Factors affecting somatic cell counts in jersey crossbred cows

Swarnalata Bara, SK Chaurasia, BPS Kanwar and AK Chaturvedani

Abstract

The present study was carried out in the herd of Jersey crossbred cows at private dairy farm located at Durg, Chhattisgarh. Milk samples were analyzed to evaluate the effect of season, stage of lactation and parity on somatic cell counts (SCC). The mean SCC in low and high milk yielders groups were 1.323 ± 0.043 and 1.274 ± 0.046 x 10^5 cell/ml, respectively while in different season (spring and summer) were noted as 1.125 ± 0.034 and 1.475 ± 0.034 x 10^5 cell/ml, respectively. In early, mid and late stage of lactation the SCC were 1.189 ± 0.051, 1.271 ± 0.051 and 1.439 ± 0.051 x 10^5 cell/ml, while in early, mid and late parities were found to be 1.215 ± 0.053, 1.299 ± 0.053 and 1.385 ± 0.053 x 10^5 cell/ml, respectively. The milk somatic cell counts of Jersey crossbred cows was found highly significant (p<0.01) with season and stage of lactation while non-significant (p>0.01) with parities. Non genetic factors such as season and stage of lactation affect the SCC.

Keywords: Jersey crossbred, somatic cell counts, season, stage of lactation, parity

Introduction

The composition of milk from dairy cows is of major interest to milk producers, processors and consumers because of its health related issues and also market demand. Profitability of dairy industry and end product quality is closely related to the hygienic and chemical properties of incoming raw milk. Raw milk quality encompasses criteria relating to composition and hygiene. The composition of milk varies with breed, feeding regimes and health status of the dairy animals and SCC is one of the most important factors to evaluate the quality and health of milk (Yarabbi et al., 2014) [17]. It directly affects the economy of milk production as well as economic condition of these farmers. The normal composition of milk somatic cell varies with the type of secretion or lactation cycle. Normally, in milk from a healthy mammary gland, the SCC is lower than 1x10^5 cells/ml, while bacterial infection can cause it to increase to above 1x10^5 cells/ml (Bytqi et al., 2010) [13]. Somatic cell counts are being used as an index of the inflammatory condition of the udder. These are secreted during normal course of lactation in milk (Silva and Silva, 1994) and therefore are a valid indication of abnormal milk secretion, milk composition and mammary disease in dairy animals (Haenlein and Hinckly, 1995) [7]. A decrease in bulk milk somatic cell count can be used as an indicator in mastitis control programme (Suriyasathaporn et al., 2000) [18]. Considerable literature on SCC levels in milk of exotic cattle is available (Sheldrake et al., 1983; Kehril and Shuster, 1994) [13, 8]. But information on mean and variations of SCC during different stages of lactation, parity and season in cows under tropical condition is not available. Therefore, the present study was carried out to evaluate the factors affecting SCC of milk of Jersey crossbred cows.

Material & Method

The present study was carried out in the herd of Jersey crossbred cows maintained at a private dairy Farm located at distance of 8 km from College of Veterinary Science and Animal Husbandry Anjora, Durg, Chhattisgarh. The area is light tropical, sub humid and monsoon climatic zone. Total 72 samples of milk from Mid February 2018 to June 2018 were collected and analyzed to study the effects of season, stage of lactation, parity on milk somatic cell counts.

Selection of animals

The present study was conducted on 35 Jersey crossbred lactating cows ranging from 1st to 5th parity.
and above lactation covering a period from mid Feb to June 2018. The information about the parity of cows and date of calving were obtained from the records available in the farm.

**Feeding and management**

The standard feeding and managerial practice were followed throughout the experimental period. The Jersey crossbreds were housed in head to head system. The milking of the animals was practiced twice a day. Milk yield was recorded separately by milk weighing machine. The Jersey crossbreds were tied and stall fed with the required quantity of paddy straw at the rate of 4 Kg per day, barseem at the rate of 10 to 15 kg per day and 1.5 kg concentrate mixture, were offered to lactating Jersey crossbreds for maintenance under the shade. The milk recording started after 5th day from calving. They were always fed individually. The fresheners were given 1 kg extra concentrate ration up to 1st month of production. After that the concentrate was given according to their milk production level. The concentrate was fed at the rate of 1 kg for each 2 kg of milk produced. The nutrient requirement of the animals was mostly met through concentrate and green fodder.

