J. Vet. Anim. Sci. (2013), Vol. 3 No. (1-2): 20-24

Cross-Sectional Epidemiological Study on Mastitis in Cows in Faisalabad, Pakistan

L. Ali[†], G. Muhammad[‡], M. Arshad[*], M. H. Rasool[*]

[†]Department of Livestock and Dairy Development, Punjab Pakistan, [‡]Department of Clinical Medicine and Surgery, [*]Department of Microbiology, Government College University, Faisalabad, Pakistan.

ABSTRACT

The present work reports some cross-sectional analytical epidemiological studies on mastitis for a total of 430 cows of different breed, ages and distributed in different villages in Tehsil Summandri of District Faisalabad, Pakistan. The epidemiological measures of association were estimated for the factors such as teat injury, evenness of floor, teat edema, blood in milk, wallowing, teat stenosis and milk leakage. Relative Risk (RR), Population Relative Risk (PRR), Attributable Rate (AR), Attributable Fraction (AF), Population Attributable Rate (PAR) and Population Attributable Fraction (PAF) calculated for all the above mentioned factors. The study indicates that the factors identified strongly predispose cows to the mastitis and must be considered for the implementation of better disease control program against mastitis in the country.

Key words: *Cross-sectional; Epidemiology; Mastitis; Cows; Faisalabad*

INTRODUCTION

Mastitis is an important disease that has huge economic implications for the dairy industry throughout the world (DeGraves and Fetrow, 1991). It affects both the quality and quantity of milk (Arshad et al., 1995). The prevalence of subclinical mastitis in dairy herds is often surprising to producers. Moreover, sub clinically infected udder quarters can develop clinical mastitis and the rate of new infections can be high (Zdunczyk et al., 2003). Annual losses in the dairy industry due to mastitis are approximately 2 billion dollars in USA and 526 million dollars in India, in which subclinical mastitis are responsible for approximately 70% of these losses (Varshney and Naresh, 2004).

Field surveys of major livestock diseases in Pakistan have indicated that mastitis is one of the most important diseases of dairy animals in the country (Ajmal, 1990; Cady et al., 1983; Hussain et al., 2005). However, little information is available in the contribution of epidemiological factors of mastitis such as teat and udder edema, teat stenosis, use of oxytocin for milk let down and milking technique. Thus information on the potential risk factors is important for planning a control strategy of this costly disease of dairy industry.

Keeping in view the economic importance of the disease, the present cross-sectional epidemiological study was conducted on mastitic cows. The epidemiological measures of association were estimated for the factors such as teat injury, evenness of floor, hard milking, folded thumb, udder edema, teat edema, blood in milk, wallowing, teat stenosis and milk leakage.

MATERIALS AND METHODS

Geographical Location

All 28 Union councils of Tehsil Summandri, District Faisalabad, Punjab, Pakistan, comprising of 133 villages were taken as study population. The time period of the study was three months. One village from each union council was randomly selected for the collection of epidemiological data. Each selected village was considered a cluster and all dairy producers in the selected village were

Corresponding Authordrmhrasooluaf@hotmail.com

included in the survey. A total of 430 cows were investigated as per livestock census.

Epidemiological Data

Relative risk (RR), Population relative risk (PRR), Attributable rate (AR), Attributable Fraction (AF), Population Attributable Rate (PAR) and Population Attributable Fraction (PAF) were computed to determine the association between mastitis and the factors related with host and management according to Thrusfield (2005). The details of calculation of these measures are indicated below.

Relative Risk (RR)

It is the ratio between rate of mastitis in exposed cows and rate of mastitis in unexposed cows.

RR = (a / a + b)/(c / c +d) where

"a" is exposed animals having mastitis

"b" is number of non-mastitic animals in the exposed group

"c" is number of mastitic animals in the unexposed group

"d" is number of non-mastitic animals in the unexposed group

Population Relative Risk (PRR)

It indicates the relative impact of the factor in the population.

PRR = [(a+c)/n]/ [(c/c+d) Where n =a+b+c+d

Attributable Rate (AR)

It is the rate of mastitis in the exposed group minus the rate in the unexposed group.

AR = [a/(a+b)]-[c/c+d)]

Attributable Fraction (AF)

It is also called as etiological fraction. It is used to know that what proportion of mastitis in the exposed group is due to the factor.

AF = (RR-1) / RR

Population Attributable Rate (PAR)

It gives the importance of a causal factor in the population and is determined by multiplying its effects (AR) by the prevalence of the factor.

PAR = [(a+b)/n] x AR

Population Attributable Fraction (PAF)

It is proportion of mastitis in the population that is attributable to the factor.

