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Full Length Article

Relationships between Somatic Cell Count and Udder Type Scores in Holstein Cows

Savas Atasever[1*] and Huseyin Erdem[1]
[1]*Department of Animal Science, Faculty of Agriculture, University of Ondokuz Mayis, 55139-Kurupelit, Samsun, Turkey*
[*]For correspondence: satasev@omu.edu.tr; satasev@yahoo.com

Abstract

This study was carried out to determine the relationships between somatic cell count (SCC) and udder type scores (UTS) of Holstein cows. A total of 120 cows raised at five private farms were monthly evaluated by SCC and UTS. In SCC analysis, direct microscopy was used, and in UTS assessment, a 1-9 point scale, where lower points indicate poor and higher points indicate larger udder structure, was applied. Data were evaluated by three parity and four season groups. Also, effect of stage of lactation was assessed in three groups (70±14d, 140±14d and 210±14d). Parity and stage of lactation had no-significant effect on both the parameters, but effect of season on SCC was significant (P<0.05). Correlation coefficient between SCC and UTS was -0.149. The UTS records could be a useful tool for selecting cows with lower SCC. © 2013 Friends Science Publishers

Keywords: Somatic cell count; Dairy cow; Milk; Selection; Udder type

Introduction

Mastitis is one of the most widely diseases of dairy herds and it is characterized by compositional changes in the milk (Guliye *et al.,* 2002). Direct selection for resistance to mastitis is not commonly applied due to its low heritability (Zwald *et al.,* 2004). Systematic clinical examination of udder is relatively inexpensive and may provide valuable information (Klaas *et al.,* 2004). In this point, somatic cell count (SCC) has been assumed as the most reliable indicator for detecting mastitis and quality level in early time because of high genetic correlation to the susceptibility of mastitis (Sharif *et al.,* 2007; Nyugen *et al.,* 2011; Atasever, 2012; Hussain *et al.,* 2012).

Evaluating structural status of udder has been advised for boosting accuracy of selection to mastitis cases (Mrode *et al.,* 1998). Also, it is important for the udder to connect to the body strongly, and deeper and larger udders with lobes in balance are demanded for milk production (Tilki *et al.,* 2005). Although some investigations have been conducted on the genetic correlations between some type traits and SCC in some countries (Zhang *et al*., 1994; Klaas *et al*., 2004; Dube *et al.,* 2008; Zavadilová *et al*., 2012), no report has been presented the possibility of using visual examination of udder for animal selection in Turkey. Revealing the connections of udder types with milk quality based on SCC could be one of the main phases to obtain accurately cow selection in dairy farms. The objective of this study was to determine the relationships between SCC and udder type scores in Holstein cows.

Materials and Methods

The study was conducted in Samsun province, Black Sea region of Turkey. The study area lies between a latitude of 41° 17' N and longitude of 36° 20' E. A total of 120 Holstein cows belong to five private farms, which had similar conditions by feeding and husbandry applications, were examined. Raw milk samples collected from 4 udder quarters of each cow and visual udder scores were obtained during the morning milking with monthly visits. For performing udder type scores (UTS) fore udder attachment, rear udder height and fore teat length were visually scored on a 1 to 9 scale (Fig 1) where higher points reflect larger structure. After scoring, three UTS values were averaged for obtaining the mean UTS for each cow.

In SCC analysis, direct microscopic counting method (Packard *et al.,* 1992) was performed for sampling. At this stage, samples were dyed by a strain that composed of 0.6 g of certified methylene blue chloride to 52 mL of 95% ethyl alcohol, 44 mL of tetrachlorethane and 4 mL glacial acetic acid. Total number of fields counted per slide was 40 and the working factor (WF) was 13255.

In this study; stage of lactation, parity, udder quarter and season were evaluated as independent variables. According to farm records, lactating cows were allocated to 3 stage of lactation groups 70, 140 and 210 (±14) days in milk, and a total of 3 parity groups (1= parity 1; 2= parity 2,3 and 4; 3= parity 5≤). Besides, data were evaluated by 4 season groups (1=12, 1 and 2nd mo; 2= 3, 4 and 5th mo; 3= 6, 7 and 8th mo; 4= 9, 10 and 11th mo). The SCC values for

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each cow were calculated by using the average of SCC levels of four udder and these values were transformed to $\log_{10}$ for normality and homogeneity of variances. In the final step, the data were examined by analysis of variance (ANOVA) and means were compared by Tukey test at 0.05 level of probability.

