a covariate. All the means were compared at a 0.05 level of significance. The statistical analysis was done using IBM SPSS Statistics software.

Results and Discussion

The mean milk yield in kg/day of different treatments under the present study are presented in Table 1. In the first and second weeks of the experiment, the control group significantly outperformed the herbal teat dipping in terms of milk yield. However, in the third and fourth weeks of the experiment, there were no significant differences between the control and treatment groups or within the treatment groups. These results are in agreement with Waghmare *et al.* (2013) and Ramprabhu *et al.* (2014). Upon reviewing the available published papers on teat dips, it was found that teat dipping does not significantly affect milk yield. The variation noticed in the milk yield in the first week of the study could be due to variations in the stage of lactation and other animal related factors.

The indicator for monitoring the udder health is somatic cell counts. An increase in somatic cell counts could be considered an early sign of the emergence of inflammatory changes in the mammary gland (Kaswan *et al.,* 2012). A somatic Cell Count (SCC) threshold of 200,000 cells/mL along with clinical signs was used to define mastitis, *i.e.,* a quarter was classified as healthy when the milk SCC was < 200,000 cells/mL, whereas an unhealthy quarter was defined when the milk SCC was > 200,000 cells/mL (Hillerton, 1999). In the present study, on day 7, the group dipped with *Aloe vera* gel had significantly ($p \leq 0.05$) higher somatic cell counts per mL of milk and the group dipped with neem oil had the lowest counts. On day 14, the control group had the significantly ($p \leq 0.05$) highest somatic cell counts and neem oil had the

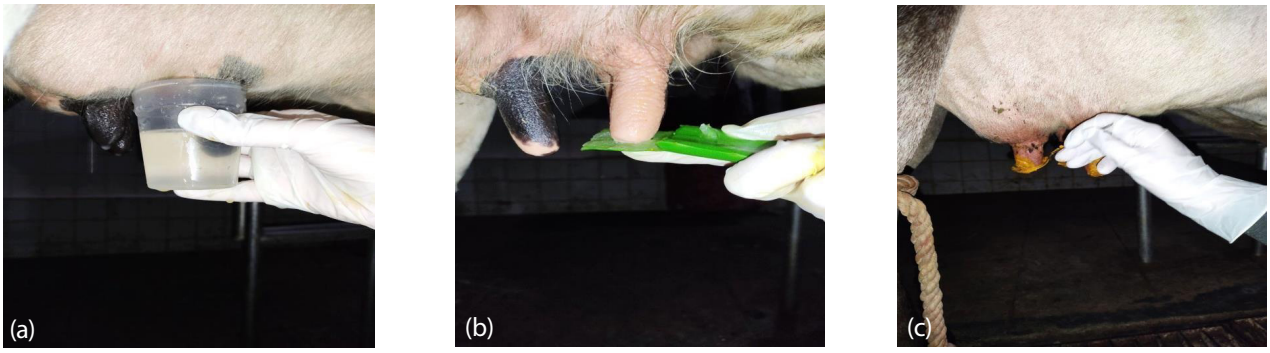

Fig. 1: Method of application of fresh clean water, potassium iodide and neem oil (a), *Aloe vera* gel (b) and turmeric paste (c)

