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# MASTITIS IN JAFFRABADI BUFFALOES: ITS INCIDENCE AND IMPACT ON MILK COMPONENTS

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**ABSTRACT**
Present study aimed to see mastitis incidence during different seasons, stages of lactation and its impact on milk components in Jaffrabadi buffaloes. Quarterly milk samples (n = 1356) were screened for mastitis by California-Mastitis-Test (CMT) and physical change of milk. Milk components such as fat, protein, lactose, solid-not-fat (SNF) and total-solids (TS) per cent were estimated. Overall incidence of sub-clinical mastitis (SCM) and clinical mastitis (CM) were 6.1 and 4.6%, respectively. SCM incidence was significantly ($p < 0.05$) higher during summer (8.9%), followed by rainy (5.4%) and winter (3.7%). However, CM incidence was higher during rainy (6.3%), followed by winter (4.2%) and summer (3.4%), but didn't differ statistically. Milk lactose from healthy quarter's was significantly higher ($5.69 \pm 0.05$g%), reduced significantly ($p < 0.05$) in SCM ($5.31 \pm 0.08$g%) and CM ($5.10 \pm 0.05$g%). Milk SNF reduced significantly ($p < 0.05$) in CM than healthy quarters ($10.29 \pm 0.11$ vs. $10.97 \pm 0.08$g%), but SNF content of SCM milk ($10.57 \pm 0.13$g%) was similar to healthy quarters. However, milk fat ($8.36 \pm 0.08$ vs. $8.35 \pm 0.15$ and $8.60 \pm 0.17$g%), protein ($4.31 \pm 0.03$ vs. $4.32 \pm 0.06$ and $4.26 \pm 0.07$g%) and TS ($19.33 \pm 0.15$ vs. $19.02 \pm 0.24$ and $18.89 \pm 0.23$g%) of healthy quarter didn't differ from SCM and CM, respectively. Results of this study revealed that mastitis incidence is affected by season and significantly affected milk lactose and SNF in Jaffrabadi buffaloes.

## INTRODUCTION

In India, dairy sector plays crucial role for upliftment of rural livelihood by providing milk which contains complete nutrition for human beings, dung as a source of organic fertilizer for agriculture and fuel for rural homes, and draft power for cultivation and transportation (Dash, 2009, 2013; Patbandha *et al*., 2015). According to National Dairy Development Board reports, India shared about 18% of the world total milk production during 2013-14 and produced 137.6 million tonnes milk during the same year (Anonymous, 2014). Buffaloes contribute more than 50% share of the total milk production of the country compared to cows (BAHS, 2013). However, mastitis is considered as one of the major health obstacle which substantially reduces the yield and quality of milk, thereby significantly affects the livelihood of the rural farmers (Sharma *et al*., 2012; NAAS, 2013). In India, the losses due to mastitis was first reported Rs. 52.9 crore annually in the year 1962 which took a gigantic leap to Rs. 6053.21 crore annually in the year 2001 (Sudhan and Sharma, 2010; Sharma *et al*., 2012). In addition, mastitis markedly alters the milk components particularly milk lactose and SNF in buffaloes (Bansal *et al*., 2007; Sharif *et al*., 2007; Tripaldi *et al*., 2010; Hussain *et al*., 2012; Patbandha *et al*., 2016), subsequently reduces the quality of milk products and their keeping quality (Malek dos Reis *et al*., 2013) and significantly reduces export standard. Therefore, early identification and treatment of mastitis and implementation of preventive measures could reduce the economic losses and improve the udder health in dairy animals.

Incidence of SCM and CM has been reported to be 5-20% and 1-10%, respectively in buffaloes in India (Joshi and Gokhale, 2006; Sinha and Thombare, 2014), indicated higher incidence of subclinical condition. Higher incidence of SCM compared to CM is due to difficulty in detection under routine farm management practices (Sharma *et al*., 2012; NAAS, 2013). Although several risk factors have been identified for mastitis; seasons and stage of lactation significantly affect the incidence of mastitis in buffaloes (Kavitha *et al*., 2009; Ali *et al*., 2014; Jingar *et al*., 2014a; Purohit *et al*., 2014). Previous studies also reported negative effect of mastitis on major milk components (fat, protein, lactose, SNF and TS) in dairy buffaloes (Bansal *et al*., 2007; Sharif *et al*., 2007; Tripaldi *et al*., 2010; Hussain *et al*., 2012; Patbandha *et al*., 2016). Although, incidence and impact of mastitis on milk components have been studied well in dairy buffaloes, the information on Jaffrabadi buffalo is scanty, although this breed contributed significantly to the milk pail of the nation. Further, identification of risk factors for mastitis could be helpful for implementation of better managerial practices and subsequently improve the milk quality as well as udder health and welfare of buffaloes. Hence, the present experiment was designed to study the incidence of mastitis during different seasons, stages of lactation and its impact on milk components such as fat, protein, lactose, SNF and TS in Jaffrabadi buffaloes.

