Effects of teat end score on milk yield and quality in Holstein-Friesian cows

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SUMMARY

Introduction - Hyperkeratosis develops in the teat end (TE) because of degeneration of the keratin layer. The functional errors and higher vacuum of the milking machine, increased milk yield, prolongation of milking, dirtiness of the animals and insufficient bedding are the reasons of the formation of hyperkeratosis on the TE. The lesions at the teats are risk for mastitis and there is a positive correlation between somatic cell count (SCC) and TE hyperkeratosis.

Aim - The aim of this study was to determine hyperkeratosis level on the TE of Holstein-Friesian (HF) cows by using a scoring system and also the effect of TE score on the quality of milk. In addition, the effects of SCC on milk yield, fat content (FC, %) and non-fat dry matter content (NFDMC, %) and the loss of milk yield due to SCC were determined.

Materials and methods - A HF herd in Aydın, Turkey, was visited monthly for nine months to score the TE for hyperkeratosis level, and to take milk samples for the determination of FC, NFDMC, and SCC. The level of hyperkeratosis on the TE were scored from 1 to 4. Correlation coefficients among the traits were also determined.

Results and Discussion - The means of TE score, Log_{10}SCC, morning (MMY) and evening (EMY) milk yield, FC and NFDMC were 2.45±0.069, 5.66±0.045, 10.88±0.289 kg, 10.88±0.283 kg, 3.96±0.070% and 10.38±0.043%, respectively. Among the parities, the lowest mean (2.02 ± 0.102) for TE score was determined in the first lactating cows, and the cows that calved in the summer (2.37 ± 0.090) had lower TE score than those that calved in winter (3.04 ± 0.109) ($P < 0.05$). Log_{10}SCC averages were higher in cows with higher TE score and higher parities (4^{th} and 5^{th}+). Log_{10}SCC means of the cows whose TE score are 4 (6.26 ± 0.094) and 3 (5.86±0.093) are higher than those with 1 (5.48±0.118) and 2 (5.51±0.078) scores ($P < 0.05$). High SCC in milk resulted in 1.73 kg (14.32%) decrease in MMY ($P<0.05$) and 3.24 kg (13.41%) in daily milk yield. Correlation coefficient between TE score and Log_{10}SCC was positive and moderate ($r=0.41$).

Conclusion - In conclusion, the TE hyperkeratosis caused by insufficient maintenance-management and barn and milking management conditions on the farm, leads to a significant increase in SCC and decrease in FC (24.4%). A significant milk yield loss were also determined in the daily milk yield due to high SCC. Scoring the TE of dairy cows gives an idea about the operating conditions on the dairy cattle farm and significant losses in milk yield and milk constituents could be prevented by decreasing SCC through improving TE score.

KEY WORDS

Dairy cattle, Teat profile, Milk yield, Fat content, Somatic cell count, Correlation.

INTRODUCTION

Milk quality is an important factor for the industrialists, the consumers as well as the producers. There is a direct relationship between the hygienic quality of milk and mastitis. Mastitis is an udder tissue inflammation commonly seen in dairy cattle, usually due to the pathogens, and is the most common and costly disease that causes significant economic losses in dairy cattle[1]. Due to higher relation with mastitis, the number of somatic cell count (SCC) in milk provides an idea about the health condition of the udder and the quality of milk produced.

It has been stated that an infection of the mammary gland is the major factor affecting SCC[2]. In the studies on the prevalence of mastitis among enterprises and other factors affecting the frequency of mastitis according to the enterprises are barn conditions, hygiene and machine milking, season, feeding and milking techniques[3]. Breed, age or parity of cow and lactation period are the factors affecting SCC at cow level and in the first month of lactation SCC level is expected to be the highest[4].

