Somatic cell count and biochemical components of milk related to udder health in buffaloes

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ABSTRACT: The 399 clinically healthy quarters from 101 Murrah buffaloes were analyzed for somatic cell count (SCC; DCC and microscope methods) and biochemical composition of milk in relation to udder health. The udder health revealed specific subclinical mastitis (SSM) in 7% and non-specific mastitis (NSM) in 49% of quarters. Latent infections comprised 1%. Staphylococci (43%), streptococci (39%) and corynebacteria (18%) constituted chief etiological agents in SSM. Electrical conductivity increased significantly both in SSM and NSM compared to healthy quarters. Significant effects for SNF and density were seen in SSM only. DCC and microscope depicted similar cell counts with a correlation coefficient of 0.89. The correlations of DCC with CMT and EC were 0.85 and 0.51, respectively. Quarters with negative CMT reactions had DCC values of < 3 × 10⁵ cells/ml. The DCC means for negative, trace, and +1 to 2 CMT scores were 122, 238, and 593 (× 10³) cells/ml, respectively. Lactose with discrimination ability of 83.76% was found better indicator of udder inflammation in buffaloes. Buffaloes unlike cows have low numbers of quarter infections, respond similarly as cows to udder inflammation but at different levels, and DCC may be effectively employed for expressing milk cell count in this species.

Key words: Somatic cell count, Biochemical components, Udder health, Buffaloes.

INTRODUCTION - Mastitis, the inflammation of mammary glands not only results in decreased milk production but also adversely affects the quality of milk and milk products. In mastitis milk lactose, fat, milk proteins and SNF contents decrease while the undesirable components such as salt, somatic cells, fatty acids, whey proteins etc., and bacterial load increase. Hence, the disease is a major hindrance to the dairy industry for manufacturing quality dairy products acceptable to the consumer from public health point. A considerable data is available worldwide on somatic cell count levels and biochemical components of milk viz. a. viz. udder health in cows. Buffalo that constitutes significant proportion of milk animal species has not been fully exploited to these aspects. The present study evaluates the somatic cell count and biochemical components of milk in relation to udder health in...
buffaloes. Further, the suitability of DeLaval cell counter (DCC) application to buffalo milk in measuring somatic cell count was explored.

**MATERIAL AND METHODS** - a) Animals. The study involved 101 Murrah buffaloes having clinically healthy udders. The animals were distributed over different parities and were hand-milked at a milking interval of 12 h with daily mean milk yield of 7.88 ± 2.56 kg. b) Collection and analysis of samples. The 5-7 ml quarter foremilk samples from each animal were collected at afternoon milking in sterilized glass test tubes for bacteriological analysis. The next 25-30 ml of milk fraction was collected in plastic vials for analysis of cell count and biochemical composition of milk as described below:

- California mastitis test (CMT) as per Thompson and Postle (1964). Results were expressed as negative (0), 1, 2, and 3 CMT score.
- Somatic cell count (direct measurement) by DeLaval cell counter (DCC) from DeLaval International AB, Tumba, Sweden. Results were expressed as cells/µl (thousand cells/ml).
- Somatic cell count (microscopic method) as described by Schalm et al. (1971). The results were expressed as thousand cells/ml.
- Electrical conductivity (EC) by microprocessor precisions digital conductivity meter (from Systronics India, Ltd.). Results were expressed in milli Siemens/cm (mS/cm).
- Fat free electrical conductivity (FFEC) was calculated by adjusting effect of milk fat on EC (Prentice, 1962).
- pH by microprocessor precisions digital pH/mV-meter (from Systronics India, Ltd.).
- Bacteriology as per procedure of National Mastitis Council (Brown et al., 1981)
- Biochemical composition (fat, total protein, lactose, SNF and density) of milk by Lactoscan milk analyser model Mega 45-VI (Chadha Sales Pvt. Ltd. India). The instrument was based upon VHFS (very high frequency sound) technology.

**c) Defining udder health.** The health status of quarters was defined on the basis of cell count (DCC method) and bacteriology of foremilk samples (International Dairy Federation, 1987; German Veterinary Medical Society, 2002).

**d) Statistical analysis.** The interpretation of the data was done in two ways. The first model evaluated the effect of quarter health status on the selected variables by one-way analysis of variance. The usefulness of variables in differentiation of healthy and mastitic quarters was evaluated by discriminant function analysis. Second model compared the cell count results of DCC with their corresponding microscopic values by applying student’s pair t-test. The interrelationship among different parameters was studied by correlation analysis (Snedecor and Cochran, 1989).

