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Original Article

Effect of mastitis on post-partum conception of cross bred dairy cows in Chittagong district of Bangladesh

Md. Shohidul Islam Khokon[1], Azizunnesa[2], Md. Mazedul Islam[3], Kulsum Begum Chowdhury[4], Md. Lutfor Rahman[5] and Md Zulfekar Ali[6]

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AFFILIATIONS

[1]*Veterinary Surgeon, Department of Livestock Services (DLS), Farmgate, Dhaka-1215, Bangladesh.*

[2] *Department of Medicine and Surgery, Chittagong Veterinary and Animal Sciences University, Chittagong-4225, Bangladesh.*

[3]*Quality Assurance, Bengal Meat Processing Industries Ltd. Pabna-6682, Bangladesh.*

[4]*Food and Agricultural Organization, Bangladesh.*

[5]*Northern Hatcharies Ltd. Bonani, Bogra-5800, Bangladesh.*

[6]*Animal Health Research Division, Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka-1341, Bangladesh.*

CORRESPONDENCE:

#Md Zulfekar Ali,
Animal Health Research Division, Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka-1341, Bangladesh.
E-mail: zulfekarvet@gmail.com
zulfekar@blri.gov.bd

ABSTRACT

Objective: The study was conducted to investigate the effect of mastitis on post-partum conception in crossed cows (Local x Friesian or Sahiwal x Friesian) in Chittagong area of Bangladesh.
Materials and methods: A total of 100 lactating cows were randomly selected from thirteen small and medium size commercial dairy farms. The cows were reared under traditional feeding and management systems. Age and number of parity of the cows were 2.5 to 6 years and 1-5, respectively. On-farm California Mastitis Test (CMT) and Whit Slide Test (WST) were performed with the milk samples to diagnose mastitis. Besides, productive and reproductive data were recorded by examining the animals and interviewing the farmers.
Results: The incidence of mastitis was significantly (P=0.037) higher (76% for CMT and 62% for WST) in 3.5-4.5 years old cows and lower (P=0.037) (47% for CMT) in 2.5-3.5 years old cows. The highest percentage of CMT (72%) and WST (59%) positive cases were found in cows having parity number 2. The CMT (71%) and WST (53%) test results were similar in third parity cows. The first parity cows were less prone to mastitis (47%). Mastitis had significantly (P=0.002) negative effect on days required to first heat after parturition. Mastitis was also negatively correlated with calving interval (CI) (P=0.030). More the incidence of mastitis prolongs the calving interval and the highest percentage (85% for CMT and 71% for WST) of mastitis was found in cows having 380-400 days calving interval. Lowest mastitis (54% for CMT and 48% for WST) incidence detected cows' lowest calving interval. Significantly, more number of Service per Conception (SPC) was also required in cows having more incidence of mastitis (P=0.03). SPC was 4 for subclinical to clinical cases and 3 for clinical cases.
Conclusion: Significant correlation between mastitis and post-partum conception is recorded in this study that may hamper reproductive performances.

KEYWORDS

Calving interval; Cow; Fertility; Mastitis; Milk; Parity; Post-partum

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INTRODUCTION

Mastitis is considered as a most common problem in dairy industry worldwide even though proper application of established control methods of teat dipping using different antiseptic solutions and total dry cow therapy. The prevalence of mastitis ranges from 10 to 50% depending on sanitation, productivity and breeds (Sharma et al., 2004), although Maiti et al. (2003) reported 70.37% incidence of sub-clinical mastitis in cows. Effects of mastitis on post-partum conception and economic losses to the milk industry was previously studied by Fang and Pyorala (2002) and Seegers et al. (2003). The influencing factors of mastitis are poor milking hygiene, poor milking management, mechanical faults in milking machine, constitutional factors, teats and udder injuries and pathogen loads on the cows' skin, epithelia and in environment (Fang and Pyorala, 2002; Hagnestam-Nielsen et al., 2009). In the rising dairy sector of Bangladesh, mastitis is the most important disease. Clinical or sub-clinical mastitis causes huge economic losses through decreased milk yield, poor milk quality, increased culling rate and treatment costs (Sharma et al., 2004; Ali et al., 2013).