One of the factor that causes an increase in mastitis prevalence and also SCC in milk is the formation of hyperkeratosis on the teat end (TE). Hyperkeratosis develops on the TE as a result of degeneration of the keratin layer, which is a physical barrier against the pathogens that cause infection in the udder[5]. The formation of hyperkeratosis on the TE may be resulted from

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many factors such as higher vacuum and the functional errors of milking machines[6], prolongation of milking[7], increased milk yield, the dirtiness of the animals, insufficient bedding and also cow factors like teat shape, yield and genetics[8].
The reasons of the short, medium and long-term changes on the TE are reported by Mein et al.[8] The changes in colour, firmness, thickness or swelling of teats, or degree of «openness» of the teat orifice are the short-term changes caused by the failure in milking machines or milking management. The medium- and long-term changes in the teat skin condition taking for a few days to 8 weeks are due to harsh weather or chemical irritation. Because of an adaptation in the teat, a ring with a diameter of 2 mm develops and it is stated that mastitis also increases with the increase of hyperkeratosis structures during lactation[9].
Hyperkeratosis is seen in cows with high milk yield especially in the fourth month of lactation[10] and a positive correlation between TE hyperkeratosis and SCC in milk was reported[11,12]. A risk for mastitis due to the lesions at the teats was also mentioned[13]. Gleenson et al.[11] reported increased risk of intramammary infection due to the TE hyperkeratosis.
In an uninfected udder lobe, SCC in milk is generally below 200,000 cells / ml[2], and it was stated that this value is expected to be below 100,000 cells / ml in cows in the first lactation, and the lowest SCC average was reported in the primaparous cows[14].
SCC in the udder lobes without infection may vary depending on environmental and physiological factors[15]. While milk yield increases with increasing parity, the sensitivity, deformations and contamination probability of the udder tissue with pathogenic microorganisms increase.
A negative correlation between SCC and milk yield exists and, 0.92 kg of milk loss per day in primaparous cows and 1.52 kg of milk yield loss in multiparous cows with increased SCC were reported[16]. Some important changes in the composition of milk are also seen because of increasing SCC in raw milk[17,18]. Depending on the increase in SCC, the lactose content of milk decreases significantly while the amount of whey protein content increases[18].
The present study was conducted in a Holstein-Friesian (HF) herd in Aydın, Turkey, to examine the effects of TE score on the quality of milk as well as to determine the effects of SCC on milk yield, milk constituents and the loss of milk yield.

MATERIAL AND METHODS

This research was carried out in a Holstein-Friesian (HF) herd at Aydın Adnan Menderes University (ADU), Faculty of Agriculture, Turkey. The herd was visited at morning milking once a month between June, 2019 and February, 2020. During the visit, besides scoring the TE of HF cows in terms of hyperkeratosis, a milk sample was taken from each cow to determine the milk fat content (FC, %), non-fat dry matter content (NFDMC, %) and SCC (cell/ml).
The level of hyperkeratosis on the TE was scored and four different TE score were recorded from 1 to 4 (Figure 1). According to this scoring system; normal teat and no deformation (1 or N), a swollen ring at the TE (2 or S), a rough ring with keratin frons with 1-3 mm elongated from the nipple canal orifice (3 or R), and a fluffy and keratinized chapped and leafy ring (4 or VR) at the tip of the head[8].

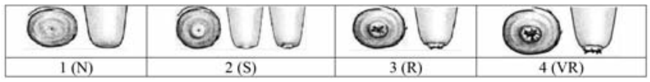

Figure 1 - Teat end (TE) hyperkeratosis scoring system (Mein et al., 2001).

A portable refractometer with the caliber 20% brix (Brand: ATC Refractometer 0-20% BRIX) was used to determine NFDMC (%) and, FC (%) was determined according to EAS[19]. In addition, the SCC level in milk was determined according to direct microscopic counting method[20].
A total of 203 milk samples were taken into the sampling containers of 50 cc per cow. The milk samples were kept in a cold chain and brought to ADU Faculty of Agriculture, Department of Animal Science, Animal Raising and Breeding Laboratory for the determination of FC, NFDMC and SCC. Milk yields produced by the cows in the morning and also evening milking were also recorded. The lactation period of the cows are divided into four lactation stages in 100-day interval, and two calving seasons are accepted as summer (May-October) and winter (November-April).
In order to determine the effects of SCC on yield, loss and constituents of milk, four different SCC groups were accepted. According to this the cows with 0-200.000 cells/ml in milk included into the first group, cows with 200.001-400.000 cells/ml in milk included into group 2, cows with 400.001-1.000.000 cells/ml included into group 3 and the cows with SCC higher than 1.000.000 cells/ml included into group 4.