lowest counts. On day 21, the control group had significantly ($p \leq 0.05$) highest somatic cell counts and the lowest was in the *Aloe vera* gel-dipped group. On day 28, significantly ($p \leq 0.05$) highest counts of somatic cells were in the turmeric paste-dipped group and the lowest in the *Aloe vera* gel and the potassium iodide dipped groups (Table 2). The results regarding the group dipped with *Aloe vera* gel agreed with Sharma *et al*. (2014), in which a significant reduction in somatic cell counts was found in the *Aloe vera* gel treated group, where an evaluation of comparative efficacy of *Aloe vera* and glutaraldehyde antisepsis as teat dip was done. Significant reduction in somatic cell counts in the *Aloe vera* treated group could be attributed to its antibacterial and anti-inflammatory properties (Habeeb *et al.,* 2007). The results obtained on day 28 concerning the turmeric paste dipped group are in contrast with Waghmare *et al.* (2013) and Thangadurai *et al.* (2017) in which turmeric powder was a component in the herbal paste applied. Reduced somatic cell counts might be due to the presence of other components like eucalyptus oil or *Berberis lycium* in the former and the presence of *Aloe vera* in the paste in the latter. The results obtained with the potassium iodide group in the current study are in agreement with the findings of Williamson and Lacy-Hulbert (2013), where post-milking spraying of iodine-based disinfectant was done and they noticed a significant lowering of somatic cell counts. The results are in contrast with the findings of Foret *et al.* (2005), where two barrier iodine teat dips having 14-20 ppm and 8-14 ppm of free iodine were used, and no significant difference in somatic cell counts was noticed throughout the trial. As iodine-based teat dips are germicidal in nature because of the free iodine present, it would have resulted in a significant lowering of somatic cell counts, as these cells appear as an indicator for udder infection. The results obtained with neem oil on days 7 and 14 in this study are in line with Thakur *et al.* (2018), where methanolic seed extract of neem was used where they found reduced somatic cell counts. Similarly, the reduced counts of somatic cells in the neem oil-dipped group were in accordance with Waghmare *et al.* (2013). The lowered somatic cell counts recorded in the neem oil-dipped group could be due to its anti-inflammatory and antibacterial properties (Gupta *et al.,* 2017).

The data on milk composition, *viz*., lactose %, protein %, fat % and SNF % (solids not fat) are presented in Table 3 and 4. In the first week of the experiment, milk composition parameters did not vary significantly between any of the herbal teat dip groups and the control group. At the end of the experiment, overall milk composition values were significantly higher in the *Aloe vera* dipped group as compared to all other groups. Lactose %, protein %, and SNF % were significantly higher in the *Aloe vera* and neem oil dipped groups than in the control group, the former also

Table 1: Effect of various herbal agents as post-milking teat dips on milk yield (kg/day) on days 7, 14, 21, and 28 in lactating dairy cattle (Mean ± SE)

Description		Milk yield (kg/day)			
		Day 7	Day 14	Day 21	Day 28
T1	Control-fresh clean water	6.69 ± 0.17^{a}	6.50 ± 0.26^{a}	6.16±0.23	6.48±0.38
T2	Potassium iodide (1%)	5.89 ± 0.17^{b}	5.79 ± 0.26^{ab}	6.48±0.23	6.26±0.38
T3	*Aloe vera* gel	6.17 ± 0.17^{bc}	5.70 ± 0.26^{b}	5.95±0.23	5.90±0.38
T4	Turmeric paste	6.69 ± 0.17^{a}	5.74 ± 0.26^{ab}	5.95±0.23	5.92±0.39
T5	Neem oil	6.50 ± 0.17^{ac}	6.08 ± 0.26^{ab}	6.42±0.23	6.14±0.38

Covariates appearing in the model are evaluated at this value of milk yield (kg) on day 1= 6.1856. Means with different superscripts in the same column vary significantly ($P \leq 0.05$)

Table 2: Effect of various herbal agents as post-milking teat dips on $\log_{10}$ Somatic cell counts/ mL of milk on days 7, 14, 21, and 28 in lactating dairy cattle (Mean ± SE)

Description		$\log_{10}$ Somatic cell counts/mL of milk			
		Day 7	Day 14	Day 21	Day 28
T1	Control-fresh clean water	6.10 ± 0.06^{bc}	6.39 ± 0.09^{a}	6.29 ± 0.11^{a}	6.20 ± 0.10^{ab}
T2	Potassium iodide (1%)	6.22 ± 0.05^{abc}	6.15 ± 0.10^{ab}	6.02 ± 0.13^{ab}	6.03 ± 0.12^{b}
T3	*Aloe vera* gel	6.29 ± 0.06^{a}	6.24 ± 0.09^{ab}	5.90 ± 0.15^{b}	5.91 ± 0.10^{b}
T4	Turmeric paste	6.25 ± 0.07^{ab}	6.16 ± 0.08^{ab}	6.19 ± 0.11^{ab}	6.39 ± 0.10^{a}
T5	Neem oil	6.04 ± 0.06^{c}	6.02 ± 0.10^{b}	6.03 ± 0.13^{ab}	6.14 ± 0.11^{ab}