## MATERIALS AND METHODS

The study was conducted on Jaffrabadi buffaloes at College of

Veterinary Science and Animal Husbandry, Junagadh Agricultural University, Junagadh, Gujarat, India for a period of one year between March, 2014 and February, 2015. Junagadh district is located at 21º 31' N latitudes and 70º36' E longitudes in South Saurashtra agroclimatic zone. The ambient temperature varies from as low as 10ºC in winter to as high as 40ºC in summer, and receives about 625 to 750 mm of average annual rain fall in a year and the climate is dry to sub-humid (Pathak, 2006). There are three major seasons in the study area such as summer (March-June), rainy (July-October) and winter (November-February). Buffaloes were maintained in loose housing system of management on pucca flooring at Cattle Breeding Farm of the University and hand milking was practiced twice a day (4 am and 4 pm) at the milking parlour. Daily ration of the buffaloes consisted of adlibitum seasonal green and dry fodder according to availability. In addition, buffaloes were offered mixture of cottonseed cake (CP: 35% and TDN: 75%), ground maize (DCP: 10% and TDN: 85%) and Amul dan (DCP: 22% and TDN: 70%) at the time of milking to fulfill the nutrient requirement as per Indian Council of Agricultural Research (ICAR) feeding standard (Anonymous, 1998). Splashing was practiced at 10-11 am and again 3-4 pm during summer season as it reduces heat stress markedly in buffaloes (Patbandha *et al.*, 2015). About 1356 quarterly milk samples at afternoon milking were randomly collected and checked immediately by California mastitis test (CMT) for any infection as CMT has been considered as gold standard cow side test suitable for screening of udder health (Pyorala, 2003; Joshi and Gokhale, 2006). Mastitis detection was carried out by visual appraisal using CMT test and physical change in milk (Swain *et al.*, 2013, Tiwari *et al.*, 2016). On the same day, milk components such as milk fat, protein, lactose, SNF and TS percent were analyzed by milk analyzer "LACTOSCAN" (New dairy engineering and trading company Pvt. Ltd., Delhi, India). Quarter wise incidence of mastitis was calculated as per the standard method described by Bhanuprakash *et al.* (2005).

$$\text{Mastitis incidence (\%)} = \frac{\text{Number of positive quaters}}{\text{Total number of quaters at risk of mastitis}} \text{X100}$$

**Statistical analysis**

The variation of sub-clinical and clinical mastitis incidence during different seasons (summer, rainy and winter) and lactation stages (early lactation: ≤100 days, mid lactation: 101-200 days and late lactation: 201-300 days) were analyzed by chi-square test. The impact of mastitis on milk components was analyzed by one way analysis of variance (ANOVA). Tukey post hoc test was used to compare the means between two groups and difference was considered as significant if '*p*' $< 0.05$. All the statistical analysis were carried out using SPSS package (Version 16.0, USA)

## RESULTS AND DISCUSSION

Although dairying plays significant role for upliftment of rural livelihood in India (Dash, 2009, 2013), the infection like mastitis imposes a serious threat. California mastitis test was considered as gold standard for screening of mastitis in dairy bovines with higher (>95%) sensitivity and specificity (Pyorala, 2003; Joshi and Gokhale, 2006).