Statistical analysis

The data obtained in the study were analyzed statistically with SAS[12] package program, and the comparison of the subgroups was determined according to Tukey ($P < 0.05$). Before the analysis, 10- base logarithmic transformation was applied to SCC data to provide a normality assumption[22]. The following statistical model was used in the analysis of TE score, Log_{10}SCC, MMY, EMY, FC (%) and NFDMC (%) data.

$$Y_{ijklmno} = \mu + a_i + b_j + c_k + d_l + f_m + g_n + e_{ijklmno}$$

$Y_{ijklmno}$: observation of the traits, μ: means of the traits, a_i: parity effect (i=1, 2, 3, 4 and 5+), b_j: calving season effect (j= winter and summer), c_k: lactation period effect (k= 1, 2, 3 and 4), d_l: observation month effect (l= April, May, … and February), f_m: TE score effect (m= 1, 2, 3 and 4, this factor is used for the analysis of MMY, EMY, FC, NFDMC and Log_{10}SCC), g_n: SCC group effect (n= 1, 2, 3 and 4 and this factor was used only for the analysis of MMY, EMY, FC and NFDMC), $e_{ijklmno}$: random error.
Phenotypic correlation coefficients among TE score, Log_{10}SCC, MMY, EMY, FC and NFDMC were also calculated.

RESULTS

The means and standard errors of TE score, Log_{10}SCC, MMY, EMY, FC and NFDMC are given in Table 1. The overall averages of these traits are 2.45 ± 0.069, 5.66 ± 0.045 (457,088 cells / ml), 10.88 ± 0.289 kg, 10.88 ± 0.283 kg, 3.96 ± 0.070% and 10.38 ± 0.043%, respectively.
The effects of parity, calving season, lactation stage and ob-

Table 1 - LSMEANS and standard errors of teat end (TE) score, Log_{10}SCC, fat (%), non-fat dry matter content (NFDMC, %) and morning and evening milk yield.

