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Mastitis Occurrence Pattern in Dairy Cows and Importance of Related Risk Factors in the Occurrence of Mastitis

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ABSTRACT

Mastitis in dairy animals is a most prevalent disease of livestock, which is challenging to field veterinarians and dairy farmers. The present study was planned to understand the occurrence pattern of subclinical mastitis (SCM) and clinical mastitis (CM) in lactating cows at organized and unorganized farms in Jammu region with possible role of risk factors in the development of mastitis. A total 2200 quarters of 550 cows were screened by Modified California Mastitis Test (mCMT) during 2016-17. The occurrence rate of SCM and CM was 59.00% and 13.50%, respectively, while quarter-wise prevalence was 42.65% and 10.87%. In the present study, subclinical mastitis (SCM) occurrence rate was higher at unorganized farms (65.08%) than at organized farms (51.82%). Out of 550 and 650 cows at organized and unorganized dairy farms, 11.09% and 15.54% animals showed clinical mastitis signs at organized and unorganized dairy farms, respectively. In Jammu region large numbers of dairymen (63.46%) have small herds (1-5 heads/herd) and about 1.92% only dairymen's have ≥11 heads per herd that ranged from 11 to 95 heads per herd. Cows between 6 to 9 years old had higher prevalence of mastitis and showed increasing trend of mastitis with increasing age and parity. Animal in late stage of lactation showed high prevalence rate of mastitis followed by in early and mid lactation in both managemental practices. Present study concluded that higher occurrence rate of mastitis is an alarming situation for dairy farmers, hence this is the high time to control the this dreadly diseases of dairy animals.

Keywords: Clinical mastitis, Subclinical mastitis, risk factors, cow

India stands first in milk production in the world with a production of 146.3 million tons with 322 grams per day per-capita availability of milk during 2014-15 (NDDB, 2016). Indian milk production is mainly by the un-organized vast rural population, which provide alternative and consistent source of income for their livelihood round the year. Animal Husbandry and dairy development play a prominent role in the rural economy in supplementing the income of rural households, particularly, the landless and small and marginal farmers. Due to regular shrinkage of agriculture land, dependency of farmers particularly marginal and landless farmers are increasing towards dairy animal practices and their products (e.g. Milk, Milk products and dung etc.) because animal husbandry provides opportunity to generate regular cash supply to fulfill the daily needs through milk and milk products that are always demand by the urban population. Therefore, there is a need of emphasis towards increasing the fertility and productivity of dairy animals by early and accurate diagnosis and controlling or preventing the occurrence of costliest diseases (e.g. bovine mastitis) of the dairy animals for the improvement of profitability of the farmers from dairy animals.

Mastitis is the most economically important disease of dairy cattle, accounting for 38% of the total direct costs of the common production diseases (Kossaibati and Esslemont, 1997). Mastitis reduces milk and milk products in all dairy producing countries of the world (International

Dairy Federation, 1999). It is the most important deadly disease of dairy animals is responsible for heavy economic losses due to reduced milk yield (up to 70%), milk discard after treatment (9%), cost of veterinary services (7%) and premature culling (14%). Mastitis is a global problem as it adversely affects animal health, quality of milk and economics of milk production and every country including developed ones suffer huge financial losses (Sharma *et al.*, 2007). India is the highest milk producer in the world, but the per capita availability of milk still remains half of the world average, demanding strategic intervention. One of the reasons for low productivity is poor animal health, particularly, mastitis which is single largest problem in dairy animal in terms of economic losses in India. It is proved by the reports that the annual economic losses due to bovine mastitis was increased 114 folds in about 4 decades from 1962 (INR 529 million/annum) (Dhanda and Sethi, 1962) to 2001 (INR 60532 million/annum) (Dua, 2001). The dramatic increase in the economic losses due to mastitis, divert the mind of researchers, policy makers and dairy farmers toward this costliest disease to control it. In addition to heavy losses in milk quality and quantity, it also causes irreversible damage to the udder tissue and less occasional fatalities (Radostits *et al.*, 2000).

