

Original Research Article

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Effect of Non-Genetic Factors on Somatic Cell Count in Sirohi Goats

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ABSTRACT

Goat milk has higher Somatic Cell Count (SCC) and the ability to correctly interpret somatic cell counts in goat depends on an understanding of the various factors which may affect the number of somatic cells. The present study was carried out to determine the effect of non-genetic factors on Sub Clinical Mastitis (SCM) and to investigate the relationships between these factors with Somatic cell count (SCC) in 105 Sirohi goats raised at Sheep breeding farm Fatehpur, Sikar in Rajasthan, India. Milk samples were collected from udder halves of lactating goats and examined by somatic cell count to check the status of subclinical mastitis. Data were collected from the record register maintained at farm and data evaluated by Parity, Stage of Lactation and Prolificacy by the SPSS packet program. On analysis of variance result revealed that the parity had highly significant ($P < 0.01$) effect on SCC. Higher incidence of SCM was in later parities in comparison to primiparous animals. Stage of lactation had also significant effect ($P < 0.05$) on the $\text{Log}_{10}\text{SCC}$ and indicated that composite SCC increased with the advancement of lactation while non-significant effect on $\text{Log}_{10}\text{SCC}$ has been found with prolificacy. So it can be concluded from the present study that the non-genetic factors like parity, stage of lactation and prolificacy have a significant effect on Milk SCC. Thus, goat farmers are advised to spend more time on their herds and given extra care to their animals in later parity and last stage of lactation to prevent the infection of sub clinical mastitis.

Keywords

Somatic cell count,
Subclinical mastitis,
Parity, Stage of
lactation, Prolificacy

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Introduction

Goat milk production is a dynamic and growing industry that is fundamental to the well-being of millions of people worldwide and is an important part of the economy in many countries (Silanikove *et al.*, 2010). In India there are about 135.17 million goats (26.4 percent of total livestock) producing

5220 tonnes (3 percent of total) of milk. Subclinical mastitis is economically one of the most costly and menacing disease of dairy industry worldwide and stands as the major obstacle towards healthy milk production (Bharti *et al.*, 2015). Somatic Cell Count is a helpful predictor of intra mammary infection (IMI), and therefore, an important component of milk in assessment of aspects of quality,

hygiene and mastitis control (Sharma *et al.*, 2016a). Milk secretion in goat is an apocrine process which results in presence of many cytoplasmic particles. This type of secretion is characterized by the detachment of the apical part of the epithelial cells from their base and release into the alveolar lumen at the end of the secretory phase (Makovicky *et al.*, 2012) resulting in higher SCC than cow milk and sheep milk. According to National Mastitis council, to differentiate between healthy and infected udder secretion the limit of SCC has been decided as 10,00,000 cells/ml. (Hinckley and Williams., 1981).

Somatic cells are present in healthy mammary glands but due to any kind of mammary inflammation there is an increase influx of cells and it is important to understand different non-infectious factors which affect Somatic Cell Count. In present study observations collected and analyzed for effect of Parity, stage of lactation and prolificacy on Somatic Cell Count. A number of studies have been done to investigate the relation of these non-genetic factors i.e. parity, stage of lactation, prolificacy etc. with occurrence of intra-mammary infection under different climatic conditions but information regarding Indigenous Goat breeds are scanty.

So the present study was conducted to determine the effect of parity, stage of lactation and prolificacy on milk Somatic Cell Count in Sirohi goats.

Materials and Methods

Location

The study was conducted at Sheep breeding farm Fatehpur, Sikar. Goat paddock located in Fatehpur city of Rajasthan. The altitude of Fatehpur city is 324 meter above mean sea level, latitude and longitude position being 27.98⁰N and 74.95⁰E, respectively.

Animal

Out of total number of goats in milk total, 105 healthy lactating Sirohi goats with no evidence of clinical mastitis were selected and the collection and analysis of milk samples were performed on the same day.

Collection of samples and diagnosis of Intra-mammary Infection

Representative milk samples were collected from udder halves of lactating goats. For this purpose, udder halves were designated as Left teat (LT) and Right teat (RT). About 30 ml of milk was collected aseptically in the clean sampling bottles after discarding the first 2-3 streaks of fore milk. The collected samples were brought to the laboratory immediately for further analysis. Within 6 h of collection, the milk samples were spread on 2 microscope slide areas, which were 10X10 mm² in size subsequently. The slides were fixed with pouring of ethyl alcohol for 2 minutes and the prepared smears were stained with the modified Newman's Lampert stain, by keeping the prepared slide in the staining solution for 1 to 2 minutes. The smears were gently washed in tap water and dried. The dried stained smears were examined under the oil immersion lens of the microscope. Thirty different fields per smear were observed, and the average number of somatic cells per field was calculated. The average number of cells per field was then multiplied by the microscopic factor of the microscope, i.e. 318471 to obtain the number of somatic cells per ml of the milk. Due to SCC not displaying a normal distribution, data of SCC were log transformed to base 10.

