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## Enhancing dairy farm sustainability: Insights into milking practices and economic realities among Kerala farmers

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### Abstract

The present survey was conducted among 49 dairy farmers to assess the awareness level in practices related to milking. A questionnaire was prepared and the items were categorized under six major domains. After content analysis of the items, it was found that 60.68 percent of the total respondents showed proper knowledge in practices related to herd health, 67.32 percent in practices related to cleanliness of animals and sheds, 60.47 percent in personal hygiene practices of milker, 49.94 percent in practices related to milking and 55.15 percent had knowledge of practices related to cleaning of milking utensils. On evaluating economics of cow rearing, 89.8 percent of the respondents agreed that cow rearing was not profitable. After assessing the items in all six domains, we draw the inference that, there is a need for providing awareness among farmers about various practices related to milking.

**Keywords:** Mastitis, milking practices, awareness, economics

### Introduction

According to the 2019 livestock census, India had a total of 300 million bovines, and its milk production reached a remarkable 187.75 million tonnes, solidifying its position as the largest milk producer globally. The dairy industry is a significant contributor to India's economy, valued at over ₹5 lakh crore, providing livelihoods to millions of farmers, contributing substantially to agricultural GDP, and ensuring nutritional security for the population. However, the sector faces notable challenges, particularly diseases, among which mastitis, a common and costly disease affecting livestock, poses a significant threat to the industry's productivity and profitability. Mastitis affects approximately 20 – 30 percent of India's dairy animals, resulting in reduced milk production, lower milk quality, increased treatment cost for farmers and industries at large scale. Annually the total economic loss due to mastitis is about Rs. 7165.51 crores in India (Bansal *et al.*, 2009) <sup>[1]</sup>.

Mastitis is a multi-etiological disease (Kibebew *et al.*, 2017) <sup>[2]</sup>. The majority is caused by bacteria, while only two percent of the infection is caused by yeast and moulds (FAO, 2014) <sup>[3]</sup>. Some studies suggests that trauma and extreme weather conditions can also result in mastitis (Cheng *et al.*, 2020) <sup>[4]</sup>. Mastitis can be broadly classified into two, as contagious mastitis and environmental mastitis. Bacteria causing contagious mastitis prefer to live and multiply within the udder while the environmental mastitis causing agents are found within the environment and are originating from bedding, soil and manure. These bacteria from environment gains entry into the teat canal with unhygienic practices during milking and colonize within the udder. Organisms that colonize the udder and cause mastitis can compromise the host immunity by evading the immune response or actively suppressing it. The toxins produced by these organisms damages the immune cells, inhibit phagocytosis or modulate the host's immune signaling pathways (Zigo *et al.*, 2021) <sup>[5]</sup>. This interference weakens the immune system's ability to detect and eliminate the invading pathogens causing mastitis. While the udder becoming an envoy of infection there will be activation of the humoral and antibody mediated immunity which will cause the release of more immunoglobulins in order to counteract the compacting infection caused by the bacterial

endotoxins and tight junction disruption (Egyedy *et al.*, 2022) [6].

There are many factors acting simultaneously to cause mastitis which generally involve the interplay between management practices, infectious agents, the host factors and climate (Awale *et al.*, 2012) [7]. Changes to the agents causing mastitis, such as the alterations in the virulence of pathogens or the resistance to the treatment can influence the severity of the condition (Fernandes *et al.*, 2011) [8]. Different climatic changes like high temperature, relative humidity and incorrect ventilation further contributes to the disease (FAO, 2014) [3]. Other factors that have been identified as contributing to the increased spread includes; lack of awareness, unhygienic milking practices, delay in disease detection, and incomplete or delay in treatment strategies (Sharma *et al.*, 2012) [9]. Because of the complexity of mastitis, identification of the pathogens and the risk factors at the herd level is fundamental in order to develop proper preventive and control measures (FAO, 2014) [3]. Faulty milking practices can cause great harm to mammary tissue and make the animal prone to disease (Sudhan and Sharma, 2010) [10].