The model was as follows:

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

Where; y_{ijkl} is observation value,
μ is population mean,
a_i is effect of the parity (i= 1,2,3),
b_j is effect of the season (j= 1,2,3,4),
c_k is effect of the stage of lactation (k=1,2,3) and
e_{ijkl} is the random residual effect.

To estimate correlations between SCC and UTS values, Pearson's correlation coefficient analysis was applied. All statistical analyses were performed using SPSS 10.0 for Windows (SPSS Inc., Chicago, IL).

Results

Effects of parity on UTS and logSCC are shown in Table 1. Although maximum UTS mean (5.61±0.80) was noted in 3rd group and minimum UTS mean (5.20±1.15) was calculated in 2nd group, no significant differences were determined by parity on UTS. Besides, while highest logSCC mean (5.67±0.34) was estimated in 2nd group and the minimum was in 1st group, statistical differences were not significant by parity on logSCC.

UTS values by season groups are given in Table 2. While UTS mean recorded in winter season was the lowest and UTS mean belongs to autumn was the highest; effect of season on UTS was not significant in this study. In contrast to UTS, effect of season on logSCC was statistically significant ($P<0.05$). LogSCC mean obtained in the winter (5.516) was different from that belongs to summer (5.739).

Means for UTS and logSCC values by three stage of lactation are given in Table 3. As seen from Table 3 that UTS tended to elevate with advancing SL, relatively. While highest UTS was calculated in the latest period and the lower was estimated in the first period, no significant differences was determined in UTS by SL groups. Similarly, despite relatively lower logSCC was determined in the second SL, no significant difference was found among SL groups, statistically.

Relationships between UTS and logSCC values are shown by box plots in Fig. 1. In the present work, the correlation coefficient of two parameters was estimated to be -0.149.

Discussion

In normal conditions, udder structures adversely change with advancing parities due to degeneration in ligaments of udder glands. However, as seen that no significant differences were determined by parity on UTS (Table 1). Thus, this result was not in agreement with the results of many studies (Bielfeldt *et al.*, 2004; Carlén *et al.*, 2004; Miller *et al.*, 2004). The fact that observing higher logSCC levels with later parities could be assumed as an expected result, theoretically. Enhancing milk production and structural degeneration are the main causes for this case. Yu *et al.* (2011) emphasized that the progressive increase of SCC when parity increased might be likely related to immune mechanisms in absence of infection and resulted from increased secretion of macrophages and leucocytes in udder. In spite of logSCC tended to reduce with first parity (Table 1), no significant differences were found among the parity groups in the present study.

A general concept that muddy areas and unhygienic conditions in dairy farms related to rainy weather are the main reasons for low UTS (Grimaud *et al.*, 2009). Actually, this case could be assumed as an expected result. Besides, Bouraoui *et al.* (2002) emphasized in their work that relatively high humidity and temperature caused to elevated SCC in raw milk. However, the results of the present study in Table 2 were in contrast to the result of Bartlett *et al.* (2001) and Green *et al.* (2006).

The fact that higher SCC values at the beginning and at the end of the lactation periods are seen as normal normal cases. This result was in agreement with results of Singh and Ludri (2001), but in contrast to results of Mungube *et al.* (2004) and Koivula *et al.* (2005).

Table 1: Means (±SD) for UTS and logSCC by parity groups

Parity	n	UTS	logSCC
1	55	5.36±1.43	5.58±0.27
2	39	5.20±1.15	5.67±0.34
3	26	5.61±0.80	5.65±0.27
Total	120	5.36±1.22	5.63±0.30