Data collection

Data were collected from the record register maintained at farm and data of SCC from all animals were classified according to parity,

stage of lactation and prolificacy. All these parameters were taken into consideration as for the factors influencing the occurrence of SCM and SCC.

Parity: All animals were classified under the different parities (viz., 1st, 2nd, 3rd and above) according to their lactation number.

Stage of lactation: The whole lactation was partitioned early stage of lactation (0 to 2 month), mid stage of lactation (2 – 4 month) and late stage of lactation (above 4 month).
Prolificacy: Goats were classified according to number of kids born in last parturition (viz., single and double)

Statistical analysis

Obtained SCC values were transformed to \log_{10} SCC for normality and homogeneity of variance. In the study, parity, stage of lactation and prolificacy were evaluated as independent variables. The data were examined by Analysis of Variance (ANOVA) and means were compared by Duncan's multiple range test. The model was as follows:

$$y_{ijklm} = \mu + a_i + b_j + c_k + d_{ijklm}$$

Where:

y_{ijklm} = Observation value for SCC

μ = Population mean

a_i = Effect of Parity (I = 1,2,3 and above)

b_j = Effect of Stage of lactation (j =1,2,3)

c_k = Effect of prolificacy (k = 1,2)

d_{ijklm} = The Random residual effect

All statistical analysis was performed using SPSS software statistical package (16.0).

Results and Discussion

Results of SCC in milk samples of Sirohi goats are presented in Table 1. The arithmetic mean \pm SE of SCC (absolute and logarithmic) of pooled milk sample were $8,22,009 \pm 23415$ cells/ml of milk and 5.894 ± 0.141 respectively. Range of SCC varied from 2,91,132 cells/ml to 13,74,733 cells/ml of milk samples collected from farm (Table 1).

Udder half-wise means \pm SE of \log_{10} SCC has been presented in the Table 2 where highest values found in right udder half i.e., 5.899 ± 0.045 . Higher incidence of SCC in right udder halves in present study is due to the resting behavior of the animals as the animals resting more in right lateral recumbence keeping the rumen upside (left side). This causes the positioning of right udder halves close to the ground which increases the chances of infection.

Effect of parity on milk SCC

After statically analysis results of the present study revealed that incidence of SCM increased with number of parity. The lowest incidence was observed in 1st parity (20.00 per cent), gradually increased and highest in >3rd parity (57.14 per cent) in Sirohi goats.

Several workers reported similar findings that enhancing milk production level and a rise in SCC with increasing parity in goats (Moroni *et al.*, 2005; Leitner *et al.*, 2008; Tancin, 2013; and Sharma *et al.*, 2016b).

The analysis of variance showed that the effect of parity on \log_{10} SCC was highly significant ($P < 0.01$) (Table 3). Mean \log_{10} SCC of Individual parity was compared by Duncan's Multiple Range Test. The results of post hoc test revealed that the mean \log_{10} SCC of 1st, 2nd and 3rd parity was significantly ($P < 0.05$) differ from each other (Table 4).

Table.1 Incidence, Mean \pm SE values & range of somatic cell counts

Number of observations	Mean \pm SE (cells/ ml)	Mean \pm SE (Log ₁₀ SCC)	Range(cells/ ml)
105	8,22,009 \pm 23415	5.894 \pm 0.141	2,91,132- 13,74,733

SE=Standard error, SCC=Somatic cell count

Table.2 Udder half-wise Mean \pm SE values of Log₁₀SCC

Different Udder halves	Number of observations	Mean \pm SE Log ₁₀ SCC
Overall mean	210	5.893 \pm 0.021
Left udder half	105	5.889 \pm 0.044
Right Udder half	105	5.899 \pm 0.045

Table.3 Mean \pm SE of Log₁₀SCC in different non genetic factors in Sirohi goats

Traits	Number of observations	Mean \pm SE of Log ₁₀ SCC
Parity	105	5.894\pm 0.141
I	15	5.774 \pm 0.193 ^a
II	69	5.895 \pm 0.119 ^b
III and above	21	5.972 \pm 0.109 ^c
Stage of Lactation	105	5.894\pm 0.141
Early stage (0 – 2 month)	42	5.841 \pm 0.154 ^a
Mid stage (2 – 4 month)	36	5.915 \pm 0.107 ^b
Late stage (above 4month)	27	5.946 \pm 0.137 ^b
Prolificacy	105	5.894\pm 0.141
Single	76	5.885 \pm 0.135
Double	29	5.915 \pm 0.155