Factor	n	Teat end score $\bar{X} \pm S_{\bar{X}}$	Log_{10}SCC $\bar{X} \pm S_{\bar{X}}$	Morning milk yield $\bar{X} \pm S_{\bar{X}}$	Evening milk yield $\bar{X} \pm S_{\bar{X}}$	NFDMC (%) $\bar{X} \pm S_{\bar{X}}$	Fat (%) $\bar{X} \pm S_{\bar{X}}$
Parity		**	*	*	*	NS	**
1	78	2.02±0.102^{Aa}	5.63±0.076^{ab}	11.55±0.44^{ab}	11.50±0.42^{ab}	10.33±0.08	3.74±0.14^{ABa}
2	53	2.67±0.118^{Bb}	5.57±0.081^{a}	10.02±0.47^{a}	10.10±0.45^{a}	10.41±0.08	4.33±0.15^{ABbc}
3	16	3.13±0.209^{Bb}	5.87±0.147^{ab}	10.07±0.83^{ab}	10.67±0.80^{ab}	10.57±0.14	4.69± 0.26^{Ab}
4	37	2.77±0.141^{Bb}	5.91±0.098^{b}	12.23±0.56^{b}	12.07±0.54^{b}	10.18±0.10	3.70±0.18^{Ba}
5+	19	2.92±0.198^{Bb}	5.91±0.135^{ab}	12.35±0.77^{ab}	12.17±0.74^{ab}	10.29±0.13	3.73±0.24^{ABac}
Calving season		**	NS	NS	NS	NS	NS
Winter	92	3.04±0.109^{Aa}	5.80±0.090	11.40±0.45^{Aa}	11.32±0.43	11.28±0.08^{Aa}	4.13±0.14
Summer	111	2.37±0.090^{Bb}	5.76±0.088	11.10±0.37^{Bb}	11.29±0.35	10.43±0.06^{Ab}	3.94±0.11
Lactation stage		*	NS	**	**	**	NS
1 (≤100 d)	43	2.36±0.144^{a}	5.87±0.099	13.81±0.58^{Aa}	13.73±0.56^{Aa}	9.98±0.10^{Aa}	3.77±0.18
2 (101-200 d)	38	2.80±0.143^{ab}	5.77±0.098	12.67±0.55^{Aa}	12.65±0.53^{Aa}	10.25±0.10^{ABb}	3.95±0.17
3 (201-300 d)	47	2.87±0.132^{b}	5.79±0.091	10.10±0.52^{BCb}	10.12±0.50^{Bb}	10.60±0.09^{Bb}	4.34±0.16
4 (≥300 d)	75	2.77±0.109^{ab}	5.67±0.076	8.40±0.43^{Cc}	8.72±0.42^{Bb}	10.59±0.07^{Bb}	4.09±0.13
Observation month		**	*	*	**	**	NS
June	21	2.33±0.188^{ABa}	5.83±0.131^{ab}	10.78±0.76^{ab}	11.91±0.72^{ACacd}	10.30±0.13^{ABab}	3.90±0.23
July	24	2.07±0.177^{Aa}	5.67±0.123^{ab}	10.06±0.73^{a}	10.74±0.69^{ABCabcd}	9.95±0.13^{Aa}	3.71±0.22
August	26	2.28±0.173^{ABac}	6.04±0.118^{a}	9.88±0.67^{a}	10.76±0.64^{ABCabcd}	10.08±0.12^{ABad}	4.04±0.21
September	23	2.47±0.179^{ABCab}	5.89±0.121^{ab}	10.05±0.68^{a}	8.26±0.65^{Bb}	10.58±0.12^{BCbc}	4.36±0.21
October	26	2.67±0.167^{ABCab}	5.73±0.113^{ab}	11.22±0.65^{ab}	9.82±0.62^{ABabc}	10.93±0.11^{Cc}	4.11±0.20
November	25	3.04±0.171^{BCb}	5.73±0.120^{ab}	12.37±0.68^{ab}	12.37±0.66^{ACcd}	10.25±0.12^{ABab}	4.04±0.21
December	21	2.96±0.185^{ABCbc}	6.06±0.128^{a}	13.27±0.73^{b}	13.59±0.69^{Ccd}	10.38±0.13^{ABCab}	4.25±0.22
January	19	3.15±0.199^{BCb}	5.61±0.140^{ab}	11.79±0.80^{ab}	11.74±0.77^{ABCacd}	10.55±0.14^{ABCbcd}	3.70±0.25
February	18	3.33±0.205^{Cd}	5.43±0.144^{b}	11.83±0.83^{ab}	12.54±0.79^{ACacd}	10.19±0.14^{ABab}	4.21±0.25
Teat end (TE) score			**	NS	NS	NS	**
1	34	-	5.48±0.118^{Aa}	10.05±0.68	10.37±0.65	10.42±0.12	4.55±0.21^{Aa}
2	82	-	5.51±0.078^{Aa}	11.55±0.45	11.42±0.43	10.32±0.08	4.13±0.14^{ABa}
3	49	-	5.86±0.093^{ABb}	11.94±0.53	12.07±0.51	10.27±0.09	4.02±0.16^{ABab}
4	38	-	6.26±0.094^{Bc}	11.44±0.60	11.34±0.58	10.42±0.10	3.44±0.18^{Bb}
SCC group				*	NS	NS	**
1 (≤200,000)	81	-	-	12.08±0.44^{a}	12.08±0.42	10.36±0.08	3.78±0.14^{Aa}
2 (200,001-400.000)	34	-	-	11.72±0.57^{ab}	12.03±0.55	10.51±0.09	3.97±0.18^{ABab}
3 (400,001-1,000,000)	28	-	-	10.84±0.66^{ab}	10.52±0.63	10.20±0.13	3.99±0.20^{ABab}
4 (>1,000,000)	60	-	-	10.35±0.46^{b}	10.57±0.45	10.36±0.08	4.40±0.14^{Bb}
Overall	**203**	**2.45±0.069**	**5.66±0.045**	**10.88±0.289**	**10.88±0.283**	**10.38±0.043**	**3.96±0.070**