Mastitis causes heavy economic losses to dairy industry, estimated about ₹ 7165.51 crores/annum (Annual Report, 2008). In another report it has been estimated approximately ₹ 16,702 million per annum (News Letter, 2012). Heavy losses can occurs due to mastitis milk, treatment costs, discarding of milk with antibiotics, lower price for quality of milk, and death from severe inflammations (Radostitis *et al.*, 1994; Schalm *et al.*, 1971).

Bovine Mastitis is a common disease entity of dairy cows, accompanied by physical, chemical, pathological and bacteriological changes in milk and glandular tissue (Samad, 2008). Bovine mastitis, defined as inflammation of mammary gland, can have an infectious or non-infectious etiology (Bradley, 2002; Martins *et al.*, 2015). Mastitis is most often sub clinical in nature, but can manifest itself in either mild or peracute clinical forms. The causation and severity of the disease involves a complex relationship of the host, agent and the environments (Radostitis *et al.*, 1994; Schalm and Radostitis, 1994). Today it can be estimated that nearly half of the dairy cow population is suffering from clinical and subclinical mastitis so considering its high prevalence and its economic importance, study was made with the objectives to study the occurrence pattern of mastitis along different regions of Jammu and its risk related factors and hence susceptibility from isolates reacting positive from Modified California Mastitis test (mCMT) were also documented.

MATERIALS AND METHODS

STUDY AREA

The present study was carried out in three blocks (Satwari, Bishnah, and R.S. Pura) of Jammu region, and those are covered by Pakistan border. Total 25 villages were covered from all three blocks. R.S. Pura (Fig. 1) has subtropical climate and is located at 32.63°N 74.73°E. It has an average elevation of 270 metres (886 feet) and bordering with Pakistan.

Fig. 1: Map depicting the study area in Jammu region

Detection of mastitis

Mastitis prevalence study was carried out in total 25 villages house holds and dairy farms in cities (Jammu and R.S Pura) at both organized and un-organized farms and on total 4368 quarters of 1200 cows were screened for clinical and subclinical mastitis. Modified California Mastitis Test (mCMT) was used for screening of lactating dairy cattle as cow side test on the spot. In brief, a plastic paddle with four chambers or shallow cups used to perform the test. About 3 ml of milk directly striped into the labeled cups as Left Fore (LF), Left Hind (LH), Right

Fore (RF) and Right Hind (RH), from the respective four quarters. To ensure equal quantity of milk in each cup, the paddle should be tilted slightly at an angle of 45° to allow overflow of excess of the milk samples, if any in any cup. Then approximately equal quantity of the test reagent (CMT reagent, 3% Sodium lauryl sulphate) added to each cup. The mixture of the milk and reagent is shaken gently in a rotating manner of the paddle in the horizontal plane. For the interpretation of severity of mastitis, different scoring system for mCMT was considered during present study (Table 1). Based on the thickness of the gel formed by mCMT reagent-milk mixture, test results were scored as 0 (negative / trace), 1+ (weak positive), 2+ (distinct positive), and 3+ (strong positive). Positive CMT-cows were defined as having at least one CMT-positive quarter.

The prevalence was expressed in percent positive by using the following formula:

$$\text{Prevalence (\%)} = \frac{\text{No. of animals positive}}{\text{No. of animals tested}} \text{ X } 100$$

Table 1: The mCMT reaction graded on the basis intensity of gel formation

CMT score	Description	Interpretation
N (Negative)	No change	Healthy quarter
T (Trace)	Slime formed which disappeared with continuous movement of paddle	Sub-clinical mastitis
1 (Weak)	Distinct slime, but no gel formation.	Sub-clinical mastitis
2 (Distinct positive)	Viscous with gel formation, which adhered to the margin.	Serious mastitis infection
3 (Strong positive)	The gel formation with convex projection, the gel did not dislodge after swirling movement of the paddle	Serious mastitis infection