**Milk sampling**

Milk sampling was done at weekly interval. The fresh milk sample was collected separately in morning and evening. On each collection day aliquots of morning and evening milking was sampled from each cow in amount proportional to the amount produced and was mixed thoroughly. In case of freshly calved cows sampling was started from 5th day of calving. Total of 72 milk samples were collected from Jersey crossbred cows with apparently healthy udder producing normal milk in appearance during the period of 4 months. During each season 36 milk samples of early, mid and late lactation were considered for determination of SCC, taking due care of parity. A representative sample of milk (30-40ml) was taken for analysis.

**Determination of somatic cell count**

SCC in milk samples were done as per method described by Shalm et al. (1971). 10µl (0.01ml) fresh milk sample was taken on pre-drawn one square cm marked area over a grease free clean glass slide which was uniformly smeared with the sterilized platinum loop, and then smear was air dried. Smears were stained by modified Newman’s stain. In SCC analysis, direct microscopic counting method was performed for sampling. Number of somatic cells was multiplied by the multiplication factor of the microscope to obtain the number of cells per ml of milk.

**Classification of data**

Data of animals were classified according to the milk yield (low milk yielder less than 10 kg per day and high yielder more than 10 kg per day), Season (spring and summer), stage of lactation (early stage, mid stage and late stage), parities (early parity- 1st and 2nd parity, mid parity- 3rd and 4th parity and late parity- 5th and above parity).

**Statistical analysis**

Statistical analysis of data was done using analysis of variance to study the effect of season, parity and stage of lactation. Test day milk yield on somatic cell count. The following fixed effect model was used for the analysis:

\[ Y_{ijklm} = \mu + A_i + B_j + C_k + D_l + e_{ijklm} \]

Where,

\[ Y_{ijklm} = m^{th} \text{ observation under } i^{th} \text{ milk yield, } k^{th} \text{ parity, } j^{th} \text{ stage of lactation and } p^{th} \text{ season} \]

\[ \mu = \text{ Overall mean} \]

\[ A_i = \text{ Effect of } i^{th} \text{ season group} \]

\[ B_j = \text{ Effect of } j^{th} \text{ stage of lactation group} \]

\[ C_k = \text{ Effect of } k^{th} \text{ parity group} \]

\[ D_l = \text{ Effect of } l^{th} \text{ milk yield group} \]

\[ e_{ijklm} = \text{ Random error, NID (0,\delta^2e)} \]

**Result and Discussion**

The mean SCC in low and high milk producers was 1.335 ± 0.041 and 1.228 ± 0.047 (x10^5 cells/ml) respectively. The level of production was had significant (p<0.05) effect on SCC level. The mean of somatic cell counts in different level of production was presented in the Table. The mean SCC changes during different seasons were significant (p<0.01), being high during summer season 1.475 ± 0.034 (x10^5 cells/ml) and low in spring season 1.125 ± 0.034 (x10^5 cells/ml). The mean SCC in early, mid and late stage of lactation were 1.189 ± 0.051, 1.271 ± 0.051 and 1.439 ± 0.051 (x10^5 cells/ml). The gradual increase in SCC level with the advancement of stage of lactation had been observed. Analysis of milk yield showed high significance (p<0.01) difference for effect of stage of lactation. The results of the present study showed increasing trend for milk SCC with parity, SCC being lowest in early parity cows and highest in late parity cows. The mean value of SCC for mid and late parity were 1.215 ± 0.053, 1.299 ± 0.053 and 1.385 ± 0.053, respectively. The analysis of variance revealed non-significant (p>0.01) effect of parity on SCC.

