Quarter-wise prevalence of subclinical mastitis in crossbred cows

Rachna Sharma*, Manju Ashutosh, Sujata Pandita, Ashutosh, Panjab Singh Yadav and Thulasiraman Parkunan

ICAR-National Dairy Research Institute,
Karnal-132 001, Haryana, India.
Received: 01-02-2016 Accepted: 25-01-2017

ABSTRACT

The present study was designed to determine the quarter-wise and animal-wise prevalence of sub-clinical mastitis in crossbred Karan Fries (Holstein x Tharparker) lactating cows. For this purpose, the udders of 73 cows were screened by modified California Mastitis Test (mCMT) and EC measurements. The efficiency of detection of mastitis and non-mastitis by EC measurements was 86% and 93% respectively. Animal-wise prevalence was found 41%, while quarter-wise prevalence was 31.16%. Among mastitic quarters, prevalence of single quarter infection, two quarter infection, three quarter infection and all four quarter infection per animal, was 0.00, 26.66, 43.33 and 30.00%, respectively. Out of all quarters, maximum prevalence was found in right hind quarters (29.67%) followed by left hind (26.37%), left fore (23.07%) and right fore (20.87%). The same pattern was observed during EC measurements. Though EC showed similarity with CMT in the detection of subclinical mastitis, the research needs to be carried out on more number of animals.

Key words: Electric conductivity, Modified California Mastitis Test, Quarter-wise prevalence, Subclinical mastitis.

INTRODUCTION

Mastitis is defined as inflammation of the mammary gland, associated with changes in physical, chemical, bacteriological and organoleptic properties of milk, causing health hazards to the public and can be triggered by many factors such as trauma and (or) injury to the udder, infection due to microorganisms, and chemical irritation (Nazifi et al., 2011 and Philpot and Nickerson, 2000). Generally mastitis occurs in two forms i.e., clinical or overt and sub-clinical or hidden (Radostitis et al., 2000). Sub-clinical mastitis is 15–40 times more prevalent than clinical mastitis, of long duration and difficult to detect (Shearer and Harris, 2003). Sub-clinical mastitis has an erosive effect on the economy of dairy farms as it causes a direct loss in milk quantity and quality in affected cows/farms. It causes high economic losses in most dairy herds (Schultz et al., 1978). In United States, sub-clinical mastitis is responsible for 60-70% of total economic losses and in India upto 68% of the total losses are associated with all mastitic infections (Merill and Galton, 1989). Radiostitis et al. (2000) reported that most estimates show that on an average, an affected quarter results in a 30% reduction in productivity and an affected cow is estimated to lose 15% of its production for the lactation following infection by sub clinical mastitis. DeGraves and Fetron (1993) gave a loss in the range of 10 to 26% per affected quarter with subclinical mastitis.

Cows with subclinical mastitis should be identified as early as possible. As there is no gross swelling of quarters or abnormality of milk, sub-clinical mastitis can be recognized by “cow side” tests that are Californian Mastitis Test (CMT) and measuring the electrical conductivity (EC) of the milk using a hand-held meter. Detection of SCM based on electrical conductivity (EC) of the milk is easier, faster than other field tests and does not require any reagents (Norberg et al., 2004). The EC of the milk increases (i.e. electrical resistance decreases) due to an increased concentration of Na+ and Cl- in the milk when a cow is exposed to an intramammary infection (Kitchen et al., 1980). Information on monitoring of udder health through milk EC measurement in Indian field conditions is also very limited. Moreover published information on the quarter-wise comparative prevalence of mastitis in crossbred cows is extremely scanty. So the present study was conducted to determine the quarter-wise prevalence of sub-clinical mastitis in crossbred cows as well as to optimise detection process for mastitis by measuring electrical conductivity of milk samples in crossbred cattle during early lactation.

MATERIALS AND METHODS

The present study was carried out in crossbred Karan Fries (Holstein x Tharparker) lactating cows selected from the NDRI, Karnal herd. The parity of cows ranged from 2-5. For detection of sub-clinical mastitis (SCM) in four quarters of the udder, the udder of 73 cows was screened using modified California Mastitis Test (mCMT) cows and EC measurements. The screening was done on 30th day of postpartum.