Risk factors

The standard questionnaire was prepared to collect the information (age, date of calving, parity, type of housing, Feeding and Watering, milking procedures, hygiene, previous history of mastitis/type of mastitis etc.) to find out the possible risk factors responsible for development of mastitis in lactating dairy cows in study area. The occurrence of mastitis in dairy herds results from a complex interaction between the host, environment and agent. Generally, the most common risk factors for CM in dairy herds can be divided in two groups: individual cow risk factors and risk factors from the environment. Many authors report risk factors for CM associated with farm management and hygiene management (shed and udder hygiene, poor teat condition, poor environmental hygiene, sanitation, large herd size, use of hand wash cloth, improper teat dipping), the breeding environment, milking technology, feeding, the calving season, preventive health management, host factors like (breed, high yielder, udder immunity, teat lesions, genetic resistance) and diet (Cu, Co, Zn, Selenium and Vitamin-E deficiency) amongst others have been reported to be important in the prevalence and epidemiology of both clinical and sub-clinical mastitis (Vandorp *et al.,* 1999). In an individual herd, cow factors are responsible for the differences among cows in contracting CM. A great number of individual cow-specific risk factors for CM have been identified, including breed, parity, period of lactation, udder and teat morphology, age at first calving, milk leakage, udder edema, milk production, number of milk somatic cells and reproductive disorders (Peeler *et al.,* 2000; Nyman *et al*., 2007; Valde *et al.,* 2007).

RESULTS AND DISCUSSION

Occurrence rate of sub-clinical mastitis (SCM) in Cows

In the present study, subclinical mastitis (SCM) occurrence rate was higher at unorganized farms (65.08%) than at organized farms (51.82%) (Table 2). It might be due to the fact that the farmers could not maintain proper hygiene at home due to non-scietific rearing of animals, while organized farms follow the scientific interventions. Most important concern is very high rate of permanent loss of quarters (blind teats) 9.00% in cows which is in close agreement with Singh *et al.* (1982) who have also recorded 10% prevalence of blind teats in bovines. Prevalence of SCM in bovine on animal basis was 59.00% in cows (Table 2). Very high prevalence (90.30%) of mastitis in dairy cows in Tanzania, which ranged from 33.30% to 100% between herds which almost corroborated with the findings in the present study.

Table 2: Animal -wise overall prevalence of bovine sub-clinical mastitis by mCMT

Species	Prevalence of bovine subclinical mastitis								
	Organized farms			Unorganized farms			Total		
	No. of animals screened	No. of animals positive	Percent	No. of animals screened	No. of animals positive	Percent	Total number of animals screened	Total number of animals positive	Percent
Cows	550	285	51.82	650	423	65.08	1200	708	59.00

Table 3: Quarter-wise prevalence of sub-clinical mastitis (SCM) with severity by mCMT score in dairy cows at organized farms

Quarters	Number of quarters screened	Number of functional quarters	mCMT score							
			N	T*	Total negative (N + T)	+	++	+++	Total positive	Blind quarters
LF	550	517	263 (50.87%)	82 (15.86%)	345 (66.73%)	34 (6.58%)	52 (10.06%)	86 (16.63%)	172 (33.27%)	33 (6.00%)
LH	550	490	230 (46.94%)	15 (3.06%)	245 (50.00%)	115 (23.47)	29 (5.92%)	101 (20.61)	245 (50.00%)	60 (10.91%)
RF	550	506	245 (48.42%)	31 (6.13%)	276 (54.55%)	81 (16.00%)	42 (8.30%)	107 (21.15%)	230 (45.45%)	44 (8.00%)
RH	550	487	252 (51.74%)	29 (5.95%)	281 (57.70%)	30 (6.16%)	58 (11.91%)	118 (24.23%)	206 (42.30%)	63 (11.45%)
Total	2200	2000	990 (49.50%)	157 (7.85%)	1147 (57.35%)	260 (13.00%)	181 (9.05%)	412 (20.60%)	853 (42.65%)	200 (9.09%)

*mCMT Trace score was considered as negative. N= Negative; T = Trace.

