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Association of some milking parameters with milk quality of smallholder dairy farms in Samsun region, Turkey

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Abstract

This study was carried out to determine the association between some milking factors and milk quality in dairy cows. While questionnaires collected from a total of 50 smallholder farms in Bafra and Samsun, number of milkers (NM), milking duration (MD), care frequency for milking machine (CMM) and age of milking machine (AMM) were used as milking parameters. Milk quality was measured by somatic cell count (SCC) of milk by direct microscopy. Milk parameters were assessed in two groups according to SCC: <400,000 and >400,000 cells ml^{-1}, respectively. Data were analyzed by SPSS, and no statistical difference was found in each parameter by SCC thresholds. However, significant ($P<0.01$) difference was determined among MD means by NM groups. Estimated correlation ($r=0.47$; $P<0.01$) indicated that lower NM causes to shorter MD during milking activity. The results of the study suggest that dairy farmers should focus on milking factors to obtain more quality milk.

Key words

Somatic cell count, Milking factors, Milk quality, Dairy farm

Introduction

Milk quality is influenced by all factors of environment in which cows are kept and milked. The problem of enhancement of both chemical implicit and some parameters for dairy sector (Kuczaj, 2001). Currently, milk somatic cell count (SCC) is an important instrument for determining quality of raw milk in lactating cows (De Vliegher *et al.*, 2004) and thus, milk quality payments are based on SCC in many countries (Viguer *et al.*, 2009). An increase of SCC leads to reduction of milk quality and in the value of the byproducts of manufacturing (Olivo *et al.*, 2005). Milking is a well-known management factor that can affect udder health status (Zucali *et al.*, 2009), proper milking procedure including experience of milkers, maintenance of milking machine (Rasmussen and Madsen, 2000), feeding regime or storage conditions play effective role on obtaining high quality and quantity milk. Studies have confirmed the association between intramammary infection and milking installations (Rasmussen and Madsen, 2000; Olivo *et al.*, 2005). In spite of some researches have been carried out on SCC and some environmental factors on SCC (Erdem *et al.*, 2007; Atasever and Erdem, 2008), quality of milk, milking management and their relationships are still remained crucial topics as similar in many countries in Turkey.

The objective of this study was to determine the relationships between some milking parameters and SCC, which is assumed as a reliable reflector of raw milk quality.

Materials and Methods

Collection of milk samples: The study was carried out in Samsun province (41°17' N and 36°20' E) located in the Black Sea Region of Turkey (Fig. 1). Raw milk samples were obtained by collecting bucket milks from a total of 50 randomly selected dairy farms. All farms assessed in this study had similar feeding and management strategies, and all of those were smallholder enterprises (<30 milking cows $farm^{-1}$). On each day time, bucket milk samples (about 100 ml $farm^{-1}$) were collected from buckets between June and October, 2009. No preservative included samples kept in an ice-cooled box and immediately transported to laboratory within same day.

Somatic cell count tests were performed by direct microscopic cell counting method (Packard *et al.*, 1992). For each

Fig. 1: Location of the study area, Samsun in Turkey

dairy farm, five slides were prepared to evaluate by direct microscopic somatic cell count (DMSCC). In this test, dye solution 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 50 and the working factor (WF) was 10604.

Collection of questionnaires: The dairy farmers were asked for recording milking parameters on each visit of the farms. These parameters constituted number of milkers (NM), milking duration (MD), age of milking machine (AMM) and care frequency for milking machine (CMM).

Statistical analyses: Due to wide ranges in the SCC data, SCC values were transformed to $\log_{10}$ for normality and homogeneity of variances. In the study, SCC values were separated in two subgroups as follows regarding the threshold of SCC for human consumption by EU directives (Kovae *et al.*, 2007). Thus, SCC values <400 000 cells ml^{-1} were assessed into first group and SCC values >400 000 cells ml^{-1} were evaluated into second group. Besides, recorded values with NM >3 were evaluated in the third NM group. Then, milking parameters were tested by these groups using *t*-test. To assess effect of NM on MD, AMM, CMM and logSCC, data were statistically examined by analysis of variance (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} = observation value, μ = population mean, a_i = effect of number of milkers (i= 1 to 3) and e_{ij} = the random residual effect.

To compute correlations among values, Pearson's correlation coefficient analysis was used. All statistical analyses were performed using SPSS statistical package program (SPSS, 1999).

Results and Discussion

The mean of NM was lower in the 1st SCC group in this study (Table 1). This finding indicates to requirement for advanced investigations with more data on this issue. Similarly, MD was higher in the 2nd group. In contrast, AMM was lower in the 2nd SCC group in the present study. This case shows that relatively new machine may cause elevated SCC or lower milk quality in dairy farms. Despite no statistical difference was found in SCC groups, CMM was applied in shorter period in the 1st group, in which SCC levels are normal for human consumption. Also, this result reflected that frequently care and check of milking machine affects milk quality positively. The fact that, SCC in raw milk collected from dairy cows depend not only on milking factors, but also on efficient labor in the enterprises (Bonhof *et al.*, 2006; Koster *et al.*, 2006). Due to cleaning and disinfection of milking equipments is essential to prevent dropping milk quality in terms of microbial contamination (Pistocchini *et al.*, 2009), this issue should especially be regarded by herd owners.