The milk from healthy and infected quarters of sub-clinical mastitis cows, was aseptically collected in the noon milking (12:00 Noon). For detection of sub-clinical mastitis (SCM) in four quarters of the udder, the udder of 73 cows was screened using modified California Mastitis Test (mCMT) and measuring the electrical conductivity (EC) of the milk using a hand-held meter. Detection of SCM based on electrical conductivity (EC) of the milk is easier, faster than other field tests and does not require any reagents (Norberg et al., 2004). The EC of the milk increases (i.e. electrical resistance decreases) due to an increased concentration of Na+ and Cl- in the milk when a cow is exposed to an intramammary infection (Kitchen et al., 1980). Information on monitoring of udder health through milk EC measurement in Indian field conditions is also very limited. Moreover published information on the quarter-wise comparative prevalence of mastitis in crossbred cows is extremely scanty. So the present study was conducted to determine the quarter-wise prevalence of sub-clinical mastitis in crossbred cows as well as to optimise detection process for mastitis by measuring electrical conductivity of milk samples in crossbred cattle during early lactation.

MATERIALS AND METHODS

The present study was carried out in crossbred Karan Fries (Holstein x Tharparker) lactating cows selected from the NDRI, Karnal herd. The parity of cows ranged from 2-5. For detection of sub-clinical mastitis (SCM) in four quarters of the udder, the udder of 73 cows was screened using modified California Mastitis Test (mCMT) cows and EC measurements. The screening was done on 30th day of postpartum.

The milk from healthy and infected quarters of sub-clinical mastitis cows, was aseptically collected in the noon milking (12:00 Noon). For the detection of mastitis in cows, modified California Mastitis Test (mCMT) developed by
Sastry (1978), was used. The reagent used consists of an anionic surface active reagent and the indicator dye. The test was carried out by taking an equal quantity of milk sample from individual quarters in cups and equal quantity of reagent (about 5 ml each) and mixed properly by gently circular movements (clockwise and anticlockwise) for about 10 seconds. Reaction did not occur immediately and there was no precipitation and gel formation in negative cases. However in positive cases, the milk sample turned to greenish blue due to alkalinity and the presence of increased number of leukocytes in milk caused gel formation. Depending upon the degree of gel formation the mCMT scores were assigned as negative, +, ++ and +++ for healthy and subclinical mastitis cases, respectively. This test was used along with EC measurements for detection of subclinical mastitis in cows. For measuring electrical conductivity in milk, Electrical Conductivity Labtronics Deluxe Conductivity Meter (Model LT - 26) was used. The fresh milk samples were maintained at 28-32°C at the time of analysis, which was the calibration temperature of analyzer. The readings were recorded. The effectiveness of EC for detection of mastitis over CMT was carried out. The prevalence of SCM quarter-wise was calculated as described by Thrusfield (1986) and percent result was calculated.

The animals were kept under normal routine management practices followed at the Institute’s farm. All the cows were fed as per the standard feeding practices followed at the NDRI farm which consisted of concentrate mixture (mustard cake, maize wheat bran, rice bran, mineral mixture and common salt), wheat straw and roughages (berseem, maize and jowar fodder). The feed and water was available ad lib to these cows.

RESULTS AND DISCUSSION

The average values of EC and mCMT score of healthy and subclinical mastitis cows have also been shown in Table 1. According to CMT score, out of 73 cows, 43 cows were healthy and 30 cows were found to be positive for sub-clinical mastitis. Out of 292 quarters, 201 (68.84%) quarters were healthy while 91 (31.16%) were mastitic. The result was calculated. The prevalence of SCM quarter-wise was carried out. The prevalence of SCM quarter-wise was calculated as described by Thrusfield (1986) and percent result was calculated.