Covariates appearing in the model are evaluated at the value on day 1 $\log_{10}$ Somatic cell count/mL of milk = 6.3278. Means with different superscripts in the same column vary significantly ($P \leq 0.05$)

being significantly higher than the latter, while the other groups did not vary significantly. Fat % was significantly higher in the *Aloe vera* group than in the neem oil dipped group, but there was no significant difference between the control group and other groups. The results recorded for the group dipped with *Aloe vera* gel in the present study are in agreement with Rathaur *et al.* (2020), who used a herbal paste containing *Aloe vera* - 3 leaves / 300 grams, Turmeric powder - 50 g, Lemon - one and a half, and Castor oil - 50 g, however, contrast results were obtained for fat % in our study. Similar findings were also recorded by Tomar *et al.* (2018), who used a combination of injection enrofloxacin and *Aloe vera* gel as a treatment modality and found increased milk composition, but fat percent in our study showed contradictory findings. The results of turmeric paste were in contrast with Rather *et al*. (2020), who used herbal paste having turmeric and showed a significant increase in milk composition. The results obtained in the group dipped with potassium iodide agreed with Rather *et al.* (2020) in which povidone-iodine was used for dipping and no significant difference was found in milk composition. No reports on the effect of milk composition for neem oil as teat dips are published. Since changes in somatic cell counts have an impact on milk composition , the increase in lactose percentage may be attributable to lower somatic cell numbers in the *Aloe vera* gel and neem oil dipped groups. Similarly, decreased milk composition in turmeric paste might be also due to increased somatic cells in that group. During infection load indicated through increased SCC, the metabolic processes within the mammary gland can be disrupted due to the presence of inflammatory cells and changes in the mammary tissue. This disruption can lead to a decrease in the availability of glucose and galactose, ultimately resulting in lower lactose synthesis and content in the milk (Cinar *et al.,* 2015).

Conclusion

Taking into consideration all the results recorded in the present study, it could be concluded that post-milking teat dipping with *Aloe vera* gel is more efficient in increasing the milk composition, *viz*., SNF, lactose, and protein, but not fat%. Among the herbal agents used in this study, turmeric paste was not as effective as neem oil and *Aloe vera* gel. Neem oil being expensive (400 rupees per kg), *Aloe vera* gel as post-milking teat dip could be recommended for use at the farmer level as it could be grown in the backyard of the house and also because of its easy application.

Acknowledgments

The authors thank the Department of Livestock Farm Complex, Veterinary College, Bengaluru, KVAFSU, Bidar for providing all necessary facilities for the conduct of the Balance the columns equally.

Table 3: Effect of various herbal agents as post milking teat dips on lactose % and protein % on days 7, 14, 21, and 28 in lactating dairy cattle (Mean±SE)

	Description	Lactose %				Protein %			
		Day 7	Day 14	Day 21	Day 28	Day 7	Day 14	Day 21	Day 28
T1	Control-fresh clean water	4.89±0.13	4.68±0.06^{c}	4.60±0.10^{b}	4.59±0.08^{c}	3.27±009	3.12±0.04^{c}	3.09±0.05^{c}	3.06±0.05^{c}
T2	Potassium Iodide (1%)	4.72±0.13	4.79±0.06^{bc}	4.80±0.10^{ab}	4.72±0.08^{bc}	3.14±0.09	3.19±0.04^{bc}	3.18±0.05^{bc}	3.16±0.05^{bc}
T3	*Aloe vera* gel	4.86±0.13	5.20±0.07^{a}	5.01±0.10^{a}	5.11±0.08^{a}	3.24±0.09	3.47±0.04^{a}	3.36±0.06^{a}	3.39±0.05^{a}
T4	Turmeric paste	4.69±0.14	4.65±0.07^{c}	4.94±0.11^{ab}	4.70±0.09^{bc}	3.11±0.10	3.10±0.05^{c}	3.20±0.06^{ac}	3.13±0.05^{bc}
T5	Neem oil	4.80±0.11	4.90±0.06^{b}	4.87±0.09^{ab}	4.84±0.07^{b}	3.20±0.08	3.27±0.04^{b}	3.25±0.05^{ab}	3.23±0.04^{b}

