



Full Length Article

Estimation of Correlation Between Somatic Cell Count and Coagulation Score of Bovine Milk

SAVAS ATASEVER¹

Department of Animal Science, Faculty of Agriculture, University of Ondokuz Mayıs, 55139- Samsun, Turkey

¹Corresponding author's e-mail: satasev@omu.edu.tr

ABSTRACT

This investigation was carried out to determine the relationship between somatic cell count (SCC) and coagulation scores (CgS) in bovine milk samples. Bucket milk samples were collected from three towns of Samsun province, Turkey, in July and October 2011 as two test days. SCC analyses were performed by direct microscopy and CgS values were obtained by alcohol test using coagulation observations. No statistical difference was found among the towns for both parameters. Also, non-significant differences was determined for CgS values in the seasonal evaluation, but SCC values belonging to October were higher ($P < 0.05$) than those calculated in July. Estimated low ($r = 0.208$) correlation between assessed markers shows that alcohol test based on subjective coagulation observations should not be used as the single method to determine raw milk quality and mastitis in dairy farms. © 2012 Friends Science Publishers

Key Words: Somatic cell count; Cow; Alcohol test; Smallholder farm; Coagulation; Mastitis

INTRODUCTION

Subclinical mastitis is one of the most persistent and widely spread disease conditions of importance to milk hygiene and quality among dairy cattle worldwide (Ogola *et al.*, 2007; Sharma, 2007). In contrast to clinical mastitis that is often recognized by farmers as a disease of individual cows, subclinical form is a herd problem that often goes undetected or is detected by increased marked markers in milk (Köster *et al.*, 2006). In other words, in spite of bacteriological culture is the standard method for detecting subclinical mastitis and milk quality level, some indirect indicators can be used for this purpose (Erdem *et al.*, 2010). As a general concept that the inflammation of udder markedly increases the somatic cell count (SCC) in milk, leading to inferior processing characteristics and reduced acceptance of dairy products, because of changes in components and properties of raw milk (Sharif & Muhammad, 2008). Indeed, increase in the leucocytes in milk and in the mammary gland, as a response to the invading pathogens or to their metabolites, leads to an increase in SCC (Piccinini *et al.*, 2006). The limit for SCC of raw milk is 400×10^3 cells mL^{-1} in the EU countries (Leth *et al.*, 2004). Although, many studies have been carried out on the associations among milk quality parameters (Lucey, 2002; Bilal *et al.*, 2004; Baro *et al.*, 2005; Sharif *et al.*, 2007), no information has been published on the relationship between SCC and milk coagulation level in dairy cows. Determining this correlation is required as an important option in point of

reliability degree of alcohol test, which has been widely used for milk evaluation in many countries as a cheap and an easy to apply technique.

The objective of the present investigation was to determine the relationship between somatic cell count and coagulation levels in bovine milk samples.

MATERIALS AND METHODS

Data were obtained by randomly collecting ten samples of bovine bucket milks in three different towns (Carsamba, Ondokuz Mayıs & Ilkadim) of Samsun province, Turkey. All cows belonged to native breed and the farms selected for the study had similar husbandry and feeding conditions. Two test days were selected for milk collection in July and October 2011, and thus a total of 60 raw milk samples were analyzed. The raw milk samples were kept in an ice-cooled box and immediately transported to the laboratory for tests. In SCC analysis, direct microscopy that is the reference method of International Dairy Federation (1995) was applied. Used strain for SCC test was 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 alcohol test, 5 mL raw milk and 5 mL ethyl alcohol were put into standard tubes. After shaking slowly, coagulation occurrence in the tubes were observed and scored (CgS) according to severity for reaction as:

CgS 1: negative, CgS 2: weak, CgS 3: distinct and CgS 4: strong coagulation.

SCC values were transformed to log₁₀ for normality and homogeneity of variances. The data were examined by analysis of variance (One-Way ANOVA) and means were compared by Duncan's multiple range test. The model was as follows:

$$y_{ij} = \mu + a_i + e_{ij}$$

Where; y_{ij} is observation value for SCC or CgS, μ is population mean, a_i is effect of the towns ($i= 1, 2, 3$), e : random residual effect. Effect of the test days/seasons on SCC and CgS were tested by Paired Simple t -test. To compute correlation between SCC and CgS, Pearson's correlation coefficient analysis was applied. All statistical analyses were performed using SPSS 10.0 for Windows (SPSS, 1999) at the 0.05 significance level.

RESULTS AND DISCUSSION

In this investigation, three subcategories belonging to untransformed SCC values are shown in Fig. 1. As seen, relatively high portion of samples were included $SCC < 500 \times 10^3$ cells mL^{-1} . Besides, calculated SCC mean ($\sim 953 \times 10^3$ cells mL^{-1}) of the present study was found as similar with the means determined in the earlier works (Atasever & Erdem, 2008, 2009) carried out in this region.