The efficiency of detection of subclinical mastitis by EC measurements was 86% in crossbred cows whereas Rizwan (2013) reported 80% detection of SCM by EC measurements. In this study, 7 outliers were also detected. Out of 30 infected cows, 26 cows had a positive mCMT score as well as high EC values whereas 4 cows had low EC (3.39 mhos) but positive CMT score. Among healthy, 3 cows had negative CMT score but high EC (4.27 mhos) value thereby reflecting non-mastitis detection efficiency to be 93% as against 100% as reported by Rizwan (2013). ECM can often be misinterpreted especially when diagnosing a subclinical mastitis case that can lead to a false positive or negative score (Viguer et al., 2009). EC showed similarity with CMT in the detection of subclinical mastitis; furthermore, its reliability would further increase when used together with the other diagnostic methods. Mastitis is not the only circumstance that causes changes in milk EC, but non-mastitis related variation in EC is a major drawback (Pyorala, 2003). Non-mastitis factors influencing EC include parity, age, milk temperature, stage of lactation, fat percentage, milking interval, season, stress, environmental factors and breed (Kasikci, et al., 2012 and Pyorala, 2003).

Infection rate (No. of quarters affected per animal) of sub-clinically mastitic animals is given in Table 2. Out of the affected animals, no single quarter infection was observed. Maximum infection was observed for three quarters infection (43.33%) followed by four quarters infection (30.00%) and then by two quarter infection (26.66%). The findings of this study are contradictory to the earlier studies. Kumar and Sharma (2002) have reported that mastitis infection was more in single quarter (52.75%) whereas Iqbal and Siddique (1999) reported that 7.9% of the animals were affected with two quarters followed by 6.7% with one quarter and for three and four quarters, the infections were least. Similarly Singh and Shankar (2002) have recorded higher incidence of mastitis for single quarter (17.4%), as compared to two (2.6%), three (0.3%), and four quarters (2.7%). Sharif and Ahmed (2007) determined the quarter-wise and animal-wise prevalence of sub-clinical mastitis in dairy buffaloes and reported maximum infection in all four quarters (49.01%) no. of animals, followed

Table 1: Screening of milk samples for detection of subclinical mastitis in crossbred cows

<table>
<thead>
<tr>
<th>Health of cows</th>
<th>Healthy</th>
<th>Subclinical</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Cows</td>
<td>43 (59%)</td>
<td>30 (41%)</td>
</tr>
<tr>
<td>Total Quarters</td>
<td>201 (68.84%)</td>
<td>91 (31.16%)</td>
</tr>
<tr>
<td>mCMT score</td>
<td>Negative</td>
<td>++/++/++++</td>
</tr>
<tr>
<td>EC Range</td>
<td>3.30-4.43</td>
<td>3.48-4.67</td>
</tr>
<tr>
<td>Average EC</td>
<td>3.82 ± 0.06</td>
<td>4.27 ± 0.05</td>
</tr>
</tbody>
</table>

Means with different superscripts (ab) differ within a column (P<0.05)
by two quarter infection (25.49%) among mastitic animals, indicating that chances of infection among quarters are more when any single quarter is infected in buffaloes. The difference in quarter-wise prevalence of mastitis is probably due to the fact that predisposing factors like injury, defective sphincters, and so forth could vary from quarter to quarter (Iqbal and Siddique, 1999).

Table 2 also reveals the prevalence of subclinical mastitis among the fore and hind quarters that was highest in hind quarters and differed significantly (P>0.05) from fore quarters. The findings of this study are comparable with those of Sudhan et al. (2005), Sharma et al. (2007) and Siddique et al. (2013), in cross bred cows. This could be due to the fact that the hind quarters are more exposed to dung and urine (Chakrabarti, 2007).

