Infrared thermal imaging of udder skin surface temperature variations to monitor udder health status in *Bos indicus* (Deoni) cows


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**HIGHLIGHTS**

- USST variations of *Bos indicus* cows were monitored by using infrared thermography.
- Milk samples were screened for mastitis using SCC, EC and California mastitis test.
- Udder skin surface temperature was positively correlated with somatic cell count and electrical conductivity.
- USST differences as monitored by IRT technique could possibly detect subclinical mastitis-affected quarters of Deoni cows at an early stage.

**ABSTRACT**

The study was conducted to evaluate the potential of infrared thermography (IRT) technique for the early detection of subclinical mastitis in indigenous cows. A total of fifty-six quarters of lactating *Bos indicus* (Deoni) cows (n = 14) were monitored for ocular surface temperature (OST) and udder skin surface temperature (USST) prior to morning and evening milking using FLIR IS (forward-looking infrared) camera continuously for 28 days. Milk samples were collected from each quarter and screened for mastitis using Somatic Cell Count (SCC), Electrical Conductivity (EC) and California Mastitis Test (CMT). Thermographic images were analyzed by using FLIR Quick Report 1.2. Data on OST and USST were compiled and analyzed statistically using SPSS 16.0. The mean (±SD) OST (i.e. body temperature) of an individual cow during the study period was 36.10 ± 0.08°C. The mean (±SD) OST (36.10 ± 0.08°C) and USST (36.19 ± 0.06 °C) of unaffected cows did not differ significantly, however, the mean (±SD) USST of the subclinical mastitis-affected quarter was 37.61 ± 0.29°C which was 1.51°C higher than the body temperature (<i>P</i> < 0.001). The increase in USST of subclinical mastitis quarters showed a positive linear relation with the SCC and EC with R² > 0.95. The maximum udder skin surface temperature of 37.90 was taken and used for the ROC analysis. The ROC curve analysis revealed a higher sensitivity and specificity for difference between OST and USST and their potential for detection of subclinical mastitis with a cut-off value >0.58°C. Infrared thermal imaging technique could be used as a potential noninvasive, cow-side diagnostic method for screening and detection of subclinical mastitis.

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1. Introduction

India ranks first in the world livestock population and milk production. According to 19th Livestock Census [1], total livestock population in India is 512.1 million numbers among this the milch animals comprises of 19.42 million crossbred and 48.12 million indigenous cattle, respectively. Mastitis is a complex multi etiological disease affecting dairy cattle and causes reduced milk yield and poor quality of milk. Mastitis ranks first among the diseases of dairy cows with high prevalence and incidence rate, which causes severe economic losses to the dairy farmers [2]. The incidence of mastitis in Karan Fries, Karan Swiss, Sahiwal, Tharparkar cows was reported to be 36.90, 38.46, 33.98 and 33.44 per cent, respectively. The incidence was highest in fourth parity and above and lowest in first parity [3]. Prevalence of subclinical mastitis among non-descript, Deoni, Jersey and HF cows were 40.8, 36.1, 47.8, and 54.7 per cent, respectively [4].

The global estimated economic loss per year due to mastitis amounts to USD 35 billion and Rs.6000 crore for Indian dairy industry in which subclinical mastitis is responsible for approximately 70–80 per cent (Rs.4365 crore) of economic losses. Delay...