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Prevalence of sub-clinical mastitis in dairy farms

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Abstract

A total of 560 lactating cows belonging to Bangladesh Agricultural University dairy farm (n = 59): Local Zebu (L), Local × Friesian (L × F), Local × Jersey (L × J), Local × Red Chittagong Cattle (L × RCC), Local × Sahiwal (L × SL), Red Chittagong Cattle (RCC); and Central Cattle Breeding Station and Dairy Farm (n = 501): Local Zebu, L × F, SL × F, Sahiwal and Australian Friesian Sahiwal (AFS) were selected to measure prevalence of subclinical mastitis (SM). The California Mastitis Test was done and the prevalence of SM was 68% on cow basis and 57% on quarter basis. The prevalence rate was significantly higher in L × F (87%, $P < 0.05$), SL × F (88%, $P < 0.05$), L × J (100%, $P < 0.01$), AFS (89%, $P< 0.05$) and SL (100%, $P < 0.01$). The local Zebu (31%) and RCC (28%) were least susceptible to SM. SM was significantly higher in multiparous ($P < 0.05$) and older cows ($P < 0.05$). The front quarters were more prone to SM than the rear. Factors such as breed, age, parity and management may have been responsible for high prevalence of SM in both farms. (*Bangl. vet*. 2013. Vol. 30, No. 2, 70–77)

Introduction

Mastitis is inflammation of the mammary gland (Burvenich *et al*., 2007; Fox, 2009) characterized by swelling, heat, redness, hardness and pain with abnormalities in milk. It is the most costly disease to the dairy industry, because of decreased milk yield, treatment and prevention cost and finally culling of the affected cows (Bar *et al*., 2008; Hertl *et al*., 2011; Murphy *et al*., 2008). Mastitis compromises animal welfare as well as its treatment is associated with human health hazard (Fogsgaard *et al*., 2011; Rasmussen *et al*., 2011).

Mastitis is most commonly caused by the bacteria belongs to *Enterobacteria, Staphylococci, Streptococci* families (Bradley, 2002). About 75-80% mastitis is subclinical, characterized by a significantly increased leukocyte count in milk (Bradley 2002). Subclinical mastitis (SM) affects the quality, quantity of milk, damages the udder tissue and most important mastitis form to cause greatest economic loss. SM is silent usually of long duration and often remained undetected in existing poor udder health management system where lack of advisory scheme. Hence, early detection and the prevalence records of SM are important for mastitis control. Comprehensive reports on SM in Bangladesh are lacking but a prevalence of 47% was recorded (Kader *et al*., 2003), and 55% was recorded in Sahiwal cows (Ghosh *et al*., 2004). This study was undertaken to study:

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- The prevalence of SM in two intensively managed dairy farms in Bangladesh
- The involvement of breed, parity, and age with the prevalence of SM
- The problems relevant to the prevalence of SM in dairy farms.

Materials and Methods

Study area

The investigation was conducted at Bangladesh Agricultural University Dairy farm (BAUDF) and the Central Cattle Breeding Station and Dairy Farm (CCBSDF), Savar, Dhaka from January to May 2005 and June to November 2007. The farms were visited several times to collect breed, parities, ages of cows and the management practices.

Animals, housing, feeding and milking

The BAUDF consisted of 59 lactating cows: Local Zebu (L), Local × Friesian (L × F), Local × Jersey (L × J), Local × Red Chittagong Cattle (L × RCC), Local × Sahiwal (L × SL), Red Chittagong Cattle (RCC). The CCBSDF consisted of 501 cows: Local Zebu, L × F, SL × F, Sahiwal and Australian Friesian Sahiwal (AFS). The average body weights of the local and crossbred cows were 250 kg ± 15 kg and 300 kg ± 20 kg, respectively. The floor of the houses in both farms was made of bricks and cement. No bedding material was used. Stall feeding was practised in both farms in the morning and afternoon. All the cows had access to water *ad libitum*. All lactating cows were hand-milked in the morning and afternoon with their calf at feet. There was no practice of teat-dipping or dry cow therapy.