Farmers awareness about the cause of mastitis and prophylactic measures, is essential to mitigate the economic losses (Audarya *et al.*, 2021) [11]. The awareness level of mastitis influences the perception and decision making ability of the farmers, which in turn will affect the different treatment regimes and various preventive measure such as post-milking teat disinfection, hygiene, milking, housing and bedding (FAO, 2014) [3]. Conducting surveys on mastitis is crucial to understand its prevalence, risk factors and economic impact, enabling the development of effective control strategies to mitigate its effect and ensure the sustainability of India's dairy industry. Hence this study was conducted to evaluate the awareness of practices related to milking among 49 randomly selected dairy farmers in different regions of Kerala.

## Materials and Methods

The study samples comprised of 49 dairy farmers selected from different districts of Kerala, *viz* Wayanad, Alappuzha, Palakkad, and Kottayam through random sampling method during the period from September 2022 to June 2023. A questionnaire was developed to evaluate the farmers awareness and knowledge levels regarding milking practices consisting of six major domains namely; practices related to herd health, cleanliness of animals and sheds, personal hygiene practices of milker, practices related to milking,

milking utensils and economics of cow rearing. The farmers were categorized into small (one to two cattle), medium (three to 10 cattle), and large (more than 10 cattle) based on the number of cattle they own (Table. 1). The collected data were compiled and analyzed using Fisher's exact test.

**Table 1:** Classification of farmers based on number of cows

Type of farmers	Frequency	Percent
Small (1-2)	23	46.90
Medium (3-10)	24	49.00
Large (Above 10)	2	4.10
Total	49	100

## Results and Discussion

The present study analysed the knowledge level regarding the various practices related to milking in 49 dairy farmers and also analysed the differences in perception of the various practices between small scale dairy farmers and medium to large scale dairy farmers. While analysing the knowledge level in practices related to herd health, it was found that practices such as regular vaccination, washing milch animals (100 percent), and checking for udder injuries (100 percent) have very high compliance in both small and medium/large farms. Regular vaccination is almost universally practiced (95.7 percent in small farms and 96.2 percent in medium/large farms) with no significant difference ( $p=1.00ns$ ). Regular deworming is more common in medium/large farms (88.5 percent) compared to small farms (73.9 percent), but the difference is not statistically significant ( $p=0.273ns$ ). This highlights their dedication to maintaining the health of their cattle. On an average 62.99 percent of the farmers were aware regarding the various practices related to herd health. This finding was in contrast with those of the (Costa *et al.*, 2013) [12] who reported that only 46 percent of the farmers were aware regarding the various procedures like vaccination, deworming, clinical examination and timely medications. While no significant differences were found in most aspects of herd level knowledge, a significant difference regarding the awareness between small scale dairy farmers and medium and large-scale farmers was found in understanding of disease transmission from humans to animals during handling ( $p$  value = 0.018) and in the awareness regarding decreased milk yield during mastitis ( $p$  value = 0.041). Record keeping is very low, especially in small farms (0%) compared to medium/large farms (3.8%), but the difference is not significant ( $p=1.00ns$ ) (Table. 2).