The present study reports higher incidence of SCM (6.1%) over CM (4.6%) in Jaffrabadi buffaloes (Table 1). The incidences of mastitis observed in the present investigation are in agreement with previous reports in dairy buffaloes (Joshi and Gokhale, 2006; Sinha and Thombare, 2014), who reported incidence of SCM 5-20% and CM 1-10% in buffaloes of periurban dairies of India. In contrast to our result, several authors reported higher incidence of SCM (11-45%) and CM (7-26%) in dairy buffaloes in India (Khate and Yadav, 2010; Sudhan and Sharma, 2010; Sharma *et al.*, 2012; NAAS, 2013; Jingar *et al.*, 2014b). Higher incidence of SCM (39.2-41.8%) and CM (13.6-21.08%) in buffaloes has also been reported by several authors in other countries (Chishty *et al.*, 2007; Ali *et al.*, 2014). This variation might be attributed to farm managemental factors coupled with climatic and environmental conditions which favour microbial growth (Sharma *et al.*, 2012). We observed higher incidence of SCM mastitis compared to CM in buffaloes which is in agreement with the previous studies (Chavoshi and Husaini, 2012; Ali *et al.*, 2014). About 15-40 times higher incidence of SCM has

**Table 1 : Incidence of mastitis during different season**

| Mastitis | Summer (n = 496) | Rainy (n = 428) | Winter (n = 432) | $\chi$ 2 Value | Total (n = 1356) |
|---|---|---|---|---|---|
| SCM (%) | 44 (8.9) | 23 (5.4) | 16 (3.7) | 11.336** | 83 (6.1) |
| CM (%) | 17 (3.4) | 27 (6.3) | 18 (4.2) | 4.610 | 62 (4.6) |

SCM, sub-clinical mastitis; CM, clinical mastitis; **, $p < 0.01$

**Table 2 : Incidence of mastitis during different stage of lactation**

| Mastitis | Early (n = 468) | Mid (n = 436) | Late (n = 452) | $\chi$ 2 Value | Total (n = 1356) |
|---|---|---|---|---|---|
| SCM (%) | 30 (6.4) | 26 (6.0) | 27 (6.0) | 0.104 | 83 (6.1) |
| CM (%) | 18 (3.8) | 18 (4.1) | 26 (5.8) | 2.205 | 62 (4.6) |

SCM, sub-clinical mastitis; CM, clinical mastitis

**Table 3 : Effect of mastitis on milk components**

| Milk components | Normal (n = 1211) | SCM (n = 83) | CM (n = 62) |
|---|---|---|---|
| Fat (%) | 8.36 ± 0.08 | 8.35 ± 0.15 | 8.60 ± 0.17 |
| Protein (%) | 4.31 ± 0.03 | 4.32 ± 0.06 | 4.26 ± 0.07 |
| Lactose (%) | $5.69^{A}$ ± 0.05 | $5.31^{B}$ ± 0.08 | $5.10^{B}$ ± 0.05 |
| SNF (%) | $10.97^{A}$ ± 0.08 | $10.57^{AB}$ ± 0.13 | $10.29^{B}$ ± 0.11 |
| TS (%) | 19.33 ± 0.15 | 19.02 ± 0.24 | 18.89 ± 0.23 |

Means with different superscript (A, B) within a row differ significantly ($p < 0.05$)

been reported in dairy bovines compared to CM (Sharma *et al*., 2012; NAAS, 2013). The SCM is not easily detected, persists longer duration and adversely affects milk quality and quantity (Sharma *et al*., 2012; NAAS, 2013). Hence, proper screening of milk samples by CMT test could detect sub-clinical form of mastitis and early treatment of infected udder quarters can reduce the economic losses due to mastitis in dairy buffaloes.

The incidence of SCM showed significant seasonal variation ($p < 0.05$) in buffaloes; but CM did not differ significantly ($p > 0.05$) among different seasons (Table 1). Incidence of SCM was observed to be significantly ($p < 0.05$) higher during summer season (8.9%), followed by rainy (5.4%) and winter (3.7%) seasons. On the other hand, though CM incidence was higher during rainy (6.3%), followed by winter (4.2%) and summer (3.4%), did not differ statistically (Table 1). Higher incidences of mastitis during summer and rainy seasons are in similar line with the previous researchers (Khate and Yadav, 2010; Sharma *et al*., 2012; Purohit *et al*., 2014). Higher incidence of mastitis during summer may be explained by the heat stress complemented with nutritional stress which increases susceptibility to udder infection in dairy buffaloes (Khate and Yadav, 2010). In addition, microbial growth is also enhanced by hot and humid season (Sharma *et al*., 2012; Purohit *et al*., 2014) and thus summer and rainy seasons may increase incidence of mastitis by increasing mastitis causing pathogens. Mitigation of heat stress and availability of good quality feed and fodder could reduce the incidence of mastitis during summer season. Niwas *et al*. (2013) reported that feeding of herbal nutraceutical to animals during summer increased dry matter intake and digestibility of nutrients; so along with heatstress mitigation strategies, feeding of herbal nutraceutical could reduce nutritional stress and improve the udder health.