Mean showing different superscripts in lower case letters in respective categories in a column differ significantly ($p < 0.05$), SE=Standard error, SCC=Somatic cell count

Table.4 Analysis of variance showing the effect of non-genetic factors on SCC in Sirohi goats

Source of variance	Degree of freedom	Sum Square	Mean Sum square	F – value
Parity	2	0.344	0.172	10.090**
Error	102	1.738	0.017	
Stage of lactation	2	0.207	0.104	5.640*
Error	102	1.875	0.018	
Prolificacy	1	0.019	0.019	0.954
Error	103	2.063	0.020	

SCC=Somatic cell count, ** Highly Significant ($p < 0.01$), *Significant ($p < 0.05$)

Similar significant association of parity with \log_{10} SCC were reported by Saanchez *et al.*, (1991), Rota *et al.*, (1993), Orman *et al.*, (2010), Kralickova *et al.*, (2012), Tancin (2013) and Sharma *et al.*, (2016b) whereas Sharma *et al.*, (2007) and Leinter *et al.*, (2008) reported non-significant effect of parity on SCC.

High SCC in later parity in comparison to primiparous animals may be due to the fact that constant exposure of animals to the pathogens and loosening of sphincters, help the easy entry of organism through streak canal which is responsible for higher rate of infection in multiparous animals in comparison to younger counterparts.

Further, animal resistance to mastitis might also be lowered with advancement of parity or age. Yu *et al.*, (2011) reported that with the increase of parity, the ratio of macrophages (MAC) and polymorphonuclears (PMN) tended to be increased and suggested that progressive increase of SCC when parity increased. Streak canal of the teats consists keratinized layer and accumulated cellular debris, which is wax like and having sebum like nature consisting of long chain fatty acids, which provides bacteriostatic effects (Mostert *et al.*, 2001). The breakdown of such streak canal barrier with advancing lactation leads to increased frequency of infection with successive increase in parity. The incidence of SCM and SCC increased as the lactation progressed and it attained the highest proportion during the 3rd and above parity.

Effect of stage of lactation on milk SCC

Results indicated that composite SCC increased with the advancement of lactation. The mean \pm SE values of \log_{10} SCC have been 5.841 ± 0.154 , 5.915 ± 0.107 and 5.946 ± 0.137 in early, mid and late stages of lactation, respectively

The analysis of variance revealed that the stage of lactation had significant effect ($P < 0.05$) on the \log_{10} SCC. The Duncun multiple range tests revealed that the difference between the mean \log_{10} SCC of mid and late stage of lactation were differ significantly from early stage of lactation but did not differ significantly from each other.

Various workers viz., Bufano *et al.*, (1996), Kuchtik *et al.*, (2006), Diana and Rotaru (2006), Orman *et al.*, (2011) and Sharma *et al.*, (2016b) found high SCC in late stage of lactation and also reported significant changes in SCC during different stages of lactation which support the results of present study. Bergonier *et al.*, (2003) and Dankow *et al.*, (2003), reported that SCC in uninfected goats is high at freshening, lowest from peak to mid-lactation and highest at drying off while Gomes *et al.*, (2006), Houda *et al.*, (2012) and De *et al.*, (2011) reported non-significant changes in SCC during different stages of lactation.

Physiologically, dairy goats have SCC with an upward trend corresponding to the progression of the productive period (Poutrel *et al.*, 1997).

This trend shows an inverse relationship with milk production (Rota *et al.*, 1993). Thus, the cellular concentration of goat milk is so high that, according to Corrales *et al.*, (1996), at the end of lactation it is impossible to distinguish between uninfected and healthy glands through SCC.

Effect of prolificacy on milk SCC

Data revealed that the mean (\pm SE) \log_{10} SCC value in case of single and double prolificacy are 5.885 ± 0.135 and 5.915 ± 0.155 respectively. The analysis of variance revealed that the prolificacy has non-significant effect on \log_{10} SCC (Table 4).

Sanchez-Rodriguez *et al.*, (2000) and Olechnowicz and Sobek (2008) supported the present findings and reported that the Prolificacy had no significant effect on somatic cell count.

It is concluded from the present study that the non-genetic factors i.e. parity, stage of lactation and prolificacy have some degree of association with prevalence of subclinical mastitis.

Therefore their inclusion in selection and breeding programme as indicator trait may help to improve udder health and milk quality in Sirohi goat.

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