**Table 2:** Knowledge level in practices related to herd health

Practices	Small (n=23)		Medium/Large (n=26)		P-value	Total	
	No	%	No	%		No	%
Periodic checkup for all contagious diseases	7	30.4	9	34.6	0.995 <sup>ns</sup>	16	32.7
Disease suspected animals are isolated	8	34.8	12	46.2	0.562 <sup>ns</sup>	20	40.8
Regular deworming	17	73.9	23	88.5	0.273 <sup>ns</sup>	40	81.6
Regular vaccination	22	95.7	25	96.2	1.00 <sup>ns</sup>	47	95.9
Screening mastitis in regular basis	4	17.4	6	23.1	0.731 <sup>ns</sup>	10	20.4
Washing milch animals	23	100.0	26	100.0	-	49	100.0
Checking for injuries and bruises on the udder	23	100.0	26	100.0	-	49	100.0
Treatment given at the earliest	20	87.0	23	88.5	1.00 <sup>ns</sup>	43	87.8
Awareness regarding decrease in milk yield during mastitis	17	73.9	25	96.2	0.041*	42	85.7
Mastitis milk is not fit for consumption	17	73.9	16	61.5	0.382 <sup>ns</sup>	33	67.3
Knowledge of disease transmission from animals to human through milk	20	87.0	25	96.2	0.330 <sup>ns</sup>	45	91.8
Knowledge of disease transmission from humans to animals while handling	18	78.3	26	100.0	0.018*	44	89.8
Knowledge of disease transmission from pasteurized milk	11	47.8	13	50.0	1.00 <sup>ns</sup>	24	49.0
Herd biosecurity practiced	0	0	0	0	-	0	0
Keeping records	0	0.0	1	3.8	1.00 <sup>ns</sup>	1	2.0

\* Significant at 0.05 level; ns non-significant

In the practices related to cleanliness of animal and shed, this study revealed that, 67.32 percent of farmers showed a strong commitment to cleanliness practices for both animals and sheds. They prioritize proper ventilation in their animal sheds, recognizing the importance of creating a hygienic environment for their livestock. This finding was in contrast with those of (Robichaud *et al.*, 2019) <sup>[13]</sup> who reported that only 27 percent of the respondents ensured cleanliness of the animals and the sheds. When analyzing the cleanliness practices of farmers, it's noted that 100 percent of them have well-ventilated sheds, benefiting from ample open spaces in rural areas. However, the lowest category, at 22.4 percent,

comprises those who store straw, concentrate, and fodder inside milking sheds due to financial constraints and space limitations. Additionally, 80 percent of farmers maintain proper udder hygiene, largely attributed to government initiatives, authoritative guidance, and accumulated experience. Overall, the table highlights that most hygiene and infrastructure practices are similarly adopted by both small and medium/large dairy farms, with no significant differences observed for most practices. The only notable difference, though not statistically significant, is in the storage of straw, concrete, or fodder inside the milking shed, which is more common in small farms (Table. 3).

**Table 3:** Practices related to cleanliness of animal and shed

Practices	Small (n=23)		Medium/Large (n=26)		P-value	Total	
	No	%	No	%		No	%
Cleaning the udder with clean water only	20	87.0	24	92.3	0.655 <sup>ns</sup>	44	89.8
Using cloth after washing udder	7	30.4	13	50.0	0.245 <sup>ns</sup>	20	40.8
Using bleaching powder for floor cleaning	16	69.6	14	53.8	0.379 <sup>ns</sup>	30	61.2
Concrete floor	21	91.3	24	92.3	1.00 <sup>ns</sup>	45	91.8
Shed is ventilated	23	100.0	26	100.0	-	49	100.0
Straw, concrete or fodder is stored inside milking shed	8	34.8	3	11.5	0.086 <sup>ns</sup>	11	22.4
Type of bedding material used (rubber mat)	15	65.2	17	65.4	1.00 <sup>ns</sup>	32	65.3

ns: non-significant

A significant 60.47 percent of respondents exhibited knowledge of milker's personal hygiene practices. They are aware of the importance of maintaining clean and trimmed nails and avoiding smoking during milking, ensuring the quality and safety of the milk. This finding was in contrast with those of (Robichaud *et al.*, 2019) <sup>[13]</sup> who found that less than half of the respondents are aware of hygienic measures to be followed in the farm. A majority of 85.7 percent respondents cleaned their hands with soap and dried them

before milking. This finding is in agreement with that of (Duguma *et al.*, 2015) <sup>[14]</sup> who found that 85.19 percent of the farmers used water and detergents to wash the hands before milking. Overall, the table highlights that most hygiene and milking practices are similarly adopted by both small and medium/large dairy farms, with no significant differences observed for most practices. The only notable but non-significant differences are in the prevalence of smoking and the practice of milking when having a disease (Table. 4)