Table 3 shows inter-quarter prevalence of subclinical mastitis in crossbred cows along with comparison of average EC values and CMT score between healthy and infected quarters. Out of 91 infected quarters, highest prevalence of mastitis was in RH quarters (27), followed by LH quarters (24), then by LF quarters (21) and minimum in RF quarters (19). Maximum percentage of CMT was 66.66% for + score in LF quarters and for ++ score in RH quarters. Among all the infected quarters, minimum CMT percentage was observed for +++ score. It was lowest in fore quarters (4.76% LF and 5.26% RF) as compared to hind quarters (16.66% LH and 7.40% RH). Average EC values for +, ++ and CMT scores were 3.78, 4.43 and 4.63 mhos, respectively. The overall average EC values obtained for fore and hind quarters were 4.21 and 4.34 mhos, for +, ++ and CMT score, respectively. An increase in EC values were observed with the increase in CMT score, indicating alteration of concentration of mineral substances (Janzekovic et al., 2009) that may be caused due to suspected pathological processes in the udder tissue (Hillerton and Walton, 1991 and Hamann and Gyodi, 2000). The results are in accordance with those of Bastan et al. (1997) and Kasikci, et al., 2012).

Determination of EC of milk offers a potential, simple and rapid test for early diagnosis of subclinical mastitis before the emergence of clinical signs to avoid economic (production/ reproductive losses) and early treatment in lactating cows. It can give results on the spot and can also help to detect quarter-wise prevalence and hence infected animals can be screened out at farm and field level. EC showed similarity with CMT in the detection of

---

**Table 2: Quarter-wise occurrence of infection in mastitis cows**

<table>
<thead>
<tr>
<th>Occurrence of infection</th>
<th>Affected cows/ quarters (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single quarter infection</td>
<td>0</td>
</tr>
<tr>
<td>Two quarters infection</td>
<td>8 (26.66)</td>
</tr>
<tr>
<td>Three quarters infection</td>
<td>13 (43.33)</td>
</tr>
<tr>
<td>All four quarters infection</td>
<td>9 (30.00)</td>
</tr>
<tr>
<td>Fore quarters infection</td>
<td>40 (43.96)</td>
</tr>
<tr>
<td>Hind quarters infection</td>
<td>51 (56.04)</td>
</tr>
</tbody>
</table>

---

**Table 3: Inter-quarter comparison of EC Values and CMT Score in Subclinical Mastitis Crossbred cows**

<table>
<thead>
<tr>
<th>Quarters infected (n=91)</th>
<th>Average EC (mhos)</th>
<th>CMT Score (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LF (n=73)</td>
<td>5 (25.87)</td>
<td>3.38</td>
</tr>
<tr>
<td>RF (n=73)</td>
<td>5 (46.86)</td>
<td>3.35</td>
</tr>
<tr>
<td>LH (n=73)</td>
<td>5 (74.81)</td>
<td>3.41</td>
</tr>
<tr>
<td>RH (n=73)</td>
<td>5 (74.81)</td>
<td>3.41</td>
</tr>
</tbody>
</table>

---

**Table 3: Inter-quarter comparison of EC Values and CMT Score in Subclinical Mastitis Crossbred cows**

<table>
<thead>
<tr>
<th>Healthy Quarters (%)</th>
<th>Average EC (mhos)</th>
<th>CMT Score (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LF (n=73)</td>
<td>5 (25.87)</td>
<td>3.38</td>
</tr>
<tr>
<td>RF (n=73)</td>
<td>5 (46.86)</td>
<td>3.35</td>
</tr>
<tr>
<td>LH (n=73)</td>
<td>5 (74.81)</td>
<td>3.41</td>
</tr>
<tr>
<td>RH (n=73)</td>
<td>5 (74.81)</td>
<td>3.41</td>
</tr>
</tbody>
</table>

---
subclinical mastitis. However, the research needs to be carried out on more number of crossbred animals for accuracy in the identification of infected animals in farm as well as in field conditions. EC was higher in infected subclinical mastitic quarters. The prevalence of subclinical mastitis was higher in hindquarters than forequarters. Udder of cows should be examined at regular intervals to detect the mastitis and those suffering from mastitis even in one quarter, should be provided similar therapeutic treatment for all the quarters. Therefore early detection of developing disease may provide the herd manager with an opportunity to make management interventions, thus removing cow stressors with the prospect of avoiding the clinical phase altogether before more profound biological changes or consequences occur.

ACKNOWLEDGEMENT

The authors are extremely thankful to the Director, NDRI Karnal for providing all the facilities for carrying out the research work.

REFERENCES