Means (±SE) of milking parameters by NM are given in Table 2. As seen that significant differences were estimated among MD groups. Estimated mean of MD was similar to the mean calculated by Gonulol and Toruk (2009), who evaluated milking parlor performance in Turkey conditions. Statistically, MD for 1st NM group was different from MD for 3rd NM group. In other words, more time

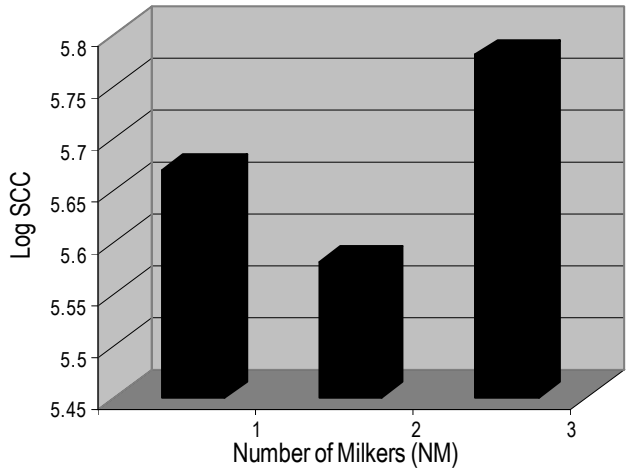

Fig. 2: Distribution of log somatic cell count (SSC) values by number of milker groups (NM 3 included ≥3 milkers in the farms)

Table - 1: Means of milking parameters by somatic cell count (SCC) groups (1: 0-400x10^3 cells ml^{-1}; SCC group 2: >400x10^3 cells ml^{-1})

Milking parameters	SCC groups	n	Mean ± SE
NM	1	27	2.00±0.11
	2	23	2.17±0.14
MD	1	27	6.67±0.39
	2	23	7.04±0.41
AMM	1	27	39.26±6.41
	2	23	28.26±3.18
CMM	1	27	0.67±0.08
	2	23	0.73±0.08

Table - 2: Means (±SE) of milking parameters by number of milkers (NM) groups

NM	MD	AMM	CMM
1	5.00±0.31^a	21.43±4.11	0.63±0.14
2	6.78±0.30^{ab}	35.44±4.71	0.67±0.07
3	8.18±0.74^{bc}	38.73±10.15	0.81±0.16
General	6.84±0.28	34.20±3.81	0.70±0.06

p< 0.01, (NM 3 included ≥3 milkers in the farms)

Table - 3: Correlations among evaluated parameters

	MD	AMM	CMM	LogSCC
NM	0.47**	0.18	0.14	0.19
MD		0.01	0.27	0.12
AMM			-0.24	-0.14
CMM				0.12

** = p< 0.01. NM = Number of milkers, MD = Milking duration (min), AMM = Age of milking machine (mo), CMM = Care for milking machine (interval-mo), n= number of farms

was spent for each milking cow in the farms, where NM are 3d". In spite of AMM and CMM values increased with higher NM values. This result could be discussed by relatively new milking machines of farms including lower NM and performing more frequently care for machines per month in herds those included lower NM. Rasmussen and Madsen (2000) pointed out that maintenance of milking machine is important for ensuring optimal milk yield and udder health. While data were evaluated by general means, MD was assumed into suitable thresholds in our study. However, mean age of milking machine was nearly 3 yr and CMM was 3 times per 2 months, approximately.

Changes of log SCC values according to NM groups are presented in Fig. 2. Although no statistically significant difference was found among log SCC values by NM groups, log SCC values were in the lowest level in the herds where 2 milkers were employed. As seen that there was no positive effect of more milkers on lower SCC or more milk quality. In their study, Fadlelmoula *et al.* (2007) emphasized that SCC values decrease with increasing herd size. While relatively less number of cows in the farms evaluated in the present study might be played on this result, our finding reflected a requirement that milkers number should be optimum in dairy operations to obtain high raw milk quality. In the view of the calculated untransformed SCC mean (~515x10^3 cells ml^{-1}) of this study, arrangement on milking and husbandrial practices of the farms may be advised for beneficial steps. Besides, the mean SCC of this study was similar to calculated value in an investigation conducted in the same region (Erdem et al., 2007), in contrast, it was found as about half of the estimated SCC means of some study results (Atasever and Erdem, 2008; 2009), which were carried out at the same region earlier.

Relationships among evaluated factors are given in Table 3. It can be seen that no significant correlations were estimated among parameters, except for NM and MD. This case was in agreement with earlier results of this study. Waage *et al.* (1998) reported that improper milking practices and inadequate equipments are important negative factors for dairy farms. Calculated significant correlation (r=0.47; P<0.01) between NM and MD pointed out that milkers with enough number and sufficiently qualify are responsible from proper milking in dairy enterprises. As the result, dairy farmers should more focus on milking factors to obtain more quality milk.

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