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Association Between Subclinical Mastitis Markers and Body Condition Scores of Holstein Cows in the Black Sea Region, Turkey

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Abstract: This study was conducted to determine the relationships between subclinical mastitis and Body Condition Scores (BCS) in Holstein cows raised at the Black Sea region of Turkey. Somatic Cell Count (SCC) and Electrical Conductivity of milk (EC) levels were used as Subclinical Mastitis Markers (SMM). With 28 days intervals, milk samples and scoring values were taken and assessed within 3 different stages of lactation and into 4 seasons. Statistical analyses were performed with MINITAB. It was determined that SMM increased at summer and autumn seasons, however BCS had a variable trend. There was no difference between SMM by stage of lactation, but value of BCS was higher in the first stage of lactation. When, SMM evaluated by 3 different BCS subgroups, there was no significant difference determined between selected SMM. In this study, it was not defined any correlation between SMM and BCS. As result, effective factors on milk quality and feeding programs should be reconsidered at hot or rainy seasons and later stages of lactation.

Key words: Subclinical mastitis, somatic cell count, electrical conductivity of milk, body condition score, holstein

INTRODUCTION

In dairy herds, managemental programs play a special role due to obtain products by maximum profit. To ensure high quality and quantity milk and to obtain healthy cows, preventing and detecting various disorders in early time is vital important. In this respect, reducing metabolic disease risks to minimal level and keeping cows at optimal body condition throughout the production cycle are suggested to dairy farmers (Koster *et al*., 2006). Today, the most serious disease for dairy industry worldwide is mastitis or inflammation of udder glands (Moroni *et al*., 2006). While, clinical form is defined as an infection of the udder that results in visible changes in the udder quarter and milk, subclinical form of this disease chacterized by a change in milk composition and signs of gross inflammation or milk abnormalities can be determined by bacteriological culture in raw milk (Karimuribo *et al*., 2006). A reference study result (Pillai *et al*., 2001) indicated that approximately, 70-80% of losses suffered are due to subclinical mastitis. Because of the more time and extra costs required for milk culture, abnormal levels of various Subclinical Mastitis Markers (SMM) such as Somatic Cell Count (SCC), Electrical Conductivity (EC), ph and enzyme levels in raw milk can be used as reliable informators to detect subclinical mastitis signs by the herd owners (Pyorala, 2003; Przysucha and Grodzki, 2004). Routinely screening, these tests in herds and combining obtained records help to dairy owner for selection cows for treatment or culling. Besides, optimal body condition of dairy cows is important for obtaining elite herd and quality milk production. Due to dairy cows with low or excessive body energy reserves may have a greater risk of lower milk yield, metabolic diseases and reproductive failure (Montiel and Ahuja, 2005). The ideal Body Condition Scores (BCS) for dairy cows throughout lactation not only optimizes milk yield, but also maximizes economic returns. Namely, consideration of all factors effective on milk production plays a special role for profit. In spite of some studies have been carried out on the relationships between milk quantity and BCS (Markusfeld *et al*., 1997; Heuer *et al*., 1999; Berry *et al*., 2003) or several studies have been conducted to investigate correlation between BCS and clinical mastitis (Lassen *et al*., 2003; Dechow *et al*., 2004), we found no sufficient reports on the direct relations between subclinical mastitis-or- milk quality parameters (especially, with EC) and nutritional status (BCS) of dairy cows.

The objectives of the present investigation were to determine the relationships between subclinical mastitis and body condition scores in Holstein cows.

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MATERIALS AND METHODS

Cow selecting: The present research was carried out in a total of 185 Holstein cows, raised at 16 farms enrolled to Cattle Breeders Association of Samsun, in the Black Sea region of Turkey, between December 2005 and October 2006. The cows had similar feeding and husbandrial conditions and all of those were free from clinical mastitis. Recorded cows were separated to 4 season groups winter; December-February, spring; March-May, summer; June-August and Autumn; September-November) and 3 lactation stages (70±14, 140±14 and 210±14 days). Data were occurred by sampling and scoring with 28 daily intervals. To evaluate parameters by stage of lactation, only cows of those lactation stages were coincided with the above periods were assessed.