Beside mastitis, another important problem in dairy industry in Bangladesh is infertility. In Bangladesh, conception rate of dairy cattle has been decreasing over last 30 years (Sultana and Bhuiyan, 2001). In 1970's, the conception rate was 50-60% which has been decreased to 35-50%. Pathogens may cause anovulation, missed fertilization and embryonic mortality (Peter et al., 2004). However, clinical or sub-clinical mastitis causes reduced feed intake and changes in metabolite concentrations and hormonal profile resulting altered follicular development (Oliver et al., 2000). Moore et al. (1991) found a negative correlation connecting clinical mastitis and reproduction because of changed inter-oestrus interval and a shorter lutealisation in cows by clinical mastitis (Ali and Sultana, 2012). Other factors related to poor fertility included missed estrus, poor heat expression, heat stress (Chebel et al., 2004; Huang et al., 2008), high milk production (Leroy et al., 2008) and diseases such as clinical mastitis (CM) (Santos et al., 2004). To circumvent these problems, many farms in Bangladesh use ovulation synchronization and planned breeding programs with limited successes. To address this issue, we have studied the effect of mastitis on the onset of post-partum reproductive cycle in crossed cows.

MATERIALS AND METHODS

Study period and area: This research was conducted in selected dairy farms of Chittagong districts in Bangladesh during the period from 2011 to 2013. The tests were conducted at the Department of Medicine and Surgery, Faculty of Veterinary Medicine, Chittagong Veterinary and Animal Sciences University, Chittagong.

Study design: A questionnaire was prepared for collection of productive and reproductive data from the farm. The farms were selected and necessary information was recorded. Milk samples were collected from randomly selected cows after maintaining proper udder hygiene. Two spot milk tests (California Mastitis Test and Whit Slide Test) were done for the identification of mastitis, and the results were interpreted.

Sample size and sampling strategy: Thirteen dairy farms were selected in Chittagong district having at least five cows per farm. In total, 100 lactating Frisian cross-bred cows were randomly selected. The average age was 4.3 years and average parity was 2.54. The animals were divided into several groups on the basis of age and parity. The number of animal was 21, 37, 26, 15 and 1 under the age group of 2.5-3.5, 3.5-4.5, 4.5-5.5, 5.5-6.5 and >6.5 years, respectively. According to parity, the number of animals were 19, 32, 28, 15 and 6 under the parity of 1, 2, 3, 4 and 5 (**Table 1**). The animals were reared under traditional management system. Before collection of milk sample, the information related to reproductive performances was recorded using the developed questionnaire. Data were recorded by physical and clinical examinations of animal, interviewing the owners and in available cases farm register data recording. The data including breed, age, body condition score, parity or lactation number, days in milk, milk production per day, quality of milk, days required to first heat after delivery, most recent artificial insemination (AI) date, previous AI date, recent calving date, date for previous calving, calving interval etc. were recorded during collection of sample.

Sample collection: Milk samples were collected aseptically in sterile 10 mL glass vials with tight fitting screw caps. The samples were collected for two spot milk tests namely California Mastitis Test (CMT) and Whit Slide Test (WST) to diagnose the presence of mastitis in the cows.

Diagnosis of mastitis: Udders and milk samples were examined to identify clinical mastitis. Milk was tested by using indirect test methods such as CMT and WST. CMT was carried out according to Albaaj et al. (2017). Udder and CMT scores were recorded according to the procedure of National Mastitis Council (1999). WST was carried out according to method of Krishnakumar et al. (2003). A cow was considered to have clinical mastitis if WST score was +, ++ or +++.

Data analysis: The collected data were entered in Microsoft Excel and analyzed with SAS software (SAS, 1996). Confidence interval for prevalence was calculated according to the formula given in SAS software. The data were analyzed by χ^2-test. *P*-value was considered significant if $P<0.05$.

RESULTS

There were 100 lactating cows in this study from 13 small and medium size dairy farms. The age of the animal was 2.5 to >6.5 years old.

Table 2 described the relationship between animal age and mastitis. The highest percentage of CMT (76%) and WST (62%) positive cases were observed in 3.5-4.5 years old animals, and the second highest positive score was observed (CMT 57% and WST 38%) in 4.5-5.5 years old. Fifty three percent CMT and 33% WST positive results were found in 5.5-6.5 years old animals followed by 47 and 42% for CMT and WST, respectively in the comparatively younger (2.5-3.5 years) animals. The only animal aging 6.5 years was positive for both CMT and WST. However, the relation between mastitis and age was not significant ($P>0.05$) (**Table 2**).

