STUDY OF PREVALENCE, SOMATIC CELL COUNTS AND ELECTRICAL CONDUCTIVITY IN SUB-CLINICAL MASTITIC CATTLE[#]

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ABSTRACT

A total of 200 quarter milk samples from 50 apparently healthy cows of different parity were examined by cultural examination, somatic cell count (SCC) and electrical conductivity. The prevalence of sub-clinical mastitis on cultural examination basis was 56.00 per cent (28/50) in cows and 37.50 per cent (75/200) in quarters. With the criterion of SCC>5 lakh cells/ml of milk, the prevalence of SCM was 56.00 per cent in cows and 43.50 per cent in quarters. Only 6.00 per cent of the quarters were having non-specific mastitis. The highest prevalence was found in 4th parity on quarter basis and in 5th parity on cow basis. Mean ± SE value of somatic cell counts in sub-clinical mastitic milk was1.576 ± 0.075 million cells/ml (range 0.523 and 3.228). The mean ± SE value of somatic cell counts in normal milk were 0.348 ± 0.007 million cells/ml (range 0.214 and 0.498). Out of 200 quarters milk samples, 76 samples (38 per cent) were found positive by electrical conductivity test. All these milk samples were higher in electrical conductivity more than 6.0 ms/cm. The average mean ± SE value of electrical conductivity in sub-clinical mastitic milk was 6.585 ± 0.050 ms/cm (range 6.02 to 8.2). The mean ± SE value of electrical conductivity in normal milk was 5.130 ± 0.055 ms/cm with the range of 3.24 to 5.96 ms/cm.

Key words: Sub-clinical mastitis, prevalence, somatic cell count, electrical conductivity, cows

Introduction

Sub-clinical form of mastitis is more common than clinical mastitis and causes great losses in dairy herds (Thapa and Kaphle, 2002). Clinical mastitis is manifested by observable signs of inflammation of udder and gross abnormality in quantity and quality of milk and is usually referred to as individual health problem, whereas sub-clinical mastitis remains to be a herd problem, without observable clinical signs or no gross changes in the milk, which may be detected by the various indirect tests like modified California mastitis test (MCMT), total somatic cell count (TSCC), electrical conductivity (EC) of milk and cultural examination. Somatic cell count has been accepted as the best quantitative index of inflammation of udder and it is used to evaluate the quality of the milk as well as to predict udder infection (Eberhart *et al*., 1987). Colonization of bovine mammary gland by pathogenic bacteria results in a series of events, which lead to major alteration in the composition of milk, secreted from the tissue cell (Schalm *et al*., 1971). The electrical conductivity was a reflection of ionic contents (Na, K and Cl ions). Concentration of Na^+ and Cl^- ions were increased in mastitic milk which leads to increase electric conductivity of milk from the infected quarter (Kitchen, 1981).

Materials and Methods

A total of 200 quarter milk samples were collected aseptically from 50 apparently healthy cows of different parity from college dairy farm and private dairies in surrounding area in Bikaner city. All the milk samples were subjected to different diagnostic tests *viz.* culture examination, somatic cell count (SCC) and electrical conductivity (EC) for determination of prevalence of sub-clinical mastitis in cattle. The somatic cell count of milk samples was performed as described by Schalm *et al*. (1971). However, for staining of milk smear, Giemsa stain was used. The criterion adopted by the international dairy federation (IDF) for the diagnosis of sub-clinical mastitis is based on the isolation of the pathogenic organism from aseptically collected milk sample and elevation of somatic cell count to more than 5,00,000 per ml of milk (International Dairy Federation, 1987).

Electrical conductivity varies with the presence of dissolved solids in the solution. This was determined by pen type EC-035 (ATC) conductivity meter of ERMA instrument. Measurement of electrical conductivity was done by passing AC voltage through the milk with conductivity cell. Measurement of resistance of the milk was done, and it was converted suitably to display the conductivity directly.

Results and Discussion

Prevalence

Prevalence of sub-clinical mastitis based on cultural examination alone was 56.00 per cent (28/50) and 37.50 per cent (75/200) on cows and quarters basis. With the criterion of SCC >5 lakh cells/ml of milk, the prevalence of Sub-clinical mastitis was 56.00 per cent (28/50) on cows basis and 43.50 per cent (87/200) on quarters basis (Table 1).