Sample collection and detection of subclinical mastitis

Fresh milk samples from each quarter of selected cows were collected aseptically in separate glass tube as described by Rosenberger (1979) at morning milking and the tube was labelled with the number of the cow. California mastitis test (CMT) was used to detect sub-clinical mastitis (SM) using the CMT test liquid and a plastic paddle with four cups according to the manual (KRUUSE® company of Denmark). The initial milk was discarded and a small amount of milk was squeezed out of each teat into the paddle. The surplus milk was tipped out of the paddle leaving 2 mL of milk in each cup. Then 3 mL of CMT test liquid was added to each cup. The paddle was gently rotated to thoroughly mix the contents. The reaction was scored as follows:

Negative (1): The mixture remained unchanged; Weak positive (2): The mixture began to coagulate and turned slightly mucus but could still be shaken; Positive (3): Movement of the mixture and unmistakable mucus formation was observed and it was still possible to tip a small portion of the mixture cut; Very positive (4): A jelly-like mucus consistency was formed, it was difficult to shake the mixture and it was no longer possible to tip any surplus mixture out.

Statistical analysis

Data were entered into Microsoft Excel® work sheets. Prevalence was defined as the number of positive cases of SM per 100 cows tested. T-test was performed to obtain the values of significance using the SPSS® software (Steel and Story, 1983).

Results and Discussion

Of 560 cows, 386 (68%) were positive to CMT and of 2059 active quarters, 1167 (57%) were positive to SM. The CMT graded SM scores were as follows: 43% as score 2, 35% as score 3 and 22% as score 4. The front-left, front-right, rear-left, and rear-right quarter infection rates were 60%, 59%, 55% and 52%, respectively**.** The prevalence of SM in L, L × F, L × SL, SL × F, RCC, L × RCC, AFS, L × J, and SL breeds were 31%, 87%, 56%, 88%, 28%, 50%, 89%, 100% and 100%, respectively (Table 1). The prevalence was significantly higher in L × F ($P < 0.05$), SL × F ($P < 0.05$), ASF ($P < 0.05$), SL ($P < 0.01$) and L × J ($P < 0.01$).

Table 1. Prevalence of California Mastitis Test (CMT)-positive cases in different breeds

Breeds	No. of tested cows	No. of CMT (+) cows	% of CMT (+) cows
Local	134	41b	30.6b
L × F	243	210a	86.7a
L × SL	48	27c	56.3c
SL × F	89	78a	87.6a
RCC	18	5b	27.8b
L × RCC	4	2d	50.0d
ASF	9	8d	88.9d
L × J	6	6d	100d
SL	9	9d	100d
Total	560	386	
Level of significance		*	*

ASF = Australian Sahiwal Friesian, F = Friesian, J = Jersey, L = Local Zebu, SL = Sahiwal, RCC = Red Chittagong Cattle. * Within columns figures with different letters differ significantly ($P < 0.05$)

The prevalence of SM in cows from 1st to 7th parity is presented in Fig. 1. The prevalence of SM was 76.4%, 82.5%, 71.7%, 92.3%, 88.0%, 86.4% and 92.3% in parities 1 to 7, respectively. The prevalence was significantly ($P < 0.05$) higher in parity 4th and above.

The prevalence of SM in cows aged 2 to 14 years was 50%, 69.8%, 64%, 68.8%, 68.5%, 65.6%, 59.6%, 62.8%, 71.1%, 75.7%, 65.2%, 66.7%, 88.6%, respectively. Cows aged 14 years and above had significantly higher ($P < 0.05$) prevalence of SM (Fig. 2).