The number of parity were 1, 2, 3, 4 and 5, and positive test was 47, 72, 71, 60 and 50% in CMT and 47, 59, 53, 53 and 50% in WST, respectively. The highest percentages of CMT (72%) and WST (53%) were found in animals having parity number 2 followed by 71% for CMT and 53% for WST positive in cows having parity 3. The percentages of mastitis in different parity were varied, but was not statistically significant ($P=0.12$).

The animals were categorized on the basis of days required to first heat after parturition. The 100% mastitis positive score was recorded in the animals showing heat after 100 days or more. The second highest result was 93 and 92% positive for CMT and WST, respectively in the animals showing heat after 80-100 days of parturition. On the other hand, 80% CMT, 76% WST and 30% CMT, 13.5% WST positive scores were found in animals showing heat after 60-80 and 42-60 days after parturition, respectively. The effect of mastitis on days required for heat after parturition was significant ($P=0.002$) (**Table 3**).

On the basis of calving interval, the animals were categorized into four groups. The highest percentage (85%) of CMT positive cases was found in the animals having 380-400 days calving intervals. Seventy five percent WST positive cases were found in the animal having more than 400 days calving intervals and 71% WST positive cases were found in the cows having 380-400 days calving intervals. The cows in the group having 360-380 days calving interval had 69% CMT and 58% WST positive cases, whereas 54 and 48% (CMT and WST, respectively) positive cases was found in cows under 340-360 days CI. The effect of mastitis on CI was found statistically significant ($P=0.01$) (**Table 4**).

Table 1. Number of cows according to different age groups and parity

No of cows based on age groups						**No of cows based on parity**					
Age group (year)	2.5-3.5	3.5-4.5	4.5-5.5	5.5-6.5	>6.5	Parity No	1	2	3	4	5
No of Cows	21	37	26	15	1	No of Cows	19	32	28	15	6
Total			100			Total			100		

Table 2. Relationship between age and mastitis

Age group (year)	**% CMT +ve**	**% WST +ve**	**χ^2-value**	***P*-value**
2.5-3.5 (n=21)	47	42		
3.5-4.5 (n=37)	76	62		
4.5-5.5 (n=26)	57	38	2.6737	0.037
5.5-6.5 (n=15)	53	33		
>6.5 (n=1)	100	100		

Table 3. Effect of mastitis on days required for first heat after parturition (DRFHP)

DRFHP Days	**%WST +ve**	**%CMT +ve**	**χ^2-value**	***P*-value**
>100 (n=4)	100	100		
80-100 (n=29)	93	92	9.8503	0.002
60-80 (n=30)	76	80		
42-60 (n=37)	13.5	30		

Table 4. Effect of mastitis on calving interval (CI)

Calving Interval	% CMT +ve	% WST +ve	χ^2-value	*P*-value
>400 (n=4)	75	75	7.361	0.0118
380-400 (n=14)	85	71		
360-380 (n=36)	69	58		
340-360 (n=46)	54	48		

Table 5. Effect of mastitis on service per conception (SPC)

Parameter	Clinical	Subclinical	Subclinical-clinical	Mastitis free	Average SPC	χ^2-value	*P*-value
SPC	3	2.3	4	2	2.54	0.58	0.030

Table 5 showed that required Service per Conception (SPC) for clinical, sub-clinical, sub-clinical mastitis converted to clinical mastitis and mastitis free cows were 3, 2.3, 4 and 2, respectively. Those cows having sub-clinical mastitis and then converted to clinical mastitis had highest SPC. This average SPC was 2.54. The effect of mastitis on SPC was found statistically significant (P=0.03).

DISCUSSION

Effects of mastitis on post-partum conception were evaluated by diagnosis of mastitis with two spot tests including CMT and WST. Mastitis can affect reproductive performances leading to infertility or subfertility in dairy industry. Diagnosis of mastitis and effect of mastitis on fertility is crucially important for sound management of dairy farm in Bangladesh. The highest positive result was found for CMT (67%) and WST (62%) in the animals aging 3.5-4.5 years. The second highest results were 57 and 38% for CMT and WST, respectively in the animals aging 4.5-5.5 years. The indirect test results of other aged group of animal were more or less similar. There were 53 and 33% for 5.5-6.5 years old and 47 and 42% for CMT and WST, respectively. The 100% test positive was observed in the cows aging >6.5 years (**Table 2**). It was indicated that the incidence of mastitis was more in the cows aging 3.5-5.5 years as compared to other age groups. It has been revealed that high-yielding and aged cows are more susceptible to mastitis. The glandular tissues of udder of high-yielding cross bred cows are more susceptible to infection (Radostits et al., 2000; Fang and Pyorala, 2002).

