

HOST DETERMINANTS BASED COMPARATIVE PREVALENCE OF SUBCLINICAL MASTITIS IN LACTATING HOLSTEIN-FRIESIAN CROSS COWS AND RED CHITTAGONG COWS IN BANGLADESH

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ABSTRACT

A comparative prevalence of sub-clinical mastitis (SCM) based on host risk factors was studied by using California Mastitis Test (CMT) in 96 Holstein-Friesian cross cows (HFCC) of Abu Baker Dairy Farm at Pansha Upazilla in Rajbari district and 20 Red Chittagong cows (RCC) of Bangladesh Agricultural University Dairy Farm (BAUDF), Mymensingh during the period from January to June 2008. Out of the 116 lactating cows examined, 51 (43.97%) showed positive reactivity to CMT. Similar prevalence rate of SCM was recorded in both the HFCC (43.75%) and RCC (45.0%). The overall prevalence of SCM on the basis of lactation stages showed that all the three lactation stages had SCM but there was a tendency to increase its prevalence rates from early (30.43%), mid (32.26%) to late (69.23%) stages. The highest prevalence of SCM was recorded at late lactation stage in both the HFCC (68.75%) and RCC (71.43%) in comparison to their respective mid and early lactation stages. The parity-wise prevalence of SCM was recorded as 18.42%, 55.0%, 66.67%, 75.0% and 75.0% in HFCC whereas, it was 20.0%, 20.0%, 66.67%, 75.0% and 66.67% in RCC at their 1st, 2nd, 3rd, 4th and 5th parity, respectively. This study recorded a relationship between the increased prevalence of SCM with decreased of milk production in both the groups of lactating cows. The respective prevalence of SCM at high, medium and low level of milk production in HFC (14.29%, 33.33% and 70.59%) and RCC (14.29%, 50.00% and 71.42%) were found significantly ($p < 0.01$) correlated with milk production. An overall 19.18% quarters was affected with SCM, of which 4.31%, 7.33% and 7.38% showed mild, moderate and severe reaction to CMT. However, comparatively, higher percentage of quarter infection was recorded in HFCC (20.31%) than RCC (13.75%). It may be concluded from these observations that both the HFCC and RCC should be monitored by using CMT for the detection of SCM in order to provide rational treatment and control it to make the dairy farming profitable.

Key words: Holstein-Friesian cross-bred cows, Red Chittagong cows, Host risk factors, Sub-clinical mastitis, California Mastitis Test.

INTRODUCTION

Bovine mastitis is the costly disease to the dairy industry worldwide and it is mainly categorized into clinical mastitis (CM) and sub-clinical mastitis (SCM). The CM is characterized by signs of inflammation of the udder and changes in the milk whereas in SCM, the milk appears grossly normal, no visible signs of inflammation of the udder but the inflammatory reaction is detectable only by indirect tests like CMT and culturing milk of all quarters. It is now a well known fact that the sub-clinical mastitis (SCM) is more serious and is responsible for much greater loss to the dairy industry in Bangladesh (Kader *et al.*, 2003). Singh and Singh (1994) reported more than three times losses due to SCM as compared to clinical mastitis (CM). The annual economic losses occur due to reduced milk production alone caused by SCM in Bangladesh have been estimated to be Taka 122.6 (US \$ 2.11) million (Kader *et al.*, 2003). Besides causing huge economic losses to milk production, the SCM remain a continuous source of infection to other herd mates. If the infection persists for longer periods, then it may form a fibrous tissue barrier between the organisms and the antibiotic preparations, thus, limiting their efficacy. It is, therefore, important to know the prevalence of SCM in dairy herds and delineate the important factors responsible for it. The SCM can be known only after laboratory examination, as there are no gross inflammatory changes in the udder tissue. California Mastitis Test (CMT) has been recognized as a highly sensitive to test to detect bovine SCM (Dangore *et al.*, 2000; Sachin and Suresh 2006; Madut *et al.*, 2009). The Red Chittagong cows (RCC) is the only recognized cattle variety available in Bangladesh and recently an attention has been given on this cattle at national levels for its development and proper utilization in the livestock industry in Bangladesh. Although inland research reports on mastitis have been made on the zebu and cross-bred cattle of Bangladesh have been reviewed (Samad, 2000) but there seems to be no such report on RCC. This paper describes the comparative prevalence of SCM associated with host risk factors in HFCC and RCC.

*Part of MS research

MATERIALS AND METHODS

This study on the prevalence of SCM was carried on randomly selected 20 RCC maintained at the BAUDF, Mymensingh and 96 HFCC of a private dairy farm (Abu Baker Dairy Farm, Upazila- Pansha, District- Rajbari) during the period from January to June 2008. These randomly selected lactating cows were aged between 2 to 8 years, at different lactation stages, parity and level of milk production (Table 2).