Laboratory tests: In this study, SCC and EC level of milk were used as SMM. Quarter milk samples (50 mL) from all quarters were taken from morning milkings by an aseptic procedure. Samples were kept in an ice-cooled box and immediately, transferred to the laboratory to analyze by SMM. SCC, a reliable indicator of quality of milk and cow's udder health, was determined using direct microscopy as recommended by the IDF standarts (International Dairy Federation, 1995). EC, a reliable reflector of ionic content of raw milk, was recorded in the milking parlor utilizing a hand-held device (Mas-D-Tec®, Wescor, Inc., Logan, Utah, USA) in which 0-4 points indicate normal and 5-9 points display abnormal levels (McDaniel *et al*., 1994). During SMM evaluating, the mean of 4 quarter milk sample values of each test d were calculated and used for each cow.

Body condition scoring: Body condition scoring was based on palpation of the back bones and lumbar processes, feeling their sharpness and covering with muscle and fat. Scoring was performed using a 1-5 point scale (Wildman *et al*., 1982) and assessment was performed as; emaciated cows, thin cows, average cows, fat cows and obese cows, Half points were used if it required (e.g., 2.5 or 3.5) and the assessor did not have access to the initial scores during the second scoring.

Statistical analysis: Due to small data in each recorded BCS groups, 3 subgroups were created as follows; 1st: BCS≤2, 2nd: 2<BCS≥3 and 3rd: BCS>3. Due to SCC values were not normally distributed, data were transformed based on log base 10. One-way ANOVA was performed in a completely randomized design:

$$\hat{y}_{ij} = \mu + \alpha_i + e_{ij}$$

where:

$\hat{y}_{ij}$ = Observation values
μ = The overall mean
α_i = The effect of the i^{st} treatment (season, stage)
e_{ij} = Residual error

Then, DUNCAN Multiple Range Test was utilized to separate these differences and Kruskal-Wallis test, a nonparametric test, was performed to test whether there were any differences among the treatments of mites for BCS. To determinate the relationship between parameters, Spearman Rank correlation analysis was performed. All the computational research was performed by means of (Minitab, 2000).

RESULTS AND DISCUSSION

In the present study, it was found statistically difference ($p<0.05$ and $p<0.01$) in the SMM and BCS means by season groups (Table 1). For SMM, relatively higher values ($p<0.01$) were obtained in the summer and autumn seasons. According to, some reference literature, the highest rate of mastitis occurrence was observed in the summer (Skrzpek *et al*., 2004), autumn (Joshi and Gokhale, 2006), winter (Bradley and Green, 2001) and in the spring (Bartlett *et al*., 2001). Some researchers (Przysucha and Grodzki, 2004) indicated the poorest hygienic quality of milk produced in the summer season both in milk collection centers and direct collection systems. Moreover, they emphasized that there is enough time for the proper care of animals, equipment and milking procedures in the winter months. Our result may be explained by the cause of relatively high environmental temperature and humidity in summer-autumn seasons in the Black Sea region of Turkey. Besides, this result indicates that taking additional managemental and sanitarial applications in these seasons are seen an obligation. Actually, obtained EC means, which were presented between normal and abnormal threshold levels, clearly indicate a risk for subclinical mastitis in these farms.

While, BCS values were assessed by season groups, an alternated trend was obtained. BCS values notably reduced in the transitional seasons such as spring and autumn, nevertheless, values were higher in the winter and summer seasons. Presumably, keeping cows in the farms of Cattle Breeders Association with proper feeding regime in the winter and grazing cows at pasture, which is rich by forage, in the summer played an important role on