NS: not significant, *: P<0.05. **: P<0.01. A, B, C: Different letters show the significance level for P <0.01; a, b, c, d: Different letters show the significance level for P<0.05.

servation month on TE score were found to be statistically significant (P <0.05). TE score mean of the cows at the first lactation (2.02 ± 0.102) is the lowest and different from all other parities (P <0.05), and other differences among them are statistically insignificant (P> 0.05). As seen in Table 1, the cows that calved in winter (3.04±0.109) had higher TE score than those that calved in summer (2.37 ±0.090) (P<0.01).

TE score was changed significantly (P<0.05) depending on the lactation stage and the lowest TE score mean was determined for the cows at the first stage of lactation and the highest for the third lactation stage. The difference between these two lactation stages was statistically significant (P<0.05), however other differences among the lactation stages were insignificant (P>0.05).

For Log_{10}SCC, the effects of parity, observation month and TE score were determined to be statistically important (P <0.05), however, calving season and lactation stage effects were insignificant (P> 0.05). As it can be seen from Table 1, the lowest Log_{10}SCC mean was determined for the 2nd parity (5.57±0.081), and the highest was determined for the 4th (5.91±0.098) and 5th (5.91±0.135) parities. The difference between the 2nd and 4th parities are statistically significant (P<0.05), and other differences among the parities are insignificant (P>0.05).

In parallel with the increase in TE score, the Log_{10}SCC averages also increased gradually and the highest Log_{10}SCC mean determined for TE score =4 (Table 1, Figure 2). The mean Log_{10}SCC for TE score =4 is 6.26±0.094 (1,819,701 cells/ml) and this TE score is different from all other TE scores (P<0.05). In addition, TE score =3 (5.86±0.093; 724,436 cells/ml) was also found to be statistically different from other TE scores (P<0.05).

The effects of parity, lactation stage and month of observation on MMY and EMY were determined to be statistically significant (P <0.05), but calving season and TE score effects on these traits were insignificant (P>0.05). On the other hand, a statistically significant effect of SCC group on MMY was determined (P<0.05) but, SCC group effect on EMY was insignificant (P>0.05). For both MMY and EMY, the highest means were calculated for the first SCC groups, the means determined for the third and fourth SCC groups for both MMY and EMY are lower than those in the first and second SCC groups. The difference between the first and the fourth SCC groups for MMY

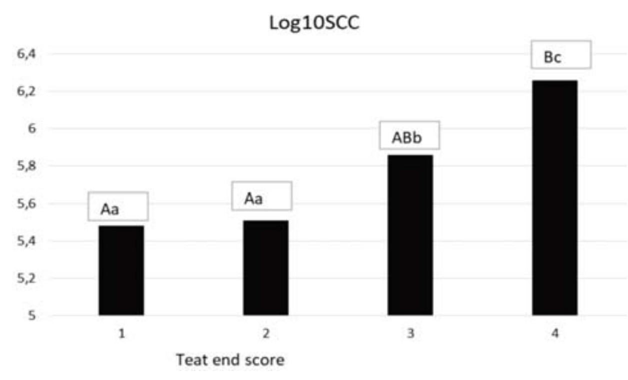

Figure 2 - Changes of SCC level depending on teat end (TE) score (A, B; significance for P<0.01, a, b, c: significance for P<0.05).