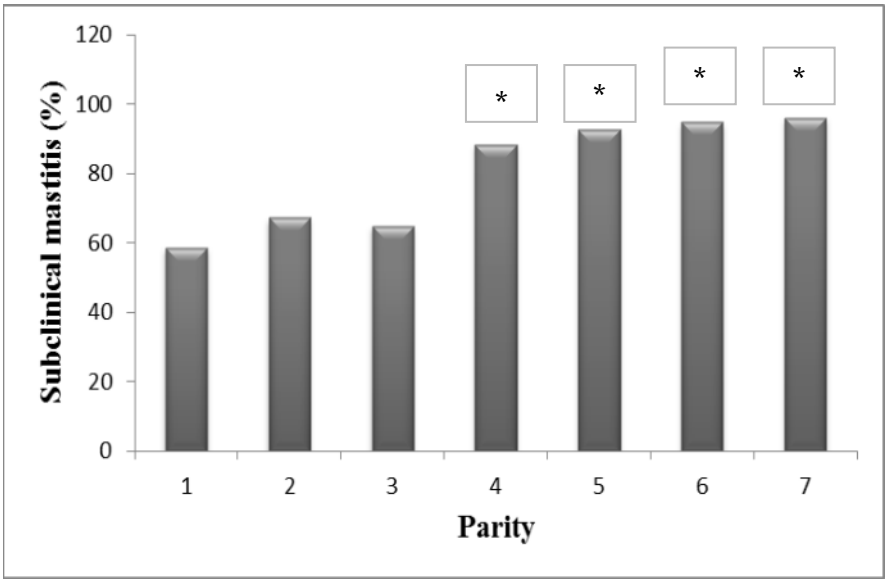

Fig. 1. The prevalence of sub-clinical mastitis in different parities, * Means P < 0.05

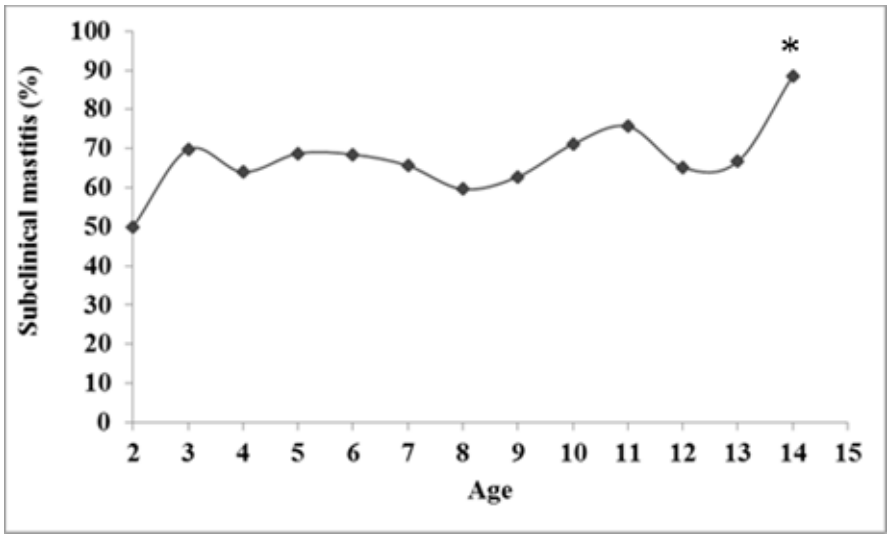

Fig. 2. The prevalence of sub-clinical mastitis in cows of different ages, *Means P < 0.05

Management

Management in BAUDF and the CCBSDF was poor. There was no post-milking teat-dipping, no udder towels were used, and there was no dry cow therapy. The milkers did not wash their hands between milking of cows. The cows were washed twice daily with fresh water, but cow dung was sticking to the teats and udder during milking.

Housing was poor. Spiders' webs were seen in the beams. In both the farms, manure was removed only twice daily and the cows had to lie on the manured floor. No

disinfectant was regularly used to disinfect the floor. The floors were not regularly washed and were embedded with algae.