Table 1: Changes of SMM and BCS values by season and stage of lactation

	logSCC		EC		BCS	
Season	n	Mean±SE	n	Mean±SE	n	Mean±SE
1	73	5.62±0.03[b]	78	3.71±0.23[b]	78	2.97±0.06[a]
2	165	5.66±0.03[b]	166	4.08±0.13[b]	166	2.80±0.04[b]
3	183	5.73±0.03[ab]	185	4.97±0.14[a]	185	2.89±0.04[a]
4	91	5.80±0.04[a]	91	5.43±0.21[a]	91	2.87±0.04[ab]
		**		**		*
Stage						
1	178	5.66±0.02	182	4.33±0.14	180	2.76±0.03[b]
2	180	5.73±0.02	182	4.71±0.16	182	2.93±0.03[a]
3	154	5.73±0.03	158	4.72±0.16	158	2.92±0.04[a]
		ns		ns		**

[a,b]Means within a line with no common superscript differ, *p<0.05, **p<0.01, ns: non significant, Season 1: Winter, 2: Spring, 3: Summer, 4: Autumn, Stage 1: 70±14 days, 2: 140±14 days, 3: 210±14 days

this case. Several reference results are supported this result, for instance, a study (Haskell *et al*., 2006) indicated that cows can be fed high levels of concentrate feed more easily when they are housed (in the winter) and in another study, some researchers (Drennan and Berry, 2006) reported that grazing on pasture where dietary energy is least expensive (in the summer) positively affect cow performance.

In this study, SMM values tended to increase with later stages, however, evaluated means were not significantly different and estimated EC means are ranked between normal and abnormal thresholds (Table 1). Normally, it can be expected that mastitis frequency in dairy herds increases with advanced lactation stages (Koivula *et al*., 2005). As parallel to this hypothesis, we can clearly observe from Table 1 that SCC and EC means were relatively higher in advanced lactation stages. Furthermore, BCS mean obtained in the 1st stage of lactation was lower than other BCS means. Besides, when BCS means were commented by lactation stages, BCS mean obtained in the 1st stage of lactation was lower than other means. In fact, this finding is regarded as an expected result. Such that, after calving, dairy cows experience a slow increase in dry matter intake, a rapid increase in milk production and increased mobilization of fat tissue (Montiel and Ahuja, 2005). In other words, the negative energy balance prior to peak milk production occurs due to most dairy cows cannot meet the energy requirements for growth, maintenance and milk production. In addition, due to metabolic and infectious diseases become clinical within the first 2 week of lactation (Berry *et al*., 2007), prepartum or postpartum fluctuations in energy balance should be considered cautiously.

Table 2 shows that the values of SMM were not linear, but no subgroups were significantly different. In other words, SMM values were not affected by BCS, statistically. Likely, considerably higher number of the cows assessed in 2nd group was caused to this result.

Table 2: SMM levels by subgroups of BCS

BCS	logSCC		EC	
subgroups	n	Mean±SE	n	Mean±SE
1	39	5.78±0.11	39	4.19±0.50
2	383	5.70±0.01	388	4.51±0.10
3	90	5.70±0.04	93	4.34±0.26

Subgroups: 1st: BCS≤2, 2nd: 2<BCS≥3, 3rd: BCS>3

Table 3: Correlations between SMM and BCS values

SMM	BCS
logSCC	-0.030
EC	-0.002

In addition to these findings, SMM were negatively correlated with BCS, but there was no different correlation between MM and BCS, statistically (Table 3). In an earlier study (Busato *et al*., 2000), it was reported no significant association between BCS and subclinical mastitis, besides, some researchers (Berry *et al*., 2007) estimated a positive association between BCS and SCC, which is one of the selected subclinical mastitis parameter in our study. No different correlation between SMM and BCS in this study may be explained in parallel to previous comment that subclinical mastitis risk parameters were not affected by body energy reserves of cows, markedly. However, further studies are needed to investigate on this case.

CONCLUSION

Additional management precautions should be suggested to dairy herd owners to produce quality milk especially in hot and humid seasons. However, dairy owners be advised more check their herds during transitional seasons viz. spring and autumn to obtain cows with favorable BCS. Finally, routinely recording mastitis signs in early time and body condition scoring dairy cows can be assumed as very the most important steps to observe herd health and management status.

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