This case clearly indicated that SCC of raw milks in the smallholder farms of the region is an important risk factor for raw milk quality and mastitis. Ogola *et al.* (2007) has also emphasized that elevated milk SCC is associated with altered protein quality, change in fatty acid composition, lactose, ion and mineral concentration, increased enzymatic activity and higher pH of raw milk. Besides, this finding was assessed as an expected case, because subclinical mastitis was highly prevalent in the smallholder dairy herds as reported earlier (Bonhof *et al.*, 2006; Karimuribo *et al.*, 2006).

Some descriptive values for logSCC and CgS by towns are given in Table I. Despite relatively higher logSCC values of Carsamba and CgS values of Ilkadim, no statistical difference was found by towns for both parameters. This case could be explained by sampling raw milk from the same region and from the same breed. Actually, Harmon (1994) pointed out that variability in SCC within breed is greater than differences in SCC among breeds.

For raw milks evaluated in two test days (TD), no significant difference was determined by CgS values (Table 2), but logSCC values were different ($P < 0.05$), statistically. Results revealed that the mean belonging to autumn season (TD 2) was found higher than that calculated in the summer (TD 1). This result was in agreement with the findings of Joshi and Gokhale (2006), but in contrast to the findings of Skrzypek *et al.* (2004). Theoretically, rainy seasons might

Table I: Descriptive values for CgS and logSCC by towns

Parameter	Town	Mean	SD	Min.	Max.
CgS	1	2.15	1.22	1	4
	2	2.00	0.97	1	4
	3	2.50	1.05	1	4
Total		2.21	1.09	1	4
logSCC	1	5.90	0.29	5.57	6.66
	2	5.83	0.28	5.25	6.30
	3	5.85	0.32	5.50	6.47
Total		5.86	0.29	5.25	6.66

Towns: 1: Carsamba, 2: Ondokuz Mayıs, 3: Ilkadim

Table II: Means (\pm SD) for CgS and logSCC by test days

Parameter	Test Day	n	Mean	SD
CgS	1	30	2.33	1.06
	2	30	2.10	1.12
logSCC	1	30	5.79	0.24
	2	30	5.94	0.32

Fig. 1: Frequency of SCC data by subgroups

(A: $SCC < 500 \times 10^3$ cells mL^{-1} , B: SCC between 500×10^3 and 1000×10^3 cells mL^{-1} and C: $SCC > 1000 \times 10^3$ cells mL^{-1})

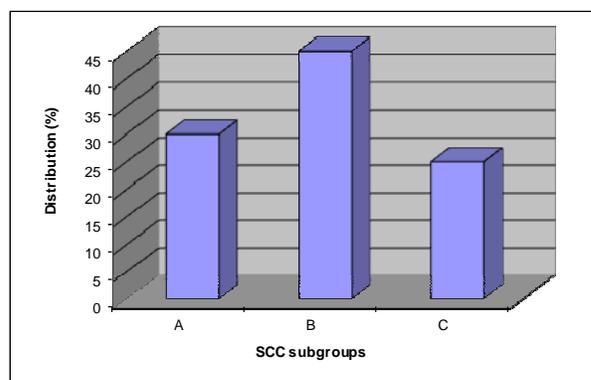
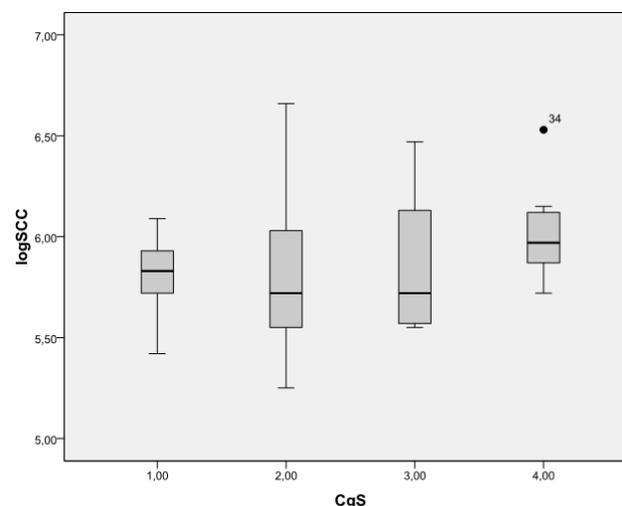


Fig. 2: Correlation between CgS and logSCC ($r = 0.208$)



have caused elevated SCC values in TD 2 in terms of presenting unhygienic conditions related to rainy floors in that period. The findings of Köster *et al.* (2006), who reported that housing hygiene has a substantial impact on milk quality, supports this concept.

In the present study, estimated correlation between logSCC and CgS was relatively low ($r=0.208$) (Fig. 2). Estimated this nonsignificant correlation indicates that CgS values obtained by alcohol tests are not good indicators for determination of raw milk quality and cow's udder health status. Chavez *et al.* (2004) emphasized that positive alcohol test results were still occurring causing confusions and good quality milk was rejected.

CONCLUSION

In smallholder dairy farms, milk quality and udder health condition are seen as the main barriers. To solve these problems, benefitting from reliable parameters and methods should be regarded as the unavoidable steps for dairy owners. In this context, alcohol test based on subjective coagulation observations should not be used as the single method to determine raw milk quality and mastitis in dairy farms. However, investigations including more data should also be carried out to confirm these findings.

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