Covariates appearing in the model are evaluated at this value of lactose % on day 1= 4.8342 and milk protein % on day 1= 3.2140 Means with different superscripts in the same column vary significantly (P≤0.05)

Table 4: Effect of various herbal agents as post milking teat dips on the fat % and SNF % on days 7, 14, 21, and 28 in lactating dairy cattle (Mean ± SE)

	Description	Fat %				SNF %			
		Day 7	Day 14	Day 21	Day 28	Day 7	Day 14	Day 21	Day 28
T1	Control-fresh clean water	4.73±0.18	4.41±0.21^{b}	4.43±0.19	4.82±0.23^{ab}	8.91±0.23	8.55±0.11^{c}	8.42±0.14^{b}	8.36±0.13^{c}
T2	Potassium Iodide (1%)	4.74±0.18	4.83±0.20^{ab}	4.83±0.19	4.80±0.22^{ab}	8.58±0.23	8.69±0.12^{bc}	8.67±0.14^{ab}	8.60±0.13^{bc}
T3	*Aloe vera* gel	4.91±0.19	5.20±0.21^{a}	4.90±0.20	5.47±0.23^{a}	8.86±0.24	9.46±0.12^{a}	9.13±0.15^{a}	9.30±0.14^{a}
T4	Turmeric paste	4.88±0.18	4.67±0.20^{ab}	4.33±0.19	5.04±0.22^{ab}	8.49±0.25	8.44±0.13^{c}	8.72±0.16^{ab}	8.64±0.14^{bc}
T5	Neem oil	4.62±0.18	4.91±0.20^{ab}	4.41±0.19	4.54±0.22^{b}	8.73±0.21	8.93±0.10^{b}	8.90±0.13^{a}	8.80±0.12^{b}

Covariates appearing in the model are evaluated at this value of fat % on day 1=4.6624 and SNF % on day 1 = 8.7788. Means with different superscripts in the same column vary significantly (P≤0.05)

References

Bansal, B.K., & Gupta, D.K. (2009). Economic analysis of bovine mastitis in India and Punjab - A review. *Indian Journal of Dairy Science*, *62*(5), 337-345.

Cinar, M., Serbester, U., Ceyhan, A., & Gorgulu, M. (2015). Effect of somatic cell count on milk yield and composition of first and second lactation dairy cows. *Italian Journal of Animal Science*, *14*(1), 3646.

Foret, C.J., Corbellini, C., Young, S., & Janowicz, P. (2005). Efficacy of two iodine teat dips based on reduction of naturally occurring new intramammary infections. *Journal of Dairy Science*, *88*(1), 426-432.

Gupta, S.C., Prasad, S., Tyagi, A.K., Kunnumakkara, A.B., & Aggarwal, B.B. (2017). Neem (*Azadirachta indica*): An Indian traditional panacea with modern molecular basis. *Phytomedicine*, *34*, 14-20.

Habeeb, F., Shakir, E., Bradbury, F., Cameron, P., Taravati, M.R., Drummond, A.J., Gray, A.I., & Ferro, V.A. (2007). Screening methods used to determine the anti-microbial properties of Aloe vera inner gel. *Methods*, *42*(4), 315-320.

Hillerton, J.E. (1997). Milking equipment for robotic milking. *Computers and Electronics in Agriculture*, *17*(1), 41-51.