Milk samples (2ml / quarter) from each quarter of the randomly selected apparently healthy 116 lactating cows (96 HFCC and 20 RCC) were collected in sterilized open-drop tubes. These collected milk samples were tested immediately after collection of the milk samples by using California Mastitis Test (CMT) kit (Leucocystest[®], Synbiotics Corporation, France). Each set of Leucocyst test kit contains Leucocystest Reactionlif: 1 vial of 1 liter and Leucocyst plate: 1 plate of 4 wells. The test was conducted as per the manufacturer instruction. Briefly, equal volumes (2.0 ml) commercial CMT reagent and quarter milk were mixed and the changes in milk fluidity and viscosity were observed. The interpretation of the result was done according to the instruction. Negative (0) and Trace (\pm) were considered as negative and different intensities of positive (1,2 and 3) were considered as positive (Table 1).

Table 1. Interpretation of the CMT results

Score	Visible reaction	Infection	Related with the average cellular numeration ($\times 10^3 / \text{ml}$)
Value Cross			
0 Negative (0)	Consistency normal or gray color.	Absent	100
- Trace (\pm)	Slight precipitation disappearing after stirring or purplish gray color.	Infection risk by minor pathogens.	300
1 Weak positive (1+)	Distinct precipitation but no gel formation or purple gray.	Sub-clinical mastitis	900
2 Distinct positive (2+)	Mixture thickness with a gel formation.	Sub-clinical mastitis	2700
3 Strong positive (3+)	Thick gel. Consistency of egg white color dark purple.	Sub-clinical mastitis near the clinical expression.	8100

Statistical analysis

Microsoft excels 2000 and stata 6.0 for Windows 98/95/NT were used for data analysis. Descriptive statistics were used for all the variables. Chi-square (X^2) was used for assessing the statistical associations of various factors with mastitis (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Bovine mastitis is a single most common disease syndrome in adult dairy cows, recognized manly as clinical and sub-clinical types worldwide. It is estimated that one third of all dairy cows are infected with some form of mastitis in one or more quarters. Mastitis is also associated with number of zoonotic diseases in which milk acts as a vehicle of infection (Samad, 2008). The sub-clinical mastitis (SCM) has been recognized to be more economically important than clinical mastitis (CM) worldwide including Bangladesh (Singh and Singh, 1994;

Kader *et al.*, 2003 ; Sachin and Suresh 2006). Although some research works on mastitis in HFCC have been made but reports on mastitis in RCC are limited (Samad, 2000). Therefore, an attempt was made to study the comparative prevalence of SCM with host determinants between HFCC and RCC.

Overall prevalence of SCM

The milk samples of 96 lactating HFCC and 20 RCC were screened for infection using CMT, of which 43.75% and 45.0% cows were affected with SCM (Table 2). These prevalence rates support the earlier reports of Singh and Baxi (1988) who reported 54.0% prevalence of SCM in India and Kader *et al.* (2002) who reported 46.6% SCM in cross-bred lactating cows on bacteriological examination of milk samples in Bangladesh. However, both lower (Sen *et al.*, 1996; Nooruddin *et al.*, 1997; Rahman *et al.*, 1997) and higher (Motice *et al.*, 1985; Ramachandraiah *et al.*, 1990) prevalence rates of SCM have been reported in the literature. These differences of prevalence rates of SCM might be due to difference of breeds of animals, management practices and the tests used for screening of the milk samples.

Prevalence of SCM at different stages of lactation

The prevalence of SCM was analyzed on the basis of three stages (early, mid and late) of lactation in both the HFCC and RCC and the results are presented in Table 2. It appears from the Table 2 that all the three stages of lactation in both the HFCC and RCC affected with SCM. The prevalence of SCM was recorded in 31.58%, 30.77% and 68.75% in HFCC, and 25.0%, 40.0% and 71.43% in RCC during the early, mid and late stages of lactation, respectively (Table 2). The highest prevalence of SCM was recorded during the last lactation stage in both the HFCC (68.75%) and RCC (71.43%) in comparison to their respective mid and early stages of lactation (Table 2). These results are in conformity with the earlier finding of Rahman *et al.* (1997) who reported higher prevalence of SCM during the 3rd months (34%) of lactation. However, these results contradict with Pal and Verma (1988) who reported lower prevalence of SCM in stages of lactation above five months. Review of literature revealed that the higher incidence of CM usually occurred during early stage of lactation due to high yielding enlarged status of udder which is particularly prone to infection and inflammatory process due to physiological stress strain of heavy milk production, but the prevalence of SCM could be high at late stage of lactation due long exposure time.