1= parity 1; 2= parity 2, 3 and 4; 3= parity 5≤

Table 2: Means (±SD) for UTS and logSCC by season groups

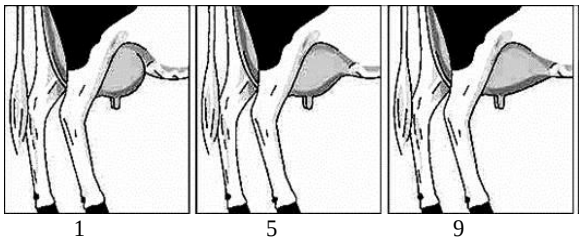
Season	n	UTS	logSCC
1	26	4.96±1.37	5.51±0.15[a]
2	33	5.30±1.35	5.55±0.24[ab]
3	41	5.53±1.18	5.73±0.33[b]
4	20	5.65±0.74	5.68±0.37[ab]
Total	120	5.36±1.22	5.63±0.30

1=winter; 2= spring; 3= summer; 4= autumn

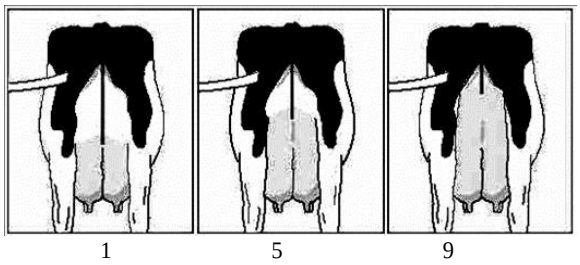
Table 3: Means (±SD) for UTS and logSCC by stage of lactation groups

Stage of lactation	n	UTS	logSCC
1	37	5.18±1.22	5.65±0.33
2	44	5.22±1.44	5.59±0.26
3	39	5.69±1.05	5.65±0.32
Total	120	5.36±1.22	5.63±0.30

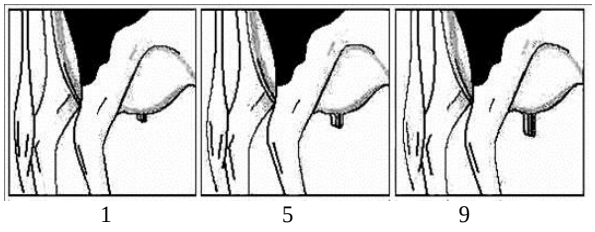
1=70±14d; 214=70±14d; 3=210±14d



a) Fore udder attachment (1 – 3: weak and loose; 4 – 7: intermediate acceptable; 8 – 9: extremely strong and tight)



b) Rear udder height (1 – 3: very low; 4 – 6: intermediate; 7 – 9: high)



c) Fore teat length (1: short; 4 – 6: intermediate; 7 – 9: long)

Fig. 1: Illustrations of considered udder type traits (Dube *et al*., 2008)

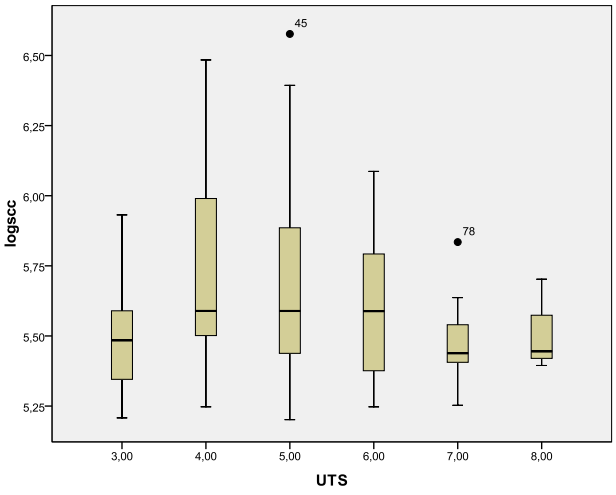


Fig. 2: Box plots of UTS by logSCC values

The reason for relatively higher logSCC at the 1st period (Table 3) could be stated as more process in the udder gland in this interval that reflects post calving time.

Estimated correlation in this study (-0.149) clearly indicates that SCC of raw milk decrease with proper udder structure. In this point, to obtain more quality or lower SCC including milk, this association should be regarded by dairy farmers. Similar to this concept, Rogers *et al.* (1995) reported that higher and more tightly attached udders were related with lower SCC.

In conclusion, combining UTS records with SCC values could be advised to dairy owners as a useful tool for selecting cows with resistant to mastitis. In addition, further investigations on the associations between SCC and each linear type traits should separately be carried out.

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