Combined effect of breed, age, parity and management were responsible for high prevalence of SM in both BAUDF and CCBSDF. The prevalence of SM was significantly higher in L × F, SL × F, L × J, AFS crosses and in SL breed. The L and RCC were least susceptible to SM. Older (over 14 years) and higher parity cows (Over 4) had significantly higher prevalence of SM.

Management of the herd and hygienic milking are considered important risk factors for SM (Kivaria *et al.,* 2004; Sarkar *et al*., 2013). The management and hygienic conditions of the farms were poor, which might lead to higher susceptibility to SM. Despite these L, RCC, L × RCC, L × SL were less susceptible to SM with least susceptibility of pure L and RCC cows. Our study supports Kader *et al*. (2003); Hossoin (2004) measured the prevalence of SM in L as 45.5% & 25%, respectively, compared with our finding of 31%. However, difference in the prevalence might be due to seasonal and management variations, number of animals observed. In contrast, higher prevalence was recorded in L × F, SL × F, AFS, which is important for culling (Bell *et al*., 2010). It would be interesting to investigate the reasons for higher resistance of L, RCC and less resistance of Holstein-Friesian cows. Genomic influence studies on mastitis are emerging (He *et al*., 2011; Pighetti *et al*., 2011; Khatun *et al*., 2013). Somatic cell count (SCC) has significant genetic association for SM either in challenged *E. coli* mastitis (Khatun *et al*., 2013) or whole genome study (Minozzi *et al*., 2011). Hence, our local zebu and zebu cross can be investigated in regard to SCC level for SM, which would be the basis for further genomic study. However, number of total cows for L × RCC, L × J, ASF and SL were less, which should be increased in future to get more significant result.

The increase in SM with age is consistent with other studies (Kader *et al*., 2003; Ghosh *et al*., 2004; Radostits *et al*., 2000). The fluctuation might be due to variation in the number of cows in different age groups (Fig. 2). Increased age predisposes the cow to exposure of infection with mastitis pathogens and decreases the potency of the teat sphincter (Pankey *et al*., 1991). In contrast younger cows possess significantly better polymorphonuclear leukocyte function than multiparous cows (Dulin *et al*., 1988; Hogan *et al.,* 1989). SM increases with parity (Kader *et al*., 2003; Mungube *et al*, 2004; Nooruddin *et al*., 1997; Sarkar *et al*., 2013). Our study found same findings where cows in 4th parity and above had significantly higher prevalence of SM than other parities. The mean prevalence of SM in cows (68%) is higher than Ghosh *et al*. (2004; 55%); Gianneechini *et al*. (2002; 52%). The quarter prevalence (57%) was close to Kader *et al*. (2003; 46.6%); Jin *et al.* (2000; 55.5%). The differences might be due to hygienic practice, number of cows observed and season.

Post-milking teat dipping (Erskine and Eberhart, 1990), milker preparation and dry cow therapy reduce the prevalence of SM (Shem *et al*., 2001; Kivaria *et al*., 2004; Sarkar *et al*., 2013), but were not practised in the farms. Moreover lack of routine detection of SM (Busato *et al*., 2000), large herd size (Kivaria *et al*., 2004; Romain *et al*., 2000), water

scarcity, residual suckling, dirty floor embedded with algae, delay in manure removal, no use of disinfectant may have aggravated the condition. Poor management and compromised animal welfare affect the productivity of farms (Costa *et al*., 2013; Husfeldt *et al*., 2012). Good management (Sarkar *et al*., 2013), herbal therapy (Fang *et al*., 1993), dry-cow therapy and teat dipping can markedly reduce the incidence of SM.

In conclusion, the prevalence of SM was significantly higher in L × F, SL × F, L × J, AFS crosses and in SL cows. The L and RCC were least susceptible to SM. Multiparous cows (over 4th parity) and older cows (over 14 years) were significantly more susceptible to SM. Good management might reduce the prevalence of SM in Bangladesh.