Table 4: Quarter-wise prevalence of sub-clinical mastitis (SCM) with severity by mCMT score in dairy cows at un-organized farms

Quarters	Number of quarters screened	Number of functional quarters	mCMT score							
			N	T*	Total negative (N + T)	+	++	+++	Total positive	Blind quarters
LF	650	616	304 (49.35%)	65 (10.55%)	369 (59.90%)	117 (18.99%)	73 (11.85%)	57 (9.25%)	247 (40.08%)	34 (5.23%)
LH	650	577	260 (45.06%)	62 (10.75%)	322 (55.81%)	101 (17.50%)	60 (10.40%)	94 (16.29%)	255 (44.19lf, rf%)	73 (11.23%)
RF	650	590	299 (50.68%)	55 (9.32%)	354 (60.00%)	109 (18.47%)	75 (12.71%)	52 (8.81%)	236 (40.00%)	60 (10.17%)
RH	650	585	255 (43.59%)	41 (7.01%)	296 (50.60%)	133 (22.74%)	86 (14.70%)	70 (11.96%)	289 (49.40%)	65 (10.00%)
Total	2600	2368	1118 (47.21%)	223 (9.42%)	1341 (56.63%)	460 (19.43%)	294 (12.41%)	273 (11.53%)	1027 (43.37%)	232 (8.92%)

*mCMT Trace score was considered as negative. N= Negative; T = Trace.

On quarter basis prevalence of SCM in cows at organized dairy farms was highest in left hind (LH) (50.00%) followed by right fore (RF), right hind (RH) and left fore (LF) (Table 3). On the basis of severity, maximum number of quarters (20.60%) had 3+ mCMT score and followed by 1+ and 2+ (Table 3). While at unorganized, quarter wise prevalence was highest in RH (49.40%) followed by LH, LF and RF (Table 4). Overall, present study found higher prevalence in the hind quarters, which might be due to possibilities of direct contact of teats with urine, dung and infected secretions in case of metritis. Moreover, most of quarters had 1+ mCMT score (19.41%) followed by 2+ and 3+ (Table 4). The higher incidence of quarter wise subclinical mastitis may due to poor management practices in the dairy farm, lack of awareness of the dairymen towards timely and appropriate treatment of the animals at the time of need.

The fact that bovine mastitis is a complex disease leads to the assumption that the differences in incidence risk between farms resulted from differences in environmental factors and farm management. Our results correspond with the results of other studies in which farm management had a statistical significant influence on mastitis occurrence probably due to differences in breeding environments, herd sizes, feeding, milking technology, hygiene management, milk production and genetic variations in the cows mastitis resistance. Clinical form of mastitis in dairy animals is easily diagnosed by visible changes in the udder/teats showed different clinical signs from swelling, redness, hot, pain in the udder, rough udder skin, and accumulation of pus or rupture of quarters, black coloration and gangrene of affected quarter. Subclinical form of mastitis is the early stage of clinical mastitis and therapeutic interventions at subclinical stage can control development of clinical mastitis, which can significantly reduce the economic losses due to clinical mastitis.

Occurrence rate of clinical mastitis (CM) in cows

Out of 550 and 650 cows at organized and unorganized dairy farms, 11.09% and 15.54% animals showed clinical mastitis signs at organized and unorganized dairy farms, respectively.

Quarter-wise prevalence of Clinical mastitis in lactating dairy cows was also highest (11.53%) at unorganized farms than organized farms (10.10%) (Table 6). At organized

Table 5: Animal-wise overall prevalence of clinical mastitis in dairy cows

Species	Prevalence of clinical mastitis								
	Organized farms			Unorganized farms			Total		
	No. of animals screened	No. of animals positive	Percent	No. of animals screened	No. of animals positive	Percent	Total number of animals screened	Total number of animals positive	Percent
Cows	550	61	11.09	650	101	15.54	1200	162	13.50