**Table 4:** Personal hygienic practices of milker

Practices	Small (n=23)		Medium/Large (n=26)		P-value	Total	
	No	%	No	%		f	%
Smoking	1	4.3	4	15.4	0.353 <sup>ns</sup>	4	15.4
Nails trimmed and clean	19	82.6	22	84.6	1.00 <sup>ns</sup>	41	83.7
While milking, milker coming in contact with body of cow	19	82.6	25	96.2	0.173 <sup>ns</sup>	44	89.8
Before milking, hands are cleaned with soap and then dried them	21	91.3	21	80.8	0.424 <sup>ns</sup>	42	85.7
Milking when having disease	15	65.2	15	57.7	0.770 <sup>ns</sup>	30	61.2
Sneezing and coughing are avoided when milking	6	26.1	10	38.5	0.382 <sup>ns</sup>	16	32.7
Cleaning of hands are done before milking of each cow	18	78.3	20	76.9	1.00 <sup>ns</sup>	38	77.6
Work wear	9	39.1	12	46.2	0.774 <sup>ns</sup>	21	42.9

ns non-significant

Only 49.94 percent of participants demonstrated sufficient knowledge about milking techniques. In small-scale farming, 78.3 percent practice full hand milking, whereas among medium and large-scale farmers, 73.1 percent adhere to this method. This indicates a need for further education in this critical aspect of dairy farming to maintain the health and productivity of milch animals. This finding was in consonance with the findings of (Heba *et al.*, 2023) <sup>[15]</sup> who reported that 50 percent of livestock farmers are aware about standard milking practices. A majority, that is 75.5 percent of respondents followed full hand milking method which is in agreement with study conducted by (Moxley *et al.*, 1978) <sup>[16]</sup> and (Bimal P. Bashir *et al.*, 2013) <sup>[17]</sup>. All the dairy farmers

practiced two times milking, which is also in agreement with findings of (Bimal P. Bashir *et al.*, 2013) <sup>[17]</sup>. All the farmers were completely milking the animals whereas a small percent of the farmers were practicing regular screening for mastitis and discarding milk during antibiotic treatment. Overall, the table highlights that most milking practices and health management measures are similarly adopted by both small and medium/large dairy farms, with no significant differences observed for most practices. The only notable practice with a near-significant difference is the adoption of dry period management practices, which are more common in medium/large farms (Table. 5).

**Table 5:** Practices related to milking techniques

Practices	Small (n=23)		Medium/Large (n=26)		P-value	Total	
	No	%	No	%		No	%
Regular screening of milk done for colour and consistency	8	34.8	10	38.5	1.00 <sup>ns</sup>	18	36.7
Regular screening of mastitis done	4	17.4	5	19.2	1.00 <sup>ns</sup>	9	18.4
Foremilk is discarded	9	39.1	7	26.9	0.542 <sup>ns</sup>	16	32.7
Potassium permanganate used for udder cleaning	9	39.1	11	42.3	1.00 <sup>ns</sup>	20	40.8
Milk discarded during antibiotic treatment	3	13.0	6	23.1	0.472 <sup>ns</sup>	9	18.4
Animal completely milked	23	100.0	26	100.0	-	49	100.0
Using of oil or ghee on teats before milking	22	95.7	25	96.2	1.00 <sup>ns</sup>	47	95.9
Dry period managemental practices	16	69.6	24	92.3	0.064 <sup>ns</sup>	40	81.6
Intramammary infusion	4	17.4	8	32.0	0.324 <sup>ns</sup>	12	25.0
Type of milking practiced Full hand Type of milking practiced Stripping	18	78.3	19	73.1	0.748 <sup>ns</sup>	37	75.5
	5	21.7	7	26.9		12	24.5

ns non-significant

A significant 55.15 percent of respondents were aware of proper milking utensil practices. Consistent understanding of these practices among all farmers is crucial to ensure milk quality and prevent contamination. Majority of the respondents sieved the milk after milking and also used detergents to clean the utensils. More than half of the respondents sun dried the milking utensils and used hot water for cleaning. But only 6.1 percent of the respondents are using milking machine. This study is in consonance with (Duguma