**RESULTS AND CONCLUSIONS** - The categorization of udder health revealed 7%, 49% and 1% quarters with specific, non-specific and latent mastitis, respectively. The organisms isolated from specific mastitis included coagulase negative staphylococci (35.71%), *S. aureus* (7.14%), *Streptococcus agalactiae* (28.57%), other streptococci (10.71%) and corynebacteria (17.86%). The five latent infections were observed due to coagulase negative staphylococci (2) and corynebacteria (3).

Analysis of biochemical composition of milk viz. a viz. udder health showed significantly (p<0.01) higher EC (mS/cm) in specific (4.72 ± 0.81) and non-specific mastitis (4.21 ± 0.56) than in healthy quarters (3.98 ± 0.36). Total protein was lowered in non-specific and specific
mastitis cases, but significant effects for lactose, SNF and density could be seen in specific mastitis only. Latent infections represented only a significant increase in pH (Table 1).

Table. 1. Comparison of milk components (Means) in healthy and mastitis quarters.

| Health category | n     | DCC (×10^3 ml) | EC      | pH      | Fat | Protein | Lactose | SNF | Density | FFEC |
|-----------------|-------|----------------|---------|---------|-----|---------|---------|-----|---------|------|
| Healthy         | 172   | 61             | 3.98    | 6.69    | 5.13| 3.44    | 5.78    | 9.84| 32.45   | 4.72 |
| Specific        | 28    | 1379*          | 4.72*   | 6.69    | 5.21| 3.26*   | 5.51*   | 9.39| 31.29*  | 5.60*|
| Non-specific    | 194   | 220            | 4.21*   | 6.66    | 5.70*| 3.37*   | 5.73    | 9.77| 32.49   | 5.04*|
| Latent          | 5     | 35             | 3.83    | 6.89*   | 5.17| 3.49    | 5.86    | 9.98| 32.52   | 4.54 |

*Significantly different as compared to that of healthy quarters (p < 0.01).

The ability of various parameters to differentiate between healthy and mastitic quarters is presented in Table 2. Lactose with discrimination ability of 83.76% was found to be the better indicator of udder inflammation among all the parameters studied. Electrical conductivity could differentiate correctly 62.94% of the healthy and mastitis quarters. However, pH was found to be the non-satisfactory indicator of mastitis in buffaloes.

Table. 2. Discrimination ability of different parameters in differentiating healthy^1^ and mastitis quarters2.

| Parameter          | Threshold value^3^ | Type of mis-classification (%) | Discriminant Function Analysis |
|--------------------|--------------------|-------------------------------|-------------------------------|
|                    |                    | False positive     | FALSE negative     | Probability of mis-classification (%) | Discrimination ability (%) |
| EC (mS/cm)         | 4.1                | 34.30             | 39.19             | 37.06                         | 62.94                        |
| Fat free EC (mS/cm)| 4.8                | 42.44             | 31.53             | 36.29                         | 63.71                        |
| Lactose (%)        | 5.5                | 18.02             | 14.86             | 16.24                         | 83.76                        |
| SNF (%)            | 9.5                | 23.84             | 61.26             | 44.92                         | 55.08                        |
| Density            | 31.7               | 33.72             | 61.26             | 49.24                         | 50.76                        |

^1 number of observations (n): 172.
^2 include both specific and non-specific mastitis quarters, number of observations (n): 222.
^3 thresholds where total error was found to be minimum irrespective of proportion of false positive and false negative results.

Evaluation of SCC by DCC and microscope depicted similar cell count levels, with a correlation coefficient of 0.89. The correlation of DCC with other mastitis indicators was: CMT (0.85), EC (0.51), lactose (-0.22) and SNF (-0.23). The 94.37% of quarters with negative CMT reaction were having DCC values < 3 × 10^5 cells/ml. The mean DCC values for negative, trace, and +1 to 2 CMT reactions were observed as 122, 238, and 593 (× 10^3) cells/ml, respectively.
To conclude, buffaloes unlike cows have low numbers of quarter infections, respond on similar line as cows to udder inflammation but at different level, and the DeLaval cell counter (DCC) may be effectively employed for expressing milk cell count in this species.

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