Table 6: Quarter wise prevalence of clinical mastitis in dairy cows

Farm type	Quarters	Number of quarters screened	Number of functional quarters	Number of quarters positive	Percent
Organized	LF	550	517	53	10.25
	LH	550	490	58	11.84
	RF	550	506	41	8.10
	RH	550	487	50	10.27
	Total	2200	2000	202	10.10
Unorganized	LF	650	616	58	9.42
	LH	650	577	57	9.88
	RF	650	590	65	11.02
	RH	650	585	93	15.90
	Total	**2600**	**2368**	**273**	**11.53**

farms LH quarters showed high prevalence (11.84%) and followed by RH, LF and RF, while at unorganized farms highest prevalence was in RH (15.90%) (Table 6). An increased rate of clinical mastitis cases was related to the use of conventional management instead of organic farming.

Clinical mastitis caused visible changes in the udder as well as in milk of affected animals, if clinical cases do not treated well in time then it may cause permanent loss of quarter(s) and heavy economic losses to dairy farmers. Clinical mastitis cases required exhaustive treatment with most effective antibiotics and supportive therapy. However, prevalence of clinical mastitis is lower than the SCM in cow.

Risk factors

The compiled data of survey on different managemental practices of dairy farms is summarized in the Table 6. From the present study surveyed data it was found that most of the farmers have <5 heads per herd (63.46%) (Table 7). In present study a total 260 dairy herds/households were attended for mastitis screening with different number of heads ranged from 1 to >11 animals per herd. In Jammu region large numbers of dairymen (63.46%) have small herds (1-5 heads/herd) and about 1.92% only dairymen's have ≥11 heads per herd that ranged from 11 to 95 heads per herd (Table 7). This might be the reason that in the present study, unorganized dairy farms have high prevalence of mastitis than organized because large numbers of farmers have small number of animals in unorganized manner without following routine mastitis diagnostic tests and prevention strategies. About 41.15% farmers have 6-10 years of experience in dairying among all dairymen, while very few numbers (2.69%) have more than 16 years of experience (Table 7). It was interesting that most small herds (66.15%) are managed only by women. The proper and complete record keeping is an important aspect in the dairy farming for implementing disease prevention and control strategies, but in our study we found that only 2.31% herds/households had good record keeping. In most of farms regular health, managemental and hygienic practices were not upto the mark. In respect to animal welfare, most of herds (91.54%) have adequate barns size for animals comfort. Most of dairymen do not wash whole udder before milking but only cleans teats. Striping as milking practice was the main technique adopted by most of farmers (86.92%). Most of farmers are not regularly adopting mastitis prevention and control practices such as use of teat dip, testing and culture of milk for mastitis, antibiotic sensitivity etc. Only 3.08% farmers have basic knowledge of mastitis in dairy animals (Table 7).

Table 7: Distribution of the management variables among 260 dairy herds/ households in Jammu district

Variables studied	Number of herds/ households	Percentage
General management		
Herd size		
1≤ n ≤5	165	63.46
6≤ n ≤10	76	29.23
11≤ n ≤20	14	5.38
n ≥ 11	05	1.92
Experience in dairying		
0-5 years	76	29.23
6-10 years	107	41.15
11-15 years	70	26.92
≥16 years	07	2.69
Labour		
Man	80	30.77
Women	172	66.15
Record keeping		
Poor	254	97.69
Good	06	2.31
Practice of weaning		
Yes	20	7.69
No	240	92.31
Calf feeding		
Residual suckling	240	92.31
Bucket feeding	20	7.69
Manure disposal		
Good	185	71.15
Poor	75	28.85