PAF = (PRR-1) PRR

RESULTS AND DISCUSSION

The factors such as teat injury, evenness of floor, hard milking, folded thumb, udder and teat edema, blood in milk, wallowing, teat stenosis and milk leakage in cows were found to be significantly associated with mastitis. The analysis of measures of association indicates that there is a relationship between the factors and prevalence of mastitis in a 2x2 contingency table (Table 1).

The Relative risk (RR) with respect to teat injury was found to be 2.13. The limits of confidence interval at 95 % level were found as 1.47 and 3.12. There is therefore, statistical association between the factor and the mastitis. The calculated AR for the factor was 0.18 which implies that 18% of the factor was attributed to the disease. The calculated Population Attributable Rate (PAR) was 0.029 which indicated 2.9% association with the disease. The Attributable Fraction (AF) was 0.532 indicating 53.2% association between teat injury and disease. The Population Attributable Fraction (PAF) provides a direct estimate of disease in the population due to present factor. The RR value with respect to evenness of floor was found to be 1.28, which indicates the association between the disease and the factor.

The RR and PRR as measured of association between hard milking and the mastitis were found to be dominant and the limits of confidence interval at 95 % level were 1.21 and 2.58. The AR and PAR value of 0.129% and 0.032% indicated that the rate of mastitis

increases with hard milking. Hard milking could be due to constriction of the teat sphincter as a result of any teat lesion or injury. Similarly, Thirunvukkarasu and Prabaharan (1998) documented that greater the epidemiological measures computed, stronger the association between the factor and the disease.

The RR of mastitis in the cows with folded thumb practices was 1.63. The limits of confidence interval at 95% level were found as 1.10 and 2.42. There is a statistical association between this factor and the mastitis. The rate of the disease in milk cows (PRR) increased by 1.136 than in cows those were milked by straight thumb techniques. AR and AF in cows attributed to folded thumb was 0.112 and 0.388 percent. The total effect in folded thumb milking practices was 0.024 (PAR) and 0.569 (PAF) percent. The value of relative risk greater than 1.00 indicates the association between the factor and the mastitis.

The RR values for udder and teat edema were 1.849, 2.679 and the confidence interval at the limits of 95 % level were found to be 1.248, 2.736 and 1.866, 3.818 respectively. Mastitis would increase by 1.156, 1.307 (PRR) times in cows having abnormality. The udder and teat AR, AF values of 0.147, 0.257 and 0.459, 0.626 percent attributed to such abnormality. The association between increased risks of clinical mastitis in both udder and teat Edema are biologically plausible. An edematous rigid teat is less likely to react normally to machine milking. Teats whose tissue elasticity is reduced may be more vulnerable to forces generated by changes in pressure during pulsation. Waage et al. (2000) also reported that the presence of udder or teat edema and blood in milk at the time of parturition was highly significant risk factor for clinical mastitis in heifers during the first 2 weeks post-partum.

The RR, PRR, AR and AF calculated for blood in milk were 1.943, 1.129, 0.167, 0.485, respectively and confidence intervals at the limits of 95 % were 1.294 and 2.924. The PAR and PAF of factor was 0.021 and 0.116. These measures suggested that the rate of mastitis between blood in the milk was many times greater than the rate of mastitis in milk without blood. The prevalence rate in cows would increase by two times than the population without blood in milk. The AR and AF in cows that may be attributed to the udder abnormalities was 14.7% and 45.9 % of mastitis. Thirunukkarasu and Prabaharan (1998); Waage et al. (2000) also reported the similar findings.

The RR and PRR calculated as measures of association between the teat stenosis and mastitis were found to be 2.797 and 1.398. Greater than 1 value of PRR indicates strong association between the factor and the mastitis. If RR is less than 1, the factor may be viewed as a sparing/putative causal factor. The limits of confidence interval at 95% level were found to be 1.96, 3.93. There is therefore statistical association between the factor and the mastitis. The larger AR values indicate greater effect of factor as 25.7 %. The calculated PAR was 0.056, indicating that the rate of mastitis in cow population can be attributed to the teat stenosis. The AF was 0.642 indicating that 64.2 % percent mastitis in cows was attributable to teat stenosis. The PAF provides direct estimates of the rate of disease due to the stenosis factor. The PAF of 0.284 calculated for teat stenosis implied that 28.4 percent of all mastitis in the cow population could be attributed to teat stenosis. The finding of the present study was also in line with those of Thirunukkarasu and Prabaharan (1998). Pyorala et al. (1992) also reported that most of the mastitis problems were often preceded by teat stenosis.