Hillerton, J.E. (1999). Redefining mastitis based on somatic cell count. *International Dairy Federation*, *345*, 4-6.

Kaswan, S., Mukherjee, J., Prasad, S., & Dang, A.K. (2012). Phagocytic activity of blood neutrophils and its relationship with plasma concentration of TNF-α, IL-6 and milk SCC in crossbred cows during early lactation. *Indian Journal of Animal Sciences*, *82*(7), 737-740.

Oliver, S.P., Gillespie, B.E., Lewis, M.J., Ingle, T.L., & Dowlen, H.H. (1994). Evaluation of chlorhexidine as a premilking teat disinfectant for the prevention of intramammary infections during lactation. *Journal of Food Protection*, *57*(7), 614-618.

Oliver, S.P., King, S.H., Lewis, M.J., Torre, P.M., Matthews, K.R., & Dowlen, H.H. (1990). Efficacy of chlorhexidine as a post milking teat disinfectant for the prevention of bovine mastitis during lactation. *Journal of Dairy Science*, *73*(8), 2230-2235.

Ramprabhu, R., Jairam, A., Karthik, K.R., & Maini, S. (2014). Evaluation of regular teat sanitization control measures for prevention of sub clinical mastitis in cattle. *American Journal of Phytomedicine and Clinical Therapeutics, 2*(9), 1212-1216.

Rathaur, A., Prakash, V., Yamini, S., Yadav, S.P., & Singh, S.J. (2020). Effect of low cost herbal combination and tri-sodium citrate treatment in subclinical mastitis affected crossbred dairy cow. *Pharma Innovation Journal*, *9*(5), 132-135.

Rather, W., Muhee, A., Bhat, R.A., Haq, A.U., Parray, O.R., Taifa, S., Nisar, M., Nabi, S.U., Hussain, S.A., & Beigh, S.A. (2020). Effect of novel teat dips on milk biochemical parameters in dairy cattle. *International Journal of Chemical Studies*, *8*(3), 2060-2063.

Schalm, O.W., Carrol, J.E., & Jain, N.C. (1971). *Bovine Mastitis*. 1st edn. Lea and Febiger, Philadelphia, USA.

Sharma, P., Kharkwal, A.C., Kharkwal, H., Abdin, M.Z., & Varma, A. (2014). A review on pharmacological properties of *Aloe vera*. *International Journal of Pharmaceutical Sciences Review and Research*, *29*(2), 31-37.

Thakur, S., Shukla, P. C., Tiwari, A., Singh, B., & Amin, A. (2018). Evaluation of therapeutic efficacy of *Nigella sativa* and *Azadaricta indica* in subclinical mastitis in buffaloes. *International Journal of Chemical Studies*, *6*(2), 2571-2573.

Thangadurai, R., Venilla, M.A., & Shanmugam, P.S. (2017). Management of mastitis in dairy cattle using herbal combination. *Journal of Krishi Vigyan*, *5*(2), 164-167.

Tomar, A., Shukla, P.C., Singh, B., & Sheikh, A.A. (2018). Comparative therapeutic efficacy of various teat dip solutions in caprine mastitis. *International Journal of Chemical Studies*, *6*(4), 123-12.

Vavrova, E., Sladek, Z., Trojan, V., & Machacek, M. (2014). Iodine teat dips: A comparison of three iodine concentrations. *Mendel Net*, *2014,* 204-206.

Waghmare, S.P., Kolte, A.Y., Ravikanth, K., & Thakur, A. (2013). Application of herbal teat dip Mastidip liquid in subclinicallymastitic animals and its role in further prevention of mastitis. *International Journal of Agricultural Sciences and Veterinary Medicine*, *1*, 43-49.

Williamson, J.H., & Lacy-Hulbert, S.J. (2013). Effect of disinfecting teats post-milking or pre-and post-milking on intramammary infection and somatic cell count. *The New Zealand Veterinary Journal*, *61*(5), 262-268.

Woolford, M. (2001). Teat-spray to halve mastitis. *Dairy Exporter*, 23.