Presence of too many flies/lice		
Yes	179	68.85
No	81	31.15
Regular deworming		
Yes	35	13.46
No	225	86.54
Fly control		
Yes	74	28.46
No	186	71.54
Housing		
Barn size		
Adequate	238	91.54
Non Adequate	22	8.46
Floor type		
Concrete	129	49.61
Soil	131	50.38
Beddings		
Yes	06	2.31
No	254	97.69
Separate calf pens		
Yes	36	13.87
No	224	86.15
Animal tethered while in house		
Yes	220	84.61
No	40	15.38
Drainage		
Good	216	83.08
Poor	44	16.92
Hygiene		
Sanitary practices		
Good	66	25.38
Poor	194	74.61
Cleaning of floor with water		
Yes	115	44.23
No	145	55.77
Floor disinfectant periodically		
Yes	12	4.62
No	248	95.38
Feeding and Watering		
Grazing/ Feeding		
Indoors	218	83.85
Outdoors	42	16.15
Type of feed		
Straw/dry fodder	27	10.38
Straw/Green fodder	233	89.61
Plan of nutrition		
Good	166	63.85
Poor	94	36.15
Extra mineral supplementation		
Yes	65	25.00
No	200	76.92
Water source		
Tap	88	33.85
Bore well /pond	172	66.15
Occurrence of water scarcity		
Frequent	26	10.00
Rare	234	90.00
Milking procedures		
Milkers hand washing before milking		
Yes	92	35.38
No	168	64.62
Udder preparation		
Wash only the teats	253	97.31
Wash whole udder	07	2.69
Type of milking		
Hand milking	260	100.00
Machine milking	00	00.00
Milking techniques		
Full hand	34	13.08
Stripping	226	86.92
Feed after milking		
Yes	19	7.31
No	241	92.69

Mastitis management practices		
Basic knowledge of mastitis		
Yes	08	3.08
No	252	96.92
Use of teat dips		
Yes	06	2.31
No	254	97.69
Time of teat dipping		
Before milking	254	97.69
After milking	06	2.31
Routine use of mastitis test		
Yes	06	2.31
No	254	97.69
Mastitis cows milked last		
Yes	04	1.54
No	256	98.46
Type of first clinician for mastitis treatment		
Veterinarian	65	25.00
Paravet	195	75.00
Culture of milk of mastitis cases before treatment		
Yes	12	4.62
No	248	95.38
Culture of milk of mastitis cases during treatment		
Yes	46	17.69
No	214	82.31
Antibiotic sensitivity test before treatment		
Yes	112	43.08
No	148	56.92
Milk discarded during antibiotic treatment		
Yes	15	5.77
No	245	94.23
Dry cow therapy		
Yes	03	1.15
No	257	98.85
Average length of dry cow period		
≤60 days	178	68.46
>60 days	82	31.54
Mastitis vaccination		
Yes	00	00.00
No	260	100.00

Various possible risk factors responsible for development of mastitis in dairy cows were recorded by filling standard proforma and analyzed relationship of these factors with the occurrence of mastitis. Risk factors play an important role in the development of mastitis in dairy animals. Hence, during framing the mastitis prevention and control strategies, the regional risk factors should consider on priority. Dairy industry in India is still in its infancy towards advanced dairy farming practices. It is possible that the risk factors of the disease may be greatly influenced by management practices and poor feeding among others. Most of these dairymen have little knowledge of dairy husbandry and the management practices are therefore of sub optimal standards. Small farmers are still lacking proper record keeping of individual animal health and their production records. Lack of enough number of milk quality testing laboratories and their availability to farmers are the key factors in the spread or increasing trend of mastitis in India.

Mastitis is generally the result of contagious infections and the occurrence is attributed more to the inability of mastitis control rather than a physiologic effect. Previous studies also revealed that animals process had a high prevalence of mastitis with poor hygiene of milking (Abdurahman 2006). This might be due to absence of milking of cows with common milkers, which have cuts and chaps on their hands, udder washing and using of common udder cloths, which could be vectors of spread especially for contagious mastitis.

