Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(5): 01-03

Received: 01-07-2020
Accepted: 03-08-2020

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Changes in somatic cell count of goat milk associated with udder health status

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DOI: https://doi.org/10.22271/j.ento.2020.v8.i5a.7499

Abstract
Sixty (60) samples of goat milk from udder halves were analysed. The samples were grouped into Normal, Subclinical 1^+, Subclinical 2^+, Subclinical 3^+ and Clinical, based on the score of California Mastitis Test (CMT). The average Somatic Cell Count (SCC) of milk was lowest ($7.17 \pm 0.11 \times 10^5$ cells/ml) in normal group and highest ($48.62 \pm 1.00 \times 10^5$ cells/ml) in Clinical group. The average SCC of milk for Subclinical 1^+, Subclinical 2^+ and Subclinical 3^+ were $13.29 \pm 0.56 \times 10^5$ cells/ml, $28.58 \pm 0.66 \times 10^5$ cells/ml and $41.08 \pm 0.50 \times 10^5$ cells/ml, respectively. These results indicated increase in SCC of milk with increase in the severity of the mastitis. As such, if the threshold level is established, the SCC of milk can be used as a diagnostic value for clinical and subclinical conditions of udder infections in does.

Keywords: Goat, milk, mastitis, CMT, somatic cell count

Introduction
Mastitis is udder infection which affects the quantity as well as quality of milk. It causes heavy losses to the farmers. It can be a health hazards to the consumers too. So, early detection of mastitis and prompt treatment is very important in order to stop further damage to the udder to minimize financial loss to the farmers as well as for prevention of health hazards to the milk consumers. It is difficult to arrive at a confirmative diagnosis of the various stages of mastitis in goat. The direct link between changes in SCC and the onset of mastitis has indeed been known for a long time and therefore, in a wide array of scientific reports, authors have considered an increase in SCC as a marker of mastitis [1]. Somatic cell count in milk is the main marker for the detection and diagnosis of mastitis [2]. The present investigation is aimed to arrive at the prediction and diagnosis of various stages of mastitis in goat.

Materials and Methods
After thorough clinical examination of the udder and performing CMT carefully, 60 samples, each of about 30 ml foremilk of goat was collected halve wise, separately in sterilized, clean and dry plastic bottles by hand milking. All the samples were collected in the morning hours. All the samples were collected in the morning hours. According to CMT score, the samples were equally divided into normal, subclinical 1^+, subclinical 2^+, subclinical 3^+ and clinical groups. The milk samples were kept immediately into icebath to carry out subsequent analysis in the laboratory.

Somatic cell count
A drop of each freshly collected milk sample was spread on a clean glass slide to have an air-dried smear of about 1 cm^2 area. The smear was stained by dipping in Livowitz-Webber solution (containing 52 ml of 95% ethyl alcohol, 44 ml tetrachlorethane, 0.6 g methylene blue chloride and 4 drops of glacial acetic acid) for 2 minutes followed by washing with distilled water. After air drying again, at least 10 fields of the stained smear were examined under oil immersion to count the average number of the somatic cells. The average of the cells counted was multiplied by 50,000 (microscopic factor) for calculation of direct microscopic SCC of each milk sample [3].

Statistical analysis

The statistical analysis, such as *t* test, Completely Randomized design and Regression coefficient of the experimental data was carried out using standard methods [4].

Results and Discussion

The averages of milk SCC with their standard errors for comparisons of different udder health status of does are presented in Table 1 and Figure 1. The average SCC of milk was lowest (7.17 ± 0.11 x 10^5 cells/ml) in the normal group and highest (48.62 ± 1.00 x 10^5 cells/ml) in the Clinical group. The average SCC of milk for Subclinical 1^+, Subclinical 2^+ and Subclinical 3^+ were 13.29 ± 0.56 x 10^5, 28.58 ± 0.66 x 10^5 and 41.08 ± 0.50 x 10^5 cells/ml, respectively.

These results indicate increase in SCC of milk with increase in the severity of the mastitis. The statistical analysis of the data generated for the average SCC of milk revealed an increasing trend from normal to clinical groups (Table 1 and Figure 1). Analysis of variance to test the difference in SCC of milk with respect to different udder health status revealed significant (P<0.01) difference (Table 2). The average difference of milk ranged from 18.35% for subclinical 3^+ - Clinical comparison to 578.24% for Normal - Clinical comparison. All the comparisons showed significant (P<0.01) difference in various udder health status. Table 3 showed significant (P<0.01) increase in SCC of milk by 11.05 x 10^5 cells/ml for each unit increase in CMT score.