Generally, cows produce more milk during the age of 3.5-5.5 years as compared to other times. In our research, the highest percentages of mastitis positive (67 and 62% for CMT and WST, respectively) cases was found in the cows aging 3.5-5.5 years. It could be because of high milk production, and high yielding udder could permit organisms easily to enter leading to mastitis. The study revealed that the younger and older cows were less susceptible to mastitis. Hagnestam-Nielsen et al. (2009) stated that the animals producing more milk were prone to mastitis. However, in another study, it was observed that rate of mastitis increased with the advancedment of age and parity (Radostits et al., 2000). Similarly, the resistance mechanism against mastitis in aged cows was less as compared to younger cows (Herath et al., 2007).

A significant variation (P=0.037) in mastitis occurrence was found in different ages of the animals. However, 100% test positive was found in the cows aging >6.5 years. The incidence of mastitis was higher (CMT-72% and WST-59%) in cows having parity number 2 and for parity 3 (CMT-71% and WST-53%) as compared to other parities, indicating a positive relation between age and occurrence of mastitis. Minimum days required for showing first heat after parturition is the most important fertility trait of reproduction in dairy industry carrying economic value (Ali et al., 2013). In our observation, the cows having more incidence of mastitis had longer time to show heat after parturition (**Table 3**). We found that days between calving to first heat were around 75 days. The prevalence of mastitis significantly affected fertility (P<0.05). This could be explained by the fact that farms with mastitis were economically viable (Hogan and Smith, 2000; Ali et al., 2013).

The minimum calving interval was 340 days and maximum was more than 400 days (**Table 4**) with an average calving interval of 368 days; whereas, Herath et al. (2007) found that the calving interval was 365 days, which was more or less similar to our results. Highest mastitis affected cows were having calving interval (CI) of 380-400 days and lowest mastitis affected cows had 340-360 days of CI (**Table 5**). It is clearly indicated that there was a positive correlation between mastitis and CI. Cows were more prone to mastitis leading to increasing CI. There was a significant (P=0.01) variation observed in relation to the effect of mastitis on CI (**Table 4**). The present study described the number of SPC was 4 which was comparatively higher in cows in which sub-clinical mastitis was converted to clinical, as described by Alam et al. (2014).

The research revealed that SPC was lower in mastitis free cows. The required SPC was 2.3 in cows were suffering from sub-clinical mastitis (**Table 5**). The effect of mastitis on SPC was significant (*P*=0.03). These results were compounded by the fact that the number of SPC increased from 1.8 to 3.4 with severity of udder infection in cows after first service (Gilbert et al., 2005). Cows with clinical mastitis after first service typically had an increased number of SPC as compared to mastitis free cows. Schrick et al. (2001) and Frago et al. (2004) reported that the number of SPC for clinical mastitis in early lactation cows was 2.1±0.2 and 2.1±0.2, respectively.

The findings of this study were in agreement with the reports of Schrick et al. (2001) and Frago et al. (2004). In this study, average SPC was 2.54, whereas Gilbert et al. (2005) reported an average SPC of 2.2. The prevalence of mastitis increased with the advancement of parity. In this study. the average number of parity was 2.5 and mastitis was 67% positive for CMT and 62% positive for WST, whereas Fang and Pyorala (2002) reported as 52%; this variation might be due to variation of environment and farm managemental factors.

CONCLUSION

Significant correlation between mastitis and post-partum conception is recorded in this study. The results of this study indicate that mastitis may affect reproductive performance by preventing ovulation and resumption of post calving estrus by reducing fertilization rates and embryogenesis. An important reason of infertility in dairy herd would be mastitis affecting fertility in cows by increasing CI, number of SPC, interval between calving to first heat and some other important reproductive parameters.

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CONFLICT OF INTEREST

The authors declare no conflict of interests.

AUTHORS' CONTRIBUTION

MSIK, A and MZA designed the work and conducted the experiments. MSIK, MMI and MZA participated in data collection. MSIK, A, KBC, LMR and MZA participated in analysis and interpretation of the data. MSIK, A and MMI drafted the manuscript. All the authors read and approved the final version of manuscript.

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