The association between lower prevalence of mastitis and concrete floor was recorded in the present study (Table 7). These findings were consistent with earlier comparisons between concrete floor and soil floor (Abera *et al.,* 2012), and soil and brick floor (Rahman *et al.,* 2009). It is likely that the space between bricks is hard to clean and preserves damp better than a flat soil or concrete floor that might dry faster. A whole concrete floor is probably easiest to clean

Table 8: Descriptive and bivariate χ^2 analysis of responses to questions related to the epidemiology and risk factors associated with mastitis in lactating cows

Variable	Mastitis (Organized)		χ^2	p-value	Mastitis (Unorganized)		χ^2	p-value
	Yes	No			Yes	No		
Age								
1-3 years	33	50	27.92*	0.000*	45	50	76.11*	0.000*
3-6 years	105	58			154	41		
6-9 years	131	55			192	27		
>9 years	85	33			125	16		
Parity								
1st	19	31	40.60*	0.000*	20	43	157.10*	0.000*
2nd	42	30			54	37		
3rd	47	38			74	25		
4th	52	20			71	9		
5th	24	24			50	6		
6th	56	17			83	1		
≥7	109	36			164	13		
Stage of lactation								
Early (0-2 months)	135	42	67.69*	0.000*	156	51	50.53*	0.000*
Mid (2-4 months)	76	110			147	70		
Late (>4 months)	143	44			213	13		
Milk production								
<5 Liter	47	72	43.85*	0.000*	92	56	37.25*	0.000*
5-10 Liter	134	66			193	44		
>10 Liter	173	58			231	34		
Season of calving								
Winter	65	54	6.97*	0.031*	113	35	9.67*	0.008*
Summer	130	70			177	60		
Rainy	159	72			226	39		

*Significant correlation at 5% ($p < 0.05$) level.