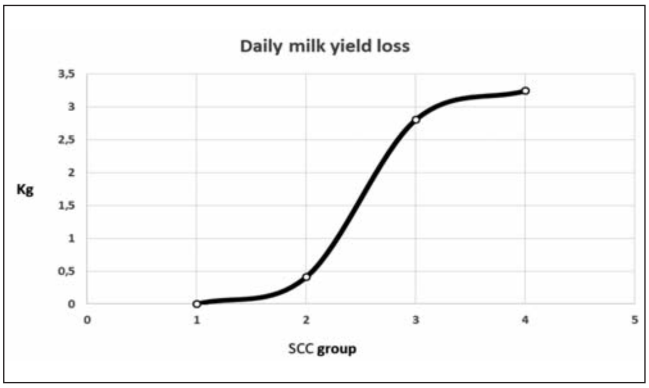

Figure 3 - Daily milk yield loss depending on SCC group.

Table 2 - Phenotypic correlation coefficients among TE score, Log_{10}SCC, MMY, EMY, FC and NFDMC.

	TE score	Log_{10}SCC	MMY	EMY	FC
Log_{10}SCC	0.41**				
MMY	0.12	-0.04			
EMY	0.11	-0.05	0.90**		
FC	-0.12	0.13*	-0.23**	-0.18**	
NFDMC	0.02	-0.02	-0.31**	-0.38**	0.14*

*: Significant for P<0.05. **: Significant for P<0.01. TE: Teat end, SCC: Somatic cell count, MMY: Morning milk yield, EMY: Evening milk yield, FC: Fat content, NFDMC: Non-fat dry matter content.

was found to be statistically different (P<0.05), but other differences among SCC groups were statistically insignificant (P>0.05) for MMY and EMY.

As seen in Table 1, the cows in the fourth SCC group with the highest SCC mean had 1.73 kg (14.32%) and 1.15 kg (12.5%) less MMY and EMY than those with SCC less than 200,000 cells/ml at the first SCC group, respectively. In other words, daily milk loss of cows for the higher SCC groups can be calculated as 2,8 kg (11.59%) and 3.24 kg (13.41%), respectively for the third and fourth SCC groups (Figure 3). The milk loss per day for SCC group 2 is only 0.41 kg (1.7%). The losses per lactation can be calculated as 125 kg, 854 kg and 988.2 kg, respectively for the 2^{nd}, 3^{rd} and 4^{th} SCC groups, compared to the first SCC group.

As expected, MMY and EMY decreased gradually depending on the advance of lactation and revers to this, NFDMC (%) and FC (%) in milk increased. NFDMC (%) and FC (%) means for the first lactation stage were 9.98±0.10% and 3.77±0.18% and the means increased to 10.60±0.09% and 4.34±0.16% at the third stage of lactation, respectively.

Among the factors, lactation stage and observation month had statistically significant effects (P<0.05) on NFDMC (%) and, for FC (%) the effects of parity, TE score and SCC group were determined to be statistically significant (P<0.05).

As seen in Table 1, FC (%) decreased as TE score increased. The highest FC (%) was calculated as 4.55±0.21% for the first TE score and the mean decreased gradually to 3.44±0.18% for TE score =4. In other words, the cows had 9.23, 11.65 and 24.4% less fat in milk for 2^{nd}, 3^{rd} and 4^{th} TE score than those the cows had TE score =1.

Phenotypic correlation coefficients among TE score, Log_{10}SCC, MMY, EMY, FC and NFDMC are given in Table 2. The phenotypic correlation between TE score and Log_{10}SCC is positive and moderate (r=0.41). The phenotypic correlations of TE score with other traits were determined to be low. As expected the correlation between MMY and EMY is very high (r=0.90). Low to moderate negative phenotypic correlations of milk yield with FC and NFDMC were also calculated (Table 2).

DISCUSSION

In the study, because the primiparous cows have both lower milk yield and less worn teats, TE score mean of them was also lower than multiparous cows. With the increase in the parity, the milk yield of the cows and the probability of deformed teats also increased.