In the present study the association between wallowing and mastitis in cows was also determined. The limits of 95% confidence interval were found to be zero in cows.

Table 1 Epidemiological measures of association between factors and mastitis status in cows

Measurements of Association	Factors									
	Teat injury	Evenness of floor	Hard milking	Folded thumb	Udder edema	Teat edema	Blood in milk	Wallow-ing	Teat stenosis	Milk leakage
A: Strength										
i. Relative Risk (RR)	2.138	1.280	1.772	1.636	1.849	2.679	1.943	1.121	2.797	1.484
Confidence Interval (CI) at the limits of 95% level	1.470, 3.129	0.000	1.213, 2.585	1.104, 2.421	1.248, 2.736	1.866, 3.818	1.294, 2.924	0.00	1.96, 3.93	0.864, 2.530
ii. Population Relative Risk (PRR)	1.204	1.273	1.197	1.136	1.156	1.307	1.129	1.010	1.398	1.041
B: Effect										
i. Attributable Rate (AR)	0.189	0.044	0.129	0.112	0.147	0.257	0.167	0.024	0.257	0.093
ii. Attributable Fraction (AF)	0.532	0.218	0.435	0.388	0.459	0.626	0.485	0.108	0.642	0.326
C: Total Effect (Importance)										
i. Population Attributable Rate (PAR)	0.029	0.420	0.032	0.037	0.026	0.046	0.021	0.0015	0.056	0.007
ii. Population Attributable Fraction (PAF)	0.169	0.214	0.164	0.119	0.134	0.234	0.116	0.009	0.284	0.039

The limits of the confidence interval at 95 % level were found as 0.864, 2.530. The association between the milk leakage and the mastitis were obvious in cows. The higher values of RR (1.484) indicate the close association between the milk leakage and the mastitis. Similar findings were also reported by Thirunukkarasu and Prabaharan (1998); Waage et al. (2000).

In the present cross-sectional epidemiological study of mastitis in cows, it was concluded that all the factors were found to be significantly associated with mastitis. These findings may be helpful in the control of mastitis in the area and thus for the implementation of better disease control program against mastitis in the country.

REFERENCES

Ajmal, M. 1990. Livestock wealth of Pakistan. Proceedings of 3rd International Congress of Pakistan Veterinary Medicine Association, University Grants Commission, Islamabad Pakistan. (*Abstr*.).

Arshad, M., F.K. Qamar, M. Siddique, and S.T.A.K. Sandhu. 1995. Studies on some epidemiological aspects of bovine mastitis. Proceedings of National Seminar on Epidemiology of Livestock and Poultry Diseases, Collage of Veterinary Sciences, Lahore Pakistan. pp:16-17 (*Abstr*.).

Cady, R.A., S.K. Shah, E.C. Schermerhorn, and R.E. McDowell. 1983. Factors affecting performance of Nili-Ravi buffaloes in Pakistan. *Journal of Dairy Science*, 66: 578-586.

DeGraves, F.J. and J. Fetrow. 1991. Partial budget analysis of vaccinating dairy cattle against coliform mastitis with an *Escherichia coli* J5 vaccine. *Journal of American Veterinary Medicine Association*, 199: 451-455.

Hussain, M., M.A. Malik, Z. Fatima, and M.R. Yousaf. 2005. Participatory surveillance of livestock disease in Islamabad capital territory. International *Journal of Agriculture and Biology*, 7: 567-570.

Pyorala, S., S.H. Jourimies, and M. Mero. 1992. Clinical bacteriological and therapeutic aspects of bovine mastitis caused by aerobic and anaerobic pathogens. *British Veterinary Journal*, 148: 54-62.

Thirunvukkarasu, M., and R. Prabaharan. 1998. Epidemiologic measures of association between the incidence of mastitis and some of its predisposing factors. *Indian Veterinary Journal*, 75: 718-722.

Thrusfield, M. 2005. Determinants of disease. In: Veterinary Epidemiology. 3rd Edition Blackwell publishing Ltd, UK. pp: 76.

Varshney, J.P. and R. Naresh, 2004. Evaluation of homeopathic complex in the clinical management of udder diseases of riverine buffaloes. Homeopathy, 93: 17.

Waage, S., S.A. Odegaard, A. Lund, S. Brattgierd and T. Rothe. 2000. Case-control study of risk factors for clinical mastitis in postpartum dairy heifers. *Journal of Dairy Science*, 84: 392-399.

Zdunczyk, S., H. Zebre, and M. Hedemaker. 2003. Importance of oestrogen and oestrogen-active compounds for udder health in cattle: A review. Dtsch Tieraztl Wochenschr, 110: 461.