



*Original Research*

## Effect of Clinical Mastitis on the Milk Yield in Dairy Cows in India

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### Abstract

The purpose of the present study was to evaluate the effect of clinical mastitis along with associated factors on milk yield in dairy cows in India by collecting the data from three organized cattle farms for the period of 2012-13. The overall prevalence of mastitis in dairy cows was observed as 29.27 %. The results of paired *t* test showed the significant reduction in daily milk yield after the occurrence of mastitis. The results of general linear model showed that the overall daily mean reduction in milk after the occurrence of mastitis was observed as 1.64 kg. The crossbred cows (2.37 kg/day) and aged cows (2.09 kg/day) showed significantly ( $p < 0.05$ ) higher reduction in milk yield due to mastitis than their indigenous (0.91 kg/day) and young lactating cows (1.19 kg/day), respectively. The longer duration of mastitis was found to be associated with higher milk losses in dairy cows.

**Key words:** Breed, Cow, General Linear Model, Mastitis, Milk Yield, Season

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### Introduction

Mastitis is characterized by physical, chemical and bacteriological changes in the milk and pathological changes in the glandular tissue of the udder (Radostits *et al.*, 2000). Mastitis is costly disease in dairy farms because of it causes heavy economic losses by reducing milk production (Biffa *et al.*, 2005) and ultimately affect the economy of the country. Annual losses in the dairy industry due to mastitis was approximately 2 billion dollars in USA and 526 million dollars in India (Varshney and Naresh, 2004). The prevalence of clinical mastitis in crossbred cows ranges between 5 to 37 % (Bangar *et al.*, 2016) and it is associated with many animal-level and environmental-level factors (Van den Borne *et al.*, 2010).

Mastitis commonly occurs in cows with high milk production and has a long lasting effect on milk yield. The cow once affected with mastitis never reached to pre-mastitis milk yield and produces less milk



throughout the rest of lactation (Lescourret and Coulon, 1994). Several studies stated that clinical mastitis has a detrimental effect on milk yield and various factors are associated with milk loss in lactating cows (Bartlett *et al.*, 1991; Houben *et al.*, 1993; Grohn *et al.*, 2004). Since the losses due to mastitis may varied from farm to farm and also may depends upon various cow-level and environmental factors, the combined statistical analysis is necessary to study the effect of mastitis on milk yield in cows across farms. Furthermore, the study of temporary fluctuation in milk yield due to mastitis, which is limited to the duration of the disease rather than whole lactation yield have special importance to examine the immediate losses due to mastitis. Duration-specific analysis of milk losses due to mastitis can avoid the overlapping of the effects of other diseases on milk yield in same lactation in dairy cows.

Therefore, the present study was carried out to study prevalence of clinical mastitis and to study effect of mastitis along with various factors on milk yield, using data of daily milk yields in dairy cows maintained at three organized cattle farms in India.

## Material and Methods

### Details of Farms

The data on mastitis in dairy cows were collected from three organized cattle farms from different geographical locations of India. The details of three cattle farms are as follows:

1. Cattle & Buffalo farm, LPM Section, Indian Veterinary Research Institute (IVRI), Bareilly (Uttar Pradesh),
2. RCDP on cattle, Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri (Maharashtra) and
3. Livestock Research Center, National Dairy Research Institute (NDRI), Karnal (Haryana).

The managerial practices at three farms were almost same. The reference period for the study was 2012 to 2013.

### Data Variables

The data on clinical mastitis in dairy cows were collected from animal history sheets, disease register and daily milk yield registers from three cattle farms. The breed of dairy cows reared at three farms was classified in to two categories i.e. crossbred and indigenous. The age at calving for each cow was recorded in years and then converted in to two categories i.e. less 5 years ( $< 5$  yrs) and 5 and above ( $\geq 5$  yrs). The season in which mastitis occurred was classified into three categories as summer (March-June), rainy (July-October) and winter (November-February). The stage of lactation was considered as early (0-3 months), mid (3-6 months) and late (6-9 months). The duration of mastitis infection was classified as up to 5 days ( $\leq 5$ ), 6 to 10 days and above 10 days ( $> 10$ ). Daily milk yield in cows was obtained from one week prior to diagnosis of mastitis to last day of the duration of mastitis. The reduction in milk yield (kg/day) for each

cow was calculated by subtracting mean milk yield (kg/day) during the period of mastitis from mean milk yield (kg/day) of week before the diagnosis of mastitis. The incomplete milk records were excluded in the analysis.