References

Bar D, Tauer LW, Bennett G, Gonzalez RN, Hertl JA, Schukken YH, Schulte HF, Welcome FL, Grohn YT 2008: The cost of generic clinical mastitis in dairy cows as estimated by using dynamic programming. *Journal of Dairy Science* **91** 2205-2214.

Bell MJ, Wall E, Russell G, Roberts DJ, Simm G 2010: Risk factors for culling in Holstein-Friesian dairy cows. *Veterinary Record* **167** 238-240.

Busato A, Trachsel P, Schallibaum M, Blum JW 2000: Udder health and risk factors for subclinical mastitis in organic dairy farms in Switzerland. *Preventive Veterinary Medicine* **44** 205-220.

Burvenich C, Bannerman DD, Lippolis JD, Peelman L, Nonnecke BJ, Kehrli MEJ, Paape MJ 2007: Cumulative physiological events influence the inflammatory response of the bovine udder to *Escherichia coli* infections during the transition period. *Journal of Dairy Science* **90** 39-54.

Bradley A 2002: Bovine mastitis: an evolving disease. *Veterinary Journal* **164** 116-128.

Costa JH, Hötzel MJ, Longo C, Balcão LF 2013: Survey of management practices that influence production and welfare of dairy cattle on family farms in southern Brazil. *Journal of Dairy Science* **96** 307-317.

Dulin AM, Paape MJ, Nickerson SC 1988: Comparison of phagocytosis and chemiluminescence by blood and mammary gland neutrophils from multiparous and nulliparous cows. American *Journal of Veterinary Research* **49** 172-177.

Erskine RJ, Eberhart RJ 1990: Post milking teat dipping use in low somatic cell count in dairy herds. *Journal of Dairy Science* **73** 1256.

Fang WH, Jiang CS, Liu HR 1993: Epidemiological aspects of bovine mastitis and its control in several dairy herds in Southeastern China. *Preventive Veterinary Medicine* **15** 169-180.

Fox LK 2009: Prevalence, incidence and risk factors of heifer mastitis. *Veterinary Microbiology* **134** 82- 88.

Fogsgaard KK, Røntved CM, Sørensen P, Herskin MS 2012: Sickness behaviour in dairy cows during *Escherichia coli* mastitis. *Journal of Dairy Science* **95** 630-638.

Ghosh CP, Nagpaul PK, Prasad S 2004: Factors affecting sub-clinical mastitis in Sahiwal cows. *Indian Journal of Dairy Science* **57** 127-131.

Gianneechini R, concha C, Rivero R, Delucci I, Moreno LJ 2002: Occurrence of clinical and sub-clinical mastitis in dairy herds in west littoral region in Uruguay. *Acta Veterinarian Scandinavica* **43** 221-230.

He Y, Chu Q, Ma P, Wang Y, Zhang Q, Sun D, Zhang Yi, Yu Y, Zhang Y 2011: Association of bovine CD4 and STAT5b single nucleotide polymorphisms with somatic cell scores and milk production traits in Chinese Holsteins. *Journal of Dairy Research* **78** 242-249.

Hertl JA, Schukken YH, Bar D, Bennett GJ, Gonzalez RN, Rauch BJ, Welcome FL, Tauer LW, Grohn YT 2011: The effect of recurrent episodes of clinical mastitis caused by gram-positive and gram-negative bacteria and other organisms on mortality and culling in Holstein dairy cows. *Journal of Dairy Science* **94** 4863–4877.

Hogan JS, Smith KL, Hoblet KH 1989: Field survey of clinical mastitis in low somatic cell count herds. *Journal of Dairy Science* **72** 1547-1553.

Hossoin SMA 2004: *Efficacy of dry cow therapy in mastitis control strategy*. MS Thesis. Department of Surgery and Obstetrics, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh.

Husfeldt AW, Endres MI 2012: Association between stall surface and some animal welfare measurements in free stall dairy herds using recycled manure solids for bedding. *Journal of Dairy Science* **95** 5626-5634.