Almost, similar findings were reported by Singh and Baxi (1980) and *Siddiquee et al. (2014) who* reported 54.00 and 55.1 per cent cow wise prevalence of sub-clinical mastitis. Supriya and Lather (2010) reported 53.33 and 32.5 per cent cow wise and quarter wise prevalence of sub-clinical mastitis. However, the infection rate observed in the study was higher in comparison to the finding of Ayano *et al*. (2013) and Kushwaha (2016) reported prevalence of sub-clinical mastitis in cows as 41.02 and 16.29 per cent but lower than Singh (2015) who reported the prevalence of sub-clinical mastitis as 66 per cent on cow basis and 42 per cent on quarter basis.

Sharma *et al.* (2012b) recorded the prevalence of sub-

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clinical mastitis in crossbred cows as 42.18 per cent on animal basis and 19.14 per cent on quarter basis. Langer and Nauriyal (2013) recorded overall prevalence of sub-clinical mastitis in cows as 66.67 per cent and 33.46 per cent in quarters. Joshi *et al*. (2013) recorded the prevalence of sub-clinical mastitis in buffaloes on quarter and animal basis was 37 per cent and 44 per cent, respectively, based on cultural examination.

Quarters showing SCC above 5,00,000 per ml and culturally positive were 37.50 per cent (75/200) and only 6.00 per cent (12/200) of quarters having SCC above 5,00,000 per ml were culturally negative. On the basis of international dairy federation (IDF) criteria, 37.50 per cent of quarter were diagnosed as sub-clinical mastitis in which somatic cell count was more than 5,00,000 per ml and culturally positive. Whereas, 6.00 per cent of the quarters having SCC above 5,00,000 per ml and culturally negative and could be considered as "non specific" mastitis. Failure to detect pathogen in such cases could possibly due to intermittent excretion of organisms or their disappearance because of spontaneous recovery (Tolle, 1975; Sharma *et al*., 2012a) or due to the infecting organism being other than those which could be culturally detected.

Highest prevalence was observed in 4th parity on quarter basis and in 5th parity on cow basis. The highest prevalence was observed 67.50 per cent, followed by 46.66, 28.12, 18.75, 17.85 and 12.50 per cent in 4th, 3rd, 5th, 6th, 2nd and 1st parity on quarter basis. On animal basis the highest prevalence was 75.00 per cent, followed by 66.66, 60.00, 50.00, 33.33 and 28.50 per cent in 5th, 6th, 3rd, 6th, 2nd and 1st parity, respectively (Table 4 and 5). It was observed that the prevalence of sub-clinical mastitis increased with parity and attained peak in 3rd to 5th parity. This could be due to lowered resistance of the animals as lactation number increased and improper functioning of the teat sphincter as mentioned by Singh and Baxi (1980). The least number of cases were detected during first lactation. Chahar *et al.* (2005) recorded highest prevalence of sub-clinical mastitis in 6th lactation on quarter basis and 3rd lactation on animal basis.

Somatic cell count

The average mean ± SE value of somatic cell counts in sub-clinical mastitic milk were 1.576 ± 0.075 million cells/ml. It ranged between 0.523 and 3.228 million cells/ml. The mean ± SE value of somatic cell counts in normal milk were 0.348 ± 0.007 million cells/ml. It ranged between 0.214 and 0.498 million cells/ml. There was significant difference in average somatic cell count of normal and sub-clinical mastitic milk samples.

Therefore, the milk samples having somatic cell count above 0.5 million cells/ml were considered as sub-clinical mastitic milk. Supriya and Lather (2010), Sharma *et al*. (2012a) and Singh (2015) also interpreted the similar results.

Maiti *et al*. (2003) recorded somatic cell count in milk of mastitis quarter was 8.75×10^5 (mean)/ml whereas that of healthy quarter was 1.13×10^5 (mean)/ml in cows and buffaloes. Chahar *et al.* (2005) recorded the prevalence of sub-clinical mastitis by somatic cell count in cows was 60.25 per cent in cows and 46.33 per cent in quarters and found that only 7.33 per cent of the quarters were having non-specific mastitis. Hamann (2002) considered the cytological examination as gold standard test to measure inflammation i.e. milk somatic cell count (SCC).

Sharma *et al*. (2012a) observed that 15.38 per cent quarter of cows were suffering from sub-clinical mastitis on account of having somatic cell count more than 5,00,000 per ml of milk and culturally positive. They also concluded that the prevalence of latent mastitis (SCC < 5 lakh/ml and culturally positive) and non-specific mastitis (SCC > 5 lakh/ml of milk and culturally negative) was 24.45 and 4.67 per cent, respectively.