The average level of milk SCC from non-infected udder halves (7.17 ± 0.11 x 10^5 cells/ml) in the present investigation was lower than those of 8.51 x 10^5 [5], 8.80 x 10^5 [6], 9.08 x 10^5 [7], 7.44 x 10^5 [8] and 7.50 x 10^5 [9] cells/ml. However, the present findings were comparable with those of 6.84 ± 0.9 x 10^5 (normal), 16.45 ± 0.5 x 10^5 (subclinical), 26.34 ± 1.2 x 10^5 (clinical 1^+), 41.8 ± 1.7 x 10^5 (clinical 2^+) and 48.68 ± 1.5 x 10^5 cells/ml (clinical 3^+) [10]. The present finding for clinical SCC is also comparable to 43.00 - 53.00 x 10^5 cells/ml [11]. The SCC more than 7.92 x 10^5 cells/ml for bacteriologically positive milk samples indicates subclinical mastitis in goats [11]. The results shown in the present investigation for subclinical mastitis were much higher than those of 7.36 ± 0.033 x 10^5 cells/ml [12] and 7.92 ± 0.02 10^5 cells/ml [8].

Despite the day to day variations in the milk SCC, its increased level was ascribed an important role in mastitis [3], as the influx of somatic cells into milk was an indicative of udder inflammation. Inflammation of mammary gland caused by the multiplication of pathogenic organisms led to the production of inflammatory mediators responsible for the modulation of SCC [13]. Moreover, the predominant leucocytes present in milk were polymorphonuclear neutrophils, however, lymphocytes, plasmocytes and macrophages might also be present [14] and the chemotactic action exerted on the blood leucocytes by the complement components, serum factors and organisms themselves or their toxins acting singly or in combination was found responsible for the increase in milk SCC [15]. Besides infection, the SCC of goat milk was observed to increase with the increase in the stage of lactation [16], but it was not affected significantly by parity and types of birth [17].

Table 1: SCC of goat milk (Mean ± SE) in different udder health status of goat

Udder health status	Normal milk	Subclinical milk				Clinical milk
		1^+	2^+	3^+	Combined (1^+, 2^+, 3^+)	
SCC of milk (x10^5 cells/ml	7.17^a ± 0.11	13.29^b ± 0.56	28.58^c ± 0.66	41.08^d ± 0.50	27.65± 0.50	48.62^e ± 1.00

Different superscripts indicate significance between udder health status

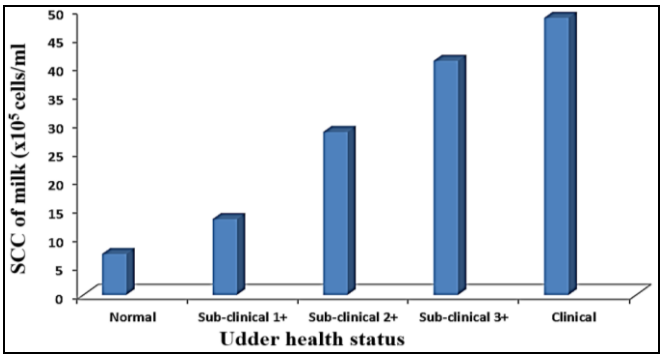

Fig 1: SCC of milk related to udder health status

Table 2: Analysis of variance for SCC of goat milk

Parameters	Source of variation	Degrees of freedom	M.S.S	F cal
SCC	Udder health status	4	3741.29	480.16**

**Significant at 1% level

Table 3: Regression of milk SCC on CMT score

Milk constituent	Regression	S.E. (b)	t (b)
SCC (x 10^5 cells/ml)	11.05	0.31	36.64**

** Significant at 1% level

Conclusion

It can be concluded that increased level of SCC found in the present investigation, although influenced by stage of lactation could be used as the clinical indicator with both predictive and diagnostic value, respectively, for detection of early and advance stages of mastitis in does.

Conflict of Interest: There is no conflict of interest among authors for this study.

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