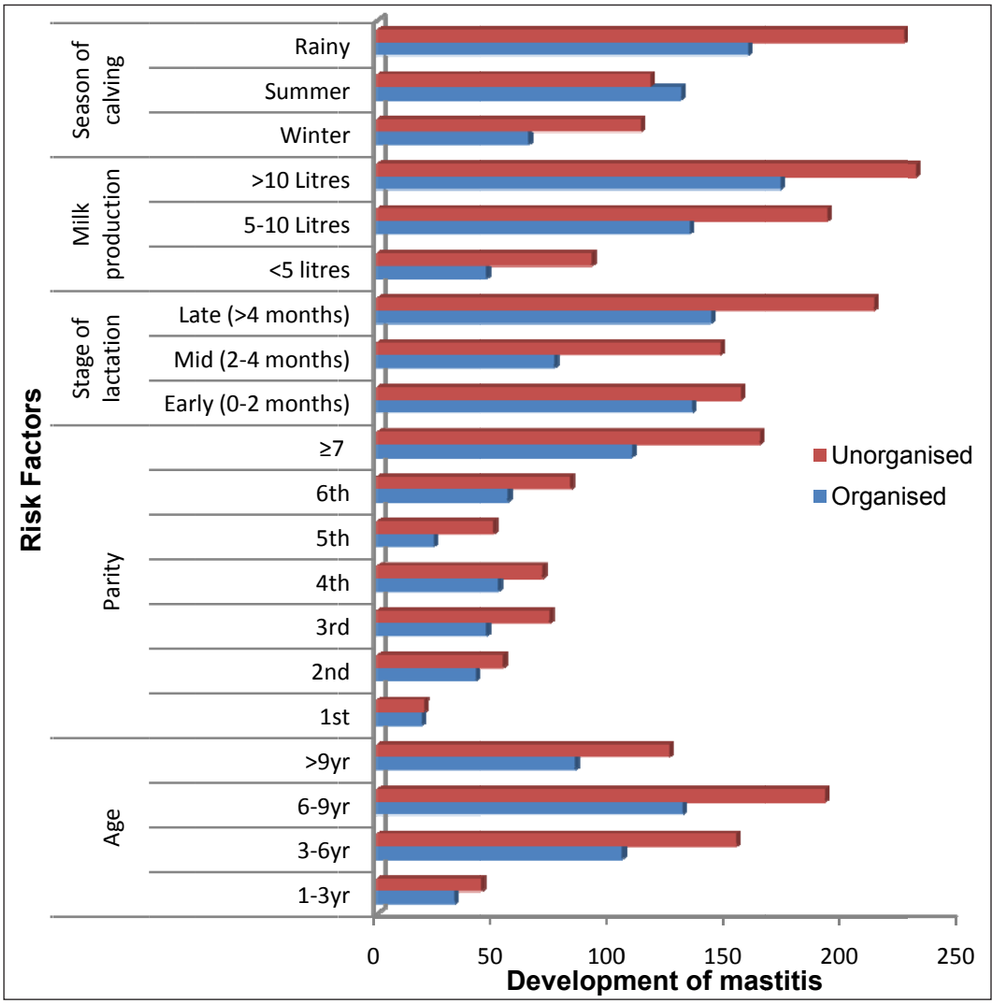

Fig. 2: Depicting descriptive and bivariate χ^2 analysis of responses to questions related to the epidemiology and risk factors associated with mastitis in and around Jammu

and dries fast which might be the reason for the lower prevalence of mastitis cases.

Previous research also showed significant impact on the mastitis prevalence due to poor condition of the floor (wet, soiled or cracked floor) (Rahman *et al.,* 2009; Mekibib *et al.,* 2010). The effect of the floor type might be explained by the fact that manure and bedding that bacterial growth is promoted by moist surroundings and environmental mastitis pathogens can be harboured in the soil (Zadoks *et al.,* 2005; Lopez-Benavides *et al.,* 2007).

To understand the relationship and impact of various risk factors on the development of mastitis in lactating dairy cows, raw data was subjected for analysis by Chi-square test and results are presented in the Table 8. It was found that animal age, parity, stage of lactation, milk productions, season of calving etc. have direct relation in

respect to development of mastitis in the dairy lactating cows at both organized and unorganized managemental practices Association of occurrence of mastitis with parity of animal, age, stage of lactation and milk production was evaluated and found to be statistically significant ($P<0.05$) (Table 8). The result was in agreement with the previous reports (Mekibib *et al.,* 2010; Haftu *et al.,* 2012; Verbeke *et al.,* 2014). Moreover, animals between 6 to 9 years old had higher prevalence of mastitis and showed increasing trend of mastitis with increasing age and parity (Table 8; Fig. 2). Animal in late stage of lactation showed high prevalence rate of mastitis followed by in early and mid lactation in both managemental practices (Table 8; Fig. 2). Higher prevelance during late lactation might be due to the fact that this period is more vulnerable to infection. There was also strong relationship between development of mastitis and higher milk production and rainy season. Occurrence of mastitis was also influenced by calving season in the present study (Table 8). However, studies have reported that calving month played an important role, and that the incidence of mastitis was greater during rainy period in the present findings in this study which almost corroborated with findings of (Breen *et al.,* 2009; Boujenane *et al.,* 2015), where incidence of mastitis was maximum during early autumn or winter and rainy season and the risk of mastitis during the winter calving may be explained by the free and open housing used in the farm under study, thus increasing the risk of infectious agents in the cow bedding.

The prevalence of SCM increases with age, increasing lactation number and parities (Islam *et al.,* 2011; Awale *et al.,* 2012; Jarassaeng *et al.,* 2012; Nibret *et al.,* 2012). It has been shown that the higher prevalence of mastitis in older animals is due to increased potency of teats and increased degree and frequency of previous exposure in multiparous old cows (Sisay *et al.,* 2012). Islam *et al.* (2011) recorded the highest prevalence in the early stage of lactation, both in crossbreds and local breeds, in Bangladesh.

The prevalence of mastitis is increasing in parallel with the development of new high milk producing breeds of Cows. Some other factors may also be contributed in the increasing incidence of mastitis like lack of awareness, delay in the detection in absence of visible signs of abnormal milk, unhygienic milking practices and, delay and incomplete treatment of clinical and chronic mastitis hence strict awareness is needed to create an effective extension service to maintain proper hygiene and other preventive measures by dairy farmers to minimise the losses due to mastitis.

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