Electrical conductivity of milk

The electrical conductivity of milk is a reflection of its ionic contents (Na, K and Cl ions). Increased in Na^+ and Cl^- and decreased K^+ levels have been widely used as methods of monitoring mastitic infections.

Prevalence of sub-clinical mastitis based on electrical conductivity was 56.00 per cent (28/50) and 38.00 per cent (76/200) on cows and quarters basis. All these milk samples were higher in electrical conductivity more than 6.0 ms/cm. Thus, the threshold value for EC to detect sub-clinical mastitis in cows was 6.0 ms/cm. The mean ± SE value of electrical conductivity in sub-clinical mastitic milk was 6.585 ± 0.050 ms/cm with the range of 6.02 to 8.2 ms/cm. The mean ± SE value of electrical conductivity in normal milk was 5.130 ± 0.055 ms/cm with the range of 3.24 to 5.96 ms/cm. One milk sample had electrical conductivity above 6.0 ms/cm while negative culturally.

Mielke *et al*. (1981) suggested the electrical conductivity above 6.9 ms/cm at 28^{0}C to 30^{0}C was indication of abnormal milk. Muller and Rudolph (1996) suggested that milk samples having electrical conductivity > 6 ms/cm were to be considered as infected. Chavan *et al*. (2001) reported 6.14 ± 0.07 ×10 and 7.50 ± 0.09 × 10 microMhos electrical conductivity in sub-clinical mastitic and clinical mastitic milk, respectively.

Oshima (1978) and Fernando *et al*. (1981) reported that there were many other factors such as stage of lactation, parity, herd difference and amount of fat in milk, which influence the EC of milk. The average EC of sub-clinical mastitic whole milk and defatted milk were 5.63 ± 0.31 and 6.69 ± 0.21 ms/cm, respectively. Saravanan *et al*. (2000) reported that the mean value of EC in milk of healthy animal was 4.8 ± 0.11 ms/cm (range 3.6 - 5.6) while that of milk with gram positive cocci group, *coliforms* and *pseudomonas* spp. were 6.9 ± 0.04 ms/cm (range 6-7.8), 6.18 ± 0.08 ms/cm (5.6 - 6.9) and 6.0 ± 0.07 ms/cm (5.7 - 6.2), respectively. Chahar *et al*. (2008) reported that the threshold value of EC for detection of sub-clinical mastitis in cows was 5.9 ms/cm.

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Table 1: Result of cultural examination and somatic cell counts (SCC) in 200 quarter milk samples from 50 apparently healthy cows

Animal culturally positive/ Total animal	28/50 (56.00%)
Quarter culturally positive/ Total quarters	75/200 (37.50%)
Animal positive with SCC (>5,00,000/ml)/ Total animals	28/50 (56.00%)
Quarter positive with SCC (>5,00,000/ml)/ Total quarters	87/200 (43.50%)
Quarter showing both SCC (>5,00,000/ml) and culturally positive/ Total Quarters	75/200 (37.50%)
Quarter positive with SCC (>5,00,000/ml) and culturally negative/ Total Quarters	12/200 (6.00%)

Table 2: Prevalence of sub-clinical mastitis by different tests in 200 quarters milk samples

Diagnostic Test	Positive Quarters (Out of total 200 quarters)	Percentage
Cultural examination	75	37.50
Somatic cell count	87	43.50
Electrical Conductivity	76	38.00

Table3: Prevalence of sub-clinical mastitis by different tests in 50 cows milk samples

Diagnostic Test	Positive Animals (Out of 50 cows)	Percentage
Cultural examination	28	56.00
Somatic cell count	28	56.00
Electrical Conductivity	28	56.00

Table4: Parity wise prevalence of sub-clinical mastitis (quarter-wise)

Parity	No. of quarters examined	No. of quarters positive for sub-clinical mastitis	Percentage
I	24	3	12.50
II	28	5	17.85
III	60	28	46.66
IV	40	27	67.50
V	32	9	28.12
VI	16	3	18.75

Table 5:Parity wise prevalence of sub-clinical mastitis (cow-wise)

Parity	No. of cows examined	No. of cows positive for sub-clinical mastitis	Percentage
I	7	2	28.57
II	6	2	33.33
III	10	6	60.00
IV	15	10	66.66
V	8	6	75.00
VI	4	2	50.00

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