### Statistical Analysis

The descriptive analysis was done to examine the preliminary details of lactating cows and prevalence of mastitis at three cattle farms. The association of mastitis with breed, age group and parity at three farms was studied using Chi-square test. The effect of mastitis on milk yield by using daily milk yield before and after occurrence of mastitis was determined by using Paired t test. The other factors were also studied to examine their influence in milk reduction in mastitic cows. For this purpose, the data on milk reduction in the affected cows were used as dependent variable and fixed effects of farm (3 levels), breed (2 levels), age (2 levels), parity (2 levels), season (3 levels), stage of lactation (3 levels) and duration of disease (3 levels) considered as independent variables. The effects of various factors on reduction in milk yield (kg/day) in mastitic cows were evaluated using by a general linear model as follows:

$$Y_{ijklmno} = \mu + F_i + B_j + A_k + P_l + S_m + L_n + D_o + \epsilon_{ijklmno}$$

Where,  $Y_{ij}$  represent the mean daily milk reduction (kg) due to mastitis in  $o^{th}$  cow at  $i^{th}$  farm;  $\mu$  represent overall mean;  $F_i$ ,  $B_j$ ,  $A_k$ ,  $P_l$ ,  $S_m$ ,  $L_n$ ,  $D_o$  represent fixed effects of farm, breed, age group, parity, season of occurrence of mastitis, stage of lactation and duration category; and  $\epsilon_{ij}$  is distributed normally with mean, 0 and variance,  $\sigma^2$ . All statistical analyses were carried out using SPSS software version 16.0.

### Results and Discussion

The distribution of lactating cows along with prevalence of mastitis is given in Table 1.

**Table 1:** Prevalence of clinical mastitis in dairy cows at organized farms (2012-13)

Factor	IVRI Farm		MPKV Farm		NDRI Farm	
	Total	Affected (%)	Total	Affected (%)	Total	Affected (%)
<b>Overall</b>	248	71 ( 28.63)	172	60 ( 34.88)	458	126 ( 27.51)
<b>Breed</b>		*		NS		NS
Crossbred	196	62 ( 31.63)	155	55 (35.48)	263	76 ( 28.90)
Indigenous	52	09 ( 17.31)	17	05 ( 29.41)	195	50 ( 25.64)
<b>Age</b>		**		NS		**
< 5 yrs	173	41 ( 23.70)	82	25 ( 30.49)	216	45 ( 20.83)
≥ 5 yrs	75	30 ( 40.00)	90	35 ( 38.89)	242	81 ( 33.47)
<b>Parity</b>		**		*		*
Primiparous	110	18 ( 16.36)	50	11 ( 22.00)	135	28 ( 20.74)
Multiparous	138	53 ( 38.41)	122	49 ( 40.16)	323	98 ( 30.34)

\* Significant at 5 % level; \*\* Significant at 5 % level; NS-Non-significant

The overall prevalence of mastitis in dairy cows at three farms was observed as 29.27% (257/878). Overall prevalence of clinical mastitis was observed as 28.63% (71/248), 34.88% (60/172) and 27.51% (126/458) at IVRI farm, MPKV farm and NDRI farm, respectively. The chi-square analysis showed that the overall prevalence of clinical mastitis was not significant ( $p > 0.05$ ) among farms. The results of overall prevalence are in accordance of findings reported by Jingar *et al.* (2014).

The prevalence of mastitis in crossbreds was higher than indigenous cows at three farms. However, chi-square analysis revealed significant ( $p < 0.05$ ) association between mastitis prevalence and breeds only for IVRI farm. At MPKV and NDRI farm, prevalence of mastitis in both breeds was not statistically ( $p > 0.05$ ) different. In age-wise analysis, the prevalence of mastitis in cows with age less than 5 yrs was significantly lower at IVRI and NDRI farm than that of cows with age above than 5 yrs. The prevalence of mastitis was significantly ( $p < 0.05$ ) higher in multiparous cows (ranged between 30.34 to 40.16 %) at three farms than in primiparous cows (ranged between 16.36 to 22.00%). The descriptive statistics of milk yield before and after incidence of mastitis is given in Table 2. There was significant ( $p < 0.05$ ) reduction in milk yield after the incidence of mastitis at each farm. The overall milk yield due to mastitis was reduced from 10.37 kg to 8.01 kg. The significant reduction in milk yield after incidence of mastitis in dairy cows were also reported earlier (Firat 1993; Rajala and Grohn, 1998).