*et al.*, 2015) [14] who reported that 85.19 percent of the producers cleansed the milk handling equipments using warm water in combination with detergent. A significant difference regarding the awareness between small and medium/ large farmers was observed at 0.05 level in the practice of sun-drying milking utensils after cleaning, (p-value 0.021). Other practices related to milking utensils did not exhibit significant variance (Table. 6).

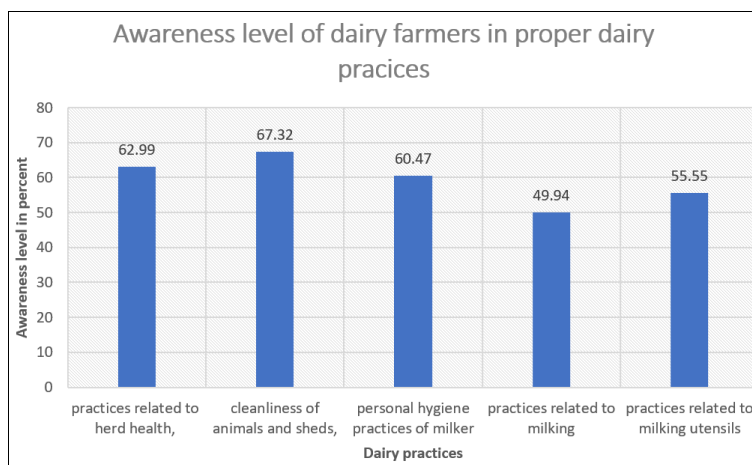
**Table 6:** Practices related to milking utensils

Practices	Small (n=23)		Medium/Large (n=26)		P-value	Total	
	No	%	No	%		No	%
Milking utensils are sundried after cleaning	10	43.5	20	76.9	0.021*	30	61.2
Milk sieved after milking	23	100.0	26	100.0	-	49	100.0
Utensils are cleaned using detergents	23	100.0	26	100.0	-	49	100.0
Milk stored inside the shed	2	8.7	5	20.0	0.419 <sup>ns</sup>	7	14.6
Back flushing of milking claw and teat cups practiced	0	0.0	3	11.5	0.237 <sup>ns</sup>	3	6.1
Hot water cleaning used for cleaning	11	47.8	13	50.0	1.00 <sup>ns</sup>	24	49.0

\* Significant at 0.05 level; ns non-significant

The finding of our survey revealed a diverse range of materials used for utensils: 55.1 percent of the respondents use aluminium, two percent use fiber, 10.2 percent use plastic, 28.6 percent use steel, two percent use a combination of steel and fiber, and two percent use a combination of steel and plastic. Interestingly, despite steel being identified as the ideal storage material in the dairy industry due to its non-corrosive nature (Dewangan *et al.*, 2015) [18], only 28.6 percent of respondents reported using it. This highlights a significant gap between the optimal material recommended for safety and quality and the materials currently in use.

After content analysis of the items, it was found that 60.68 percent of the total respondents showed proper knowledge on various practices related to herd health. Of the total respondents, 67.32 percent showed proper knowledge regarding practices related to cleanliness of animals and sheds, and 60.47 percent showed knowledge related to personal hygiene practices of milker, 49.94 percent had knowledge related to practices related to milking and 55.15 percent had knowledge of practices related to cleaning of milking utensils (Fig. 1).