**Table 1: Analysis of variance for Somatic Cell Counts (x10^5 cells/ml)**

<table>
<thead>
<tr>
<th>Effect</th>
<th>df</th>
<th>Sum of square</th>
<th>Mean square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk Production</td>
<td>1</td>
<td>0.286</td>
<td>0.286</td>
<td>4.200*</td>
</tr>
<tr>
<td>Season</td>
<td>1</td>
<td>2.212</td>
<td>2.212</td>
<td>54.515**</td>
</tr>
<tr>
<td>Stage of lactation</td>
<td>2</td>
<td>0.784</td>
<td>0.392</td>
<td>6.337**</td>
</tr>
<tr>
<td>Parity</td>
<td>2</td>
<td>0.348</td>
<td>0.174</td>
<td>2.555</td>
</tr>
</tbody>
</table>

**Table 2: Group, season, and parity wise Means, standard error and standard deviation for somatic cell counts (x10^5 cells/ml)**

<table>
<thead>
<tr>
<th>Source</th>
<th>Mean</th>
<th>Std. error</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low yield</td>
<td>1.323</td>
<td>0.043</td>
<td>0.238</td>
</tr>
<tr>
<td>High yield</td>
<td>1.274</td>
<td>0.046</td>
<td>0.296</td>
</tr>
<tr>
<td>Season</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>1.125</td>
<td>0.034</td>
<td>0.202</td>
</tr>
<tr>
<td>Summer</td>
<td>1.475</td>
<td>0.034</td>
<td>0.266</td>
</tr>
<tr>
<td>Stage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early</td>
<td>1.189*</td>
<td>0.051</td>
<td>0.220</td>
</tr>
<tr>
<td>Mid</td>
<td>1.271*</td>
<td>0.051</td>
<td>0.290</td>
</tr>
<tr>
<td>Late</td>
<td>1.439*</td>
<td>0.051</td>
<td>0.228</td>
</tr>
<tr>
<td>Parity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early</td>
<td>1.215*</td>
<td>0.053</td>
<td>0.208</td>
</tr>
<tr>
<td>Mid</td>
<td>1.299*</td>
<td>0.053</td>
<td>0.287</td>
</tr>
<tr>
<td>Late</td>
<td>1.385*</td>
<td>0.053</td>
<td>0.279</td>
</tr>
</tbody>
</table>

*Significant at p<0.05, **Significant at p<0.01
Fig 1: Graph showing average values of milk yield, season, stage of lactation and parities on somatic cell counts (x10³ cell/ml)

A total 72 milk samples were examined for somatic cell count during the four months of experimental period. The means of the low and high producing animals was significantly (p<0.05) differed from each other. Similar to present findings, significant differences in milk SCC were observed by Samanta et al. (2006) [11] between different levels of milk yield. Ouedraogo et al., 2008 [9] reported higher SCC values for low yielding animals compared to high yielding animals. The low yielding animal possibly get less attention in terms of feeding and cleaning thereby affecting milk yield and increase in SCC. The SCC was higher in summer season as compare to the spring season. Syridion et al. (2012) [10] and Baul et al. (2011) [11] also reported significant effect of season on SCC variation. Animals during summer are under stress as well as high temperature and excess moisture in hot humid region make them more susceptible to infections, having a greater number of SCC. Similar to present study, the gradual increase in SCC level with the advancement of stage of lactation have been observed by Fadlemoula et al. (2008) and Ruegg and Pantoja (2013) [10]. Increased SCC values towards the end of lactation could be due to higher infection rate as the udder canals are dilated due to continuous milking and dilution effect of increased milk yield during early lactation and declines of milk yield during mid and late lactation. In the present study the effect of parity on SCC was non-significant. SCC was highest in late parity and lowest in early parity. It shows increasing trend for milk somatic cell count with parity. Ahn et al. (2006) [1] and De et al. (2011) [11] observed non-significant effect of parity on SCC. Contrary, Erdem et al. (2010) [5] reported significant effect of parity on SCC. The higher SCC in later parity in comparison to primiparous animals may be due to fact that animal’s resistance to mastitis might be lowered with advancement of lactation number or age.

Conclusion
This study indicates that SCC content varied as per season and stage of lactation suggesting these are very much influenced by non genetic factors. Therefore, it is suggested that monthly control of SCC in dairy farms is one of the most effective methods to monitor and evaluate changes in the amount of production of milk and milk quality. Understanding the relationship between somatic cells and the production of high-quality milk is fundamental for the profitability of the dairy business. Optimum outputs can be achieved by reducing somatic cell counts at the herd level. Routine screening tests, improved sanitation, dry period therapy and improvement in management, as well as feeding, are needed to reduce somatic cell counts and prevent the occurrence of udder infections.

References