The higher TE score mean determined in winter calved cows are due mainly to wet and dirtiness conditions of the barns because of the insufficient usage of bedding of the barn depending on the higher rainfall and humidity in winter in the region. This situation can be seen much more clearly by the changes of TE score depending on the observing month. As the winter approached, the TE score mean increased especially in the months from November to February (Table 1).

Because of less worn teats at the first stage of lactation the cows had the lowest TE score compared to other lactation stages. As emphasized before in some studies[6,7], the causes of deformations occurring at the TE are vacuum differences due to the functional structure of the milking machine; continuing milking despite the cessation of milk flowing from the udder; wet and muddy conditions of the barn[8] and insufficient bedding. Indeed, it was stated that in a study[23], deformations at the TE are related to the quality of the management conditions of the farms.

As a result of the cracking of the keratin layer, a suitable environment is formed at the TE to proliferate microorganisms, and these microorganisms pass through the TE into the udder tissue more easily, causing mastitis while increasing SCC in milk. The increase in SCC seen in this study depending on the increase of TE score agree with a study[11]. They reported an association of severe hyperkeratosis with clinical and subclinical mastitis and an increase in SCC in infected quarter. They also added that the risk of intermammary infection increased with the TE hyperkeratosis.

The overall mean of back-transformed value of Log_{10}SCC (457,088 cells / ml) found in this study is similar to the averages of a study[14] for some herds in the same region.

The estimated milk losses per day and per lactation found in this study due to high SCC agree with the results of other studies[18,24,25]. Similar to this study Jonas et al.[25] estimated 3.4 kg loss milk yield per day at the first parity Hungarian Holstein cows. Hortet and Seegers[24] determined the average loss per lactation is 300-400 kg (ie. 4-6%) and added that the loss could be increased to 950-1050 kg/lactation. Due to high SCC, in a study, a significant milk yield loss per milking (12.7%/milking) was reported[18], besides 11.92% and 6.33% reduction in lactose content and NFDMC in Red-Holstein cows, respectively.

A reverse situation to TE score was seen for the SCC group. As SCC in milk increased, FC decreased, gradually. The increase in the FC (%) as SCC increases could mainly be due to the decrease in milk yield. As milk yield decreases, FC (%) increases. In a study[26], conducted in Jersey, Holstein and Guernsey dairy cattle, stated that while the level of yield increases according to the parity, protein and fat content decrease.

As seen in Table 1, the milk yield is low from June to September for MMY and July to October in EMY. The low level of milk yield found in this study in these months is due to the high air temperature and humidity seen in these months in the region, and the increase in the yield in the November and December may be attributed to the suitable climatic conditions seen in the region. The effects of high air temperature and humidity also cause a decrease in the percentage of NFDMC in milk in July and August.

It means that as the hyperkeratosis score increases, milk SCC and prevalence of mastitis increases as well. This finding agrees with the finding of Emre[12] and showing that lesions at the TE pose a risk for mastitis[13]. Since the hyperkeratosis structures occurring at the TE negatively affect the anatomical defense system of the udder, an increase in SCC in milk is considered.

CONCLUSIONS

In this study, the changes of TE score depending on non-genetic factors and its effects on milk yield, constituents and SCC were determined in addition to the determination of the effects of SCC on milk yield, constituents and loss of milk yield. The cows with hyperkeratosis at the TE also had high TE score and SCC value in milk. TE hyperkeratosis caused by insufficient maintenance-management and barn and milking management conditions on the farm, besides treating the health of dairy cattle, leads to significant increase in SCC and decrease in FC (24.4%) in milk. A significant milk yield loss (3.24 kg or 13.41%) were also seen in the daily milk yield due to high SCC.

As an indicator of the udder health, milking management, hygiene and barn conditions, scoring the TE of dairy cows gives an idea about the operating conditions on the dairy cattle farm and with this way significant losses in milk yield and milk constituents could be prevented by decreasing SCC through improving TE score.

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