Prevalence of SCM on the basis of parity

The prevalence of SCM was analyzed on the basis of parity in both the HFCC and RCC (Table 2). The prevalence of SCM in HFCC was recorded as 18.42%, 55.0%, 66.67%, 75.0% and 75.0%, whereas it was 20.0%, 20.0%, 66.67%, 75.0% and 66.67% in RCC at the 1st, 2nd, 3rd, 4th and 5th parity, respectively (Table 2). It indicates that the prevalence of SCM was found highest at 4th (75.0%) and 5th (75.0%) parity in HFCC and at 4th (75.0%) parity in RCC in comparison to 1st and 2nd parity but an increasing tendency was recorded with increased of parity. This observation supports the reports of Rasool *et al.* (1985), Devi *et al.* (1997) and Dego and Tareke (2003).

Prevalence of SCM on the basis of milk production

The prevalence of SCM on the basis of milk production in both the HFCC and RCC is presented Table 2. The selected lactating cows were grouped into three on the basis of milk production (high, medium and low) and the highest prevalence of SCM was recorded in cows with low milk production in both the HFCC and RCC (Table 2). These results indicate that there is a relationship between the prevalence of SCM and decrease of milk production. These findings supports the reports of Verma (1978), Singh and Singh (1994) and Kader *et al.* (2003) who reported economic losses caused by reduction of milk production in SCM affected lactating cows.

Quarter-wise prevalence of SCM

The milk samples of 96 HFCC which consisted of 384 quarters and 20 RCC which consisted of 80 quarters samples were screened by using CMT, of which 78 (20.31%) HFCC and 11 (13.75%) RCC samples were found positive for SCM (Table 2). The quarter-wise overall prevalence of SCM was found comparatively higher at both the right front (20.69%) and right hind (24.14%) quarters in comparison to left front (15.52%) and left hind (15.52%) quarters (Table 2). However, Lalrintluangu *et al.* (2003) reported the incidence of clinical mastitis more frequently in left hind quarters (30.25%) in cows.

Table 2. Host determinants associated prevalence of sub-clinical mastitis (SCM) in lactating cows detected by California Mastitis Test (CMT)

S/N	Risk factors	Types	Holstein-Friesian cross-bred cows		Red Chittagong cows		Overall	
			No. of cows tested	Positive No. (%)	No. of cows tested	Positive No. (%)	No. of cows tested	Positive No. (%)
①	Stage of lactation	Early (6-90d)	38	12 (31.58)	8	2 (25.00)	46	14 (30.43)
		Mid (91-180d)	26	08 (30.77)	5	2 (40.00)	31	10 (32.26)
		Late (>180d)	32	22 (68.75)*	7	5 (71.43)*	39	27 (69.23)*
		Sub-total:	96	42 (43.75)	20	9 (45.00)	116	51 (43.97)
②	Parity	1	38	07 (18.42)	5	1 (20.00)	43	08 (18.60)
		2	40	22 (55.00)	5	1 (20.00)	45	23 (51.11)
		3	06	04 (66.67)	3	2 (66.67)	09	06 (66.67)
		4	04	03 (75.00)*	4	3 (75.00)*	08	06 (75.00)*
		5	08	06 (75.00)*	3	2 (66.67)	11	08 (72.73)
		Sub-total:	96	42 (43.75)	20	9 (45.00)	116	51 (43.97)
③	Milk yield+ (liter/day)	High	14	02 (14.29)	7	1 (14.29)	21	03 (14.29)
		Medium	48	16 (33.33)	6	3 (50.00)	54	19 (35.29)
		Low	34	24 (70.59)*	7	5 (71.42)*	41	29 (70.73)*
		Sub-total:	96	42 (43.75)	20	9 (45.00)	116	51 (43.97)
④	Quarter	LF	96	16 (16.67)	20	02 (11.76)	116	18 (15.52)
		LH	96	16 (16.67)	20	02 (11.76)	116	18 (15.52)
		RF	96	23 (23.96)	20	01 (05.88)	116	24 (20.69)
		RH	96	23 (23.96)	20	05 (23.50)	116	28 (24.14)
		Sub-total:	384	78 (20.31)	80	11 (13.75)	464	89 (19.18)

+HF cross cows: Low 1-5 liter, Medium 6-9 liter and High \geq 10 liter; RCC: Low 0.5-1 liter, Medium >1-2 liter and High > 2 liter *Significantly ($p < 0.01$) increased.

These results showed that stages of lactation, parity, level of milk yield and quarter location are the important host factors associated with the prevalence of SCM in cows. Therefore, this study suggests further studies to identify the environmental, pathogens and management risk factors and antibiotic sensitivity tests for the isolates as this would help to device treatment and control of SCM in dairy cows.

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