Jin GM, Jiang YL, Yang JS, Gen YB, Zhou J, Wang G 2000: Investigation on the recessive mastitis in dairy cows of Northern Anhui, China. *China Dairy Cattle* **4** 39-40.

Kader MA, Samad MA, Saha S 2003: Influence of host level factors on the prevalence and economics of subclinical mastitis in dairy cows in Bangladesh. *Indian Journal of Dairy Science* **56** 235-240.

Khatun M, Sørensen P, Jørgensen HB, Sahana G, Sørensen LP, Lund MS, Ingvartsen KL, Buitenhuis AJ, Vilkki J, Bjerring M, Thomasen JR, Røntved CM 2013: Effects of *Bos taurus* autosome 9-located quantitative trait loci haplotypes on the disease phenotypes of dairy cows with experimentally induced *Escherichia coli* mastitis. *Journal of Dairy Science* **96** 1820-1833

Kivaria FM, Noordhuizen JPTM, Kapaga AM 2004: Risk factors associated with subclinical mastitis in small holder dairy cows in Tanzania. *Tropical Animal Health and Production* **36** 581-592.

Minozzi G, Nicolazzi EL, Strozzi F, Stella A, Negrini R, Ajmone-Marsan P, Williams JL 2011: Genome wide scan for somatic cell counts in Holstein bulls. *Bio Medical Center Proceeding* **4** S17.

Mungube EO, tenhagen BA, Kassa T, Regassa F, Kyule MN, Greiner M, Baumann MPO 2004: Risk factors for dairy cow mastitis in the central highlands of Ethiopia. *Tropical Animal Health and Production* **36** 463-472.

Murphy K, Travers P, Walport M 2008: *Innate immunity in immune biology*, 7th edn. Garland Science, Taylor & Francis Group, LLC.

Nooruddin M, Ali LM, Debnath NC 1997: Retrospective epidemiologic study of periparturient diseases in dairy cows. *The Bangladesh Veterinarian* **14** 43-47.

Pankey JW, Drechsler PA, Wilkman EE 1991: Mastitis prevalence in primigravid heifers at parturition. *Journal of Dairy Sciences* **74** 1550-1552.

Pighetti GM, Elliott AA 2011: Gene polymorphisms: the keys for marker assisted selection and unravelling core regulatory pathways for mastitis resistance. *Journal of Mammary Gland Biology and Neoplasia* **16** 421-432.

Radostits OM, Gay CC, Blood DC, Hinchliff KW 2000: *Mastitis*. In Veterinary Medicine, A text book of the diseases of cattle, sheep, pigs, goats and horses. 9th edn. WB Saunders Co. Philadelphia, pp. 603-612.

Romain HT, Adesiyun AA, Webb LA, Lauckner FB 2000: Study on risk factors and their association with sub-clinical mastitis in lactating dairy cows in Trinidad. *Journal of Veterinary Medicine* **47** 257-272.

Rasmussen DB, Fogsgaard K, Røntved CM, Klaas IC, Herskin MS 2011: Changes in thermal nociceptive responses in dairy cows following experimentally induced *Escherichia coli* mastitis. *Acta Veterinaria Scandinavica* **53** 32.

Rosenberger G 1979: *Clinical examination of cattle*. 1st edn, Verlag, Paul Parey, Brelin, Germany, pp. 215-220.

Sarkar SC, Parvin MS, Rahman AK, Islam MT 2013: Prevalance and risk factors of sub-clinical mastitis in lactating dairy cows in north and south regions of Bangladesh. *Tropical Animal Health and Production* **45** 1171-1176

Shem MN, Malole JML, Machangu R, Kurwijila LR, Fujihara T 2001: Incidence and causes of subclinical mastitis in dairy cows on small holder and large scale farms in tropical areas of Tanzania. *Asian-Australasian Journal of Animal Sciences* **14** 372-377.