**Table 2:** Effect of mastitis on milk yield (kg/day) in dairy cows at three farms (2012-13)

Farm	Number of Affected cows	Mean milk yield (kg) before incidence	Mean milk yield (kg) after incidence	Paired t	p value
IVRI	55	8.23 ± 0.50	6.47 ± 0.46	14.18	< 0.001
MPKV	39	10.75 ± 0.77	8.54 ± 0.72	6.96	< 0.001
NDRI	75	11.75 ± 0.64	8.86 ± 0.61	10.5	< 0.001
Total	169	10.37 ± 0.38	8.01 ± 0.36	15.55	< 0.001

The effects of various cow-level and environmental factors on daily reduction in milk yield (kg) are presented in Table 3. Mean daily reduction in milk yield (kg) was observed as  $1.64 \pm 0.22$  kg. Rajala-Schultz *et al.* (1999) reported that the daily loss due to mastitis varied 1.0 to 2.5 kg in Finnish Ayrshire cows. In another study, Hortet and Seegers (1998) reported that average daily milk loss due to mastitis varied 0 to 3 kg. The farm had significant ( $p < 0.05$ ) effect on mean daily reduction in milk in mastitic cows. The highest reduction in milk yield (kg/day) was observed at NDRI farm ( $2.46 \pm 0.25$  kg) followed by MPKV ( $1.25 \pm 0.36$  kg) and IVRI farm ( $1.20 \pm 0.30$  kg). The mean daily reduction in milk yield was higher in crossbred cows ( $2.37 \pm 0.22$  kg) than in indigenous cows ( $0.91 \pm 0.33$  kg). Higher milk losses in crossbred cows as compared to indigenous cows were also reported by Kumar *et al.*, (2010). The high losses in crossbred cows may relate to high milk production. Additionally, crossbred cows are more susceptible

to intra-mammary infection as compared to indigenous cows (Slettbakk *et al.*, 1995; Radostits *et al.*, 2000; Sharma and Maiti, 2010).

**Table 3:** Least-square estimates of milk reduction (kg/day) in mastitis affected cows due to various factors at organized farms (2012-13)

Factors	Level	N	Mean Effect	Std. Error
<b>Grand Mean</b>		169	1.64	0.22
Farm	IVRI	55	1.20 <sup>a</sup>	0.3
	MPKV	39	1.25 <sup>a</sup>	0.36
	NDRI	75	2.46 <sup>b</sup>	0.25
Breed	Crossbred	135	2.37 <sup>b</sup>	0.22
	Indigenous	34	0.91 <sup>a</sup>	0.33
Age (years)	< 5 years	68	2.09 <sup>b</sup>	0.25
	≥ 5 years	101	1.19 <sup>a</sup>	0.31
Parity	Primiparous	29	1.34	0.38
	Multiparous	140	1.93	0.21
Season of Incidence	Summer	77	1.9	0.27
	Rainy	51	1.26	0.31
	Winter	41	1.76	0.32
Stage of Lactation	Early	63	1.84	0.27
	Mid	42	1.18	0.35
	Late	64	1.9	0.28
Duration of Disease (days)	≤ 5 days	72	1.44 <sup>a</sup>	0.28
	6 to 10 days	51	1.19 <sup>a</sup>	0.32
	> 10 days	46	2.29 <sup>b</sup>	0.31

Means bearing different superscripts (a, b) among levels for each factor differ significantly ( $p < 0.05$ ).

Similarly, the age of mastitic cows was significantly associated with mean daily milk reduction (kg) and it was revealed that it was higher in cows with age above 5 years ( $2.09 \pm 0.25$  kg) than their counterparts ( $1.19 \pm 0.31$  kg). The parity and stage of lactation did not significantly affect the milk yield in mastitic cows. Additionally, season of disease occurrence did not differ the milk yield in mastitic cows. The duration of disease was studied to find impact of it on milk yield in cows and it was revealed that milk yield was extensively affected due to course of disease. The longer duration of disease caused higher mean daily reduction in milk yield in dairy cows. The cows with mastitis more than 10 days ( $2.29 \pm 0.31$  kg) had significantly ( $p < 0.05$ ) higher mean daily reduction in milk yield other cows. The duration of mastitis of up to 5 or 10 days were at par in term of reduction in milk yield.

The estimates of milk losses from the present study indicate importance of prevention and control of mastitis at farm and field level. The high losses in dairy cows can be reduced by improving managerial and therapeutic measures (Petrovski *et al.*, 2006; Rahman *et al.*, 2009; Bangar *et al.*, 2015).

## Conclusion

The clinical mastitis causes huge reduction in milk yield in dairy cows. Furthermore, the crossbred cows had more losses in milk yield as compared to the indigenous cows which indicate that the losses may depends upon level of milk production. Higher milk losses due to mastitis were associated longer duration of disease. The study of the impact of clinical mastitis in dairy cows using the data from several locations provides the guidelines for monitoring the health status of productive animals and implementation of programs for prevention and control of this disease.

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## Competing Interests

The authors declare that they have no competing interests.

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