Incidence of SCM and CM during different stage of lactation is presented in table 2. The SCM and CM did not differ statistically among different stage of lactation (Table 2.). Although, SCM (6.4%) and CM (5.8%) incidences were higher during early and late lactation, respectively, did not differ statistically compared to other stages. In a similar line, others reported higher incidence of mastitis during early and late lactation in dairy buffaloes (Kavitha *et al*., 2009; Sharma *et al*., 2012; Ali *et al*., 2014; Jingar *et al*., 2014a; Purohit *et al*., 2014). The higher incidence of mastitis during early lactation may be attributed to immuno suppression, as buffalo experienced stressful condition and negative energy balance during peripartum period which directly affects the phagocytic activity of neutrophils (Sharma *et al*., 2012; Pathan *et al*., 2014; Purohit *et al*., 2014). Further, farm management practices also markedly influence the mastitis incidence in dairy buffaloes by altering pathogens (Khate and Yadav, 2010; Sharma *et al*., 2012). In the present study, similar trend in incidence of mastitis throughout the lactation was observed which might be attributed to better management practices followed in the farm.

Effect of SCM and CM on different major milk components in Jaffrabadi buffaloes is presented in table 3. Irrespective of the udder health status, mean values of milk fat, protein, lactose, SNF and TS were more or less comparable with other studies on Jaffrabadi buffaloes (Sethi, 2003; Moioli and Borghese, 2008; Garaniya *et al*., 2013; Patbandha *et al*., 2015) as well as other buffalo breeds (Bansal *et al*., 2007; Abd El-Salam and El-Shibiny, 2011; Claeys *et al*., 2014). Milk lactose and SNF per cent were significantly ($p < 0.05$) affected by mastitis in Jaffrabadi buffaloes. Milk lactose content in normal milk samples was observed to be $5.69 \pm 0.05$g% which reduced significantly ($p < 0.05$) in SCM ($5.31 \pm 0.08$g%) and CM ($5.10 \pm 0.05$g%) condition. Similarly, milk SNF content reduced significantly ($p < 0.05$) in CM condition compared to normal milk ($10.97 \pm 0.08$ *vs*. $10.29 \pm 0.11$g%), but such difference was not observed between SCM condition as compared to normal milk. The lower milk lactose and SNF in mastitic milk of Jaffrabadi buffaloes is in agreement with other studies (Bansal *et al*., 2007; Sharif *et al*., 2007; Tripaldi *et al*., 2010; Hussain *et al*., 2012; Patbandha *et al*., 2016). The lower milk lactose and SNF in mastitic milk may be attributed to impaired synthesis of glandular cells or leakage from milk to blood (Sharif *et al*., 2007; Hussain *et al*., 2012; Patbandha *et al*., 2016). Contrary to the previous studies (Bansal *et al*., 2007; Hussain *et al*., 2012), we did not observe any significant variation of milk fat, protein and TS per cent between mastitic and normal milk samples (Table 3). The disparity of results may be associated with types of mastitis causing microbes which affect the degree of severity of infections and subsequently alteration of synthesis of milk components or their degradation or leakage to blood (Sharif *et al*., 2007; Hussain *et al*., 2012; Malek dos Reis *et al*., 2013). Further, TS content of milk is not affected by a single trait, rather affected by milk fat, protein, lactose, ash, *etc*., so it is difficult to interprete changes of milk TS during mastitis.

The present study highlights the incidence of SCM and CM of Jaffrabadi buffaloes in an organized dairy farm during different seasons and lactation stages. The incidence of mastitis in Jaffrabadi buffaloes is affected by seasons but not by lactation stages. In addition, Jaffrabadi buffaloes are more vulnerable to mastitis during summer and rainy seasons. Further, mastitis markedly affects the milk lactose and SNF in buffalo milk. Hence, better farm managerial and hygienic practices could reduce mastitis incidence and improve the udder health status in dairy buffaloes.

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