**Fig 1:** Awareness level of dairy farmers in various practices related to milking

**Economic concerns**

Average income of 49 dairy farmers per month is found to be Rs 11660.4 ±1015.349 and average expenditure per month is Rs 7682 ± 537.558. Around 48 percent of the farmers reported that the total income obtained is in between 5000-10000 rupees. This finding is in contrast to the findings of (Manju *et al.*, 2023) [19] who reported only 14.6 percent of dairy farmers is in between 5001-10000 rupees group. A significant portion, accounting for 78 percent, of the total expenditure is associated with feed cost. This data is in consonance with the findings of (Sabin *et al.*, 2021) [20] and (Smitha *et al.*, 2019) [21]. This result show that dairy sector requires much more support from the government through various schemes and also need to provide alternatives to reduce the feed cost. By supporting farmers and spreading awareness, we can make the dairy sector stronger and more successful. A significant difference among small and medium/large farmers was observed in profitability at the 0.05 level (p-value 0.018) (Table.7). Among the total 49 farmers only 27 are beneficiaries of any milk cooperatives. There exists no significant difference between the small-scale farmers and medium/large scale farmers in availing support from milk cooperatives. Method of dung disposal was also assessed in the study group (Table.8). Farmers primarily manage their dung through composting, using it as manure or selling directly or after drying. In this study a significant majority of farmers, regardless of scale, prioritize using dung as manure. Small scale farmers are more reliant on using dung as manure compared to medium/large scale farmers, likely due to resource limitations and the immediate benefits of manure for crop productivity. It suggests that the immediate and well-known benefits of dung as a fertilizer are still highly valued. The usage of dung for biogas production is minimal among both small and medium/large scale farmers. This could be due to the initial investment and infrastructure required for biogas production, which may not be accessible or deemed necessary by most farmers. The low percentage of farmers using dung for biogas indicates a potential area for development and education. Promoting biogas could offer a sustainable energy source and additional income stream. Small scale farmers show a greater tendency to diversify dung usage, which could be driven by economic necessity and a higher degree of innovation to maximize resource utility.

**Table 7:** Profitability among the studied dairy farmers

Response	Small (n=23)		Medium/Large (n=26)		Total	
	f	%	f	%	f	%
No	18	78.3	26	100	44	89.8
Yes	5	21.7	0	0	5	10.2
P-value = 0.018*						

\*Significant at 0.05 level

**Table 8:** Method of dung disposal practiced

Method	Small (n=23)		Medium/Large (n=26)		Total	
	No	%	No	%	No	%
Biogas	1	4.3	1	3.8	2	4.1
Biogas, Manure	3	13.0	10	38.5	13	26.5
Manure	16	69.6	14	53.8	30	61.2
Sold	3	13.0	1	3.8	4	8.2
P-value = 0.149 <sup>ns</sup>						

ns non-significant

**Conclusion**

In conclusion, the survey results among 49 dairy farmers have provided valuable insights into their knowledge and practices in dairy farm management. The majority of participants

demonstrated awareness and competence in various aspects of dairy animal care. Notable findings include:

1. Practices such as regular vaccination, washing milch animals (100 percent), and checking for udder injuries (100 percent) have very high compliance in both small and medium/large farms. Most respondents showed proficiency in washing milch animals and inspecting udder injuries.
2. The majority of farmers prioritize proper ventilation in their animal sheds.
3. It was observed that most individuals understand the importance of maintaining clean and trimmed nails and avoiding smoking during milking.
4. All animals were consistently milked thoroughly, ensuring proper milking practices.
5. All surveyed farmers were found to be consistently sieving milk after milking and cleaning utensils with detergents.

However, there are areas of improvement, with varying levels of knowledge about milking techniques and milking utensil practices. Additionally, a significant portion of respondents expressed concerns about the profitability of cow rearing, primarily due to rising feed costs and limited government support.

In light of these findings, there is a pressing need to enhance awareness among farmers regarding milking practices and to better inform them about available government support programs. This will not only improve the overall well-being of milch animals but also help sustain the livelihoods of dairy farmers. By addressing these challenges and enhancing knowledge in specific areas, the dairy industry can thrive and continue to provide essential products for consumers.

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