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The relationship of somatic cell count with milk yield and composition in different stages of lactation in Holstein cows

Orhan Ermetin[1*], Ertuğrul Kul[2] and Ibrahim Cihangir Okuyucu[3]

[1]*Department of Animal Science, Faculty of Agriculture, University of Yozgat Bozok, Yozgat, Turkey*
[2]*Department of Animal Science, Faculty of Agriculture, University of Kırşehir Ahi Evran, Kırşehir, Turkey*
[3]*Department of Animal Science, Faculty of Agriculture, University of Ondokuz Mayis, Samsun, Turkey*

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ABSTRACT

Globally, the milk yield of Holstein cows has increased considerably, but this situation has reduced the cows' tolerance to environmental factors and, thus, it has negatively affected udder health and milk quality. This study aimed to determine the influence of somatic cell count (SCC) on milk yield and its composition in early (<100 days), mid (100–200 days), and late lactation (>200 days) between November 2019 and August 2020. The study material consists of 927 records of 132 Holstein cows raised on a commercial dairy cattle farm in the Kırşehir province of Turkey. SCC was categorized into three groups (<100x10^3 cell/mL, 100-200x10^3 cell/mL, and >200x10^3 cell/mL). SCC data were logarithmically transformed to $\log_{10}$ base. In the study, logSCC, test day milk yield (MY), fat content (FC), solids-not-fat (SNF), protein content (PC), lactose content (LC), fat yield (FY), and protein yield (PY) were recorded as 5.12±0.01, 37.54±0.34 kg, 3.59±0.02%, 9.08±0.01%, 3.35±0.01%, 4.99±0.01%, 1.33±0.01 kg, and 1.26±0.01 kg, respectively. LogSCC, MY, FC, SNF, PC, LC, FY, and PY were significantly affected by the parity, lactation stage, and sampling season (P<0.05). Both milk yield and its composition in late lactation were negatively affected by high SCC compared to early and mid-lactation. MY, SNF, PC, LC, FY, and PY were determined to be the highest in cows with SCC<100x10^3 cells/mL, and the lowest in cows with SCC>200x10^3 cells/mL. Consequently, it may be that milk loss related to an increase in SCC was, consequently, highest toward the end of lactation. As a result, we suggest that prevalence measures should focus on reducing the incidence of SCC toward the end of lactation in Holstein cows.

Key words: Holstein; somatic cell count; milk yield; milk composition

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Introduction

Milk contains water, fat, proteins, lactose, minerals, etc., and has high biological value. Dairy product quality is primarily associated with raw milk composition (IVANOV et al., 2017). Therefore, raw milk's composition and physicochemical properties are important for the consumer, dairy farmers, and the dairy industry (MALEK DOS REIS et al., 2013). There are many factors that affect milk

*Corresponding author:
Orhan Ermetin, Department of Animal Science, Faculty of Agriculture, University of Yozgat Bozok, Yozgat, Turkey, e-mail: orhan.ermetin@yobu.edu.tr

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composition, such as: breed, age, lactation period, season, milking interval, nutrition, etc. (IVANOV et al., 2017). Also, mastitis adversely influences the quantity of milk, its quality and processing characteristics (RUPP et al., 2000).

Mastitis is a costly disease due to its biological effects and economic consequences, including the loss of milk yield, culling, and veterinary treatment costs in dairy cattle (NEMCOVA et al., 2007; TURK et al., 2017; BENIĆ et al., 2018; KOVAČIĆ, et al., 2019; LAMARI et al., 2021). In this respect, it is important to monitor intramammary infections to protect milk quality in dairy cows and herd health. Various methods are available to diagnose mastitis, and the standard method of bacteriological culture of milk samples is used, but it is usually expensive and time-consuming. However, somatic cell count (SCC) is cheaper than microbiological culture and is used to determine the infection status at the cow and herd level (MALEK DOS REIS et al., 2013).

SCC has been recognized as a reliable marker for the early detection of milk quality or any disturbance in production cycles. The SCC is used as an important parameter of udder health because somatic cells protect the mammary gland from infection (RUPP et al., 2000; TURK et al., 2012). SCC in milk includes leukocytes and a few epithelial cells. The relative proportions of different populations of leukocytes reflect the state of the mammary gland. While lymphocytes and macrophages are dominant in the healthy udder, PMN is low. The onset of inflammation significantly alters the milk leukocyte composition with the transition from mononuclear cells to polymorphonuclear cells (KUL et al., 2006).

The increase in SCC at the beginning of lactation is important because it causes a lower milk yield in the later stages of lactation. In this context, the use of test-day SCC values, in addition to fat content (FC) and protein content (PC), are widely used as reliable parameters to detect productivity abnormalities in herds (ATASEVER and STÁDNÍK, 2015). Therefore, SCC is widely used as an indicator of udder health and detection of mastitis in cows (EL-TAHAWY and EL-FAR, 2010; GUO et al., 2010). Cows with fewer than $100x10^3$ cells/mL are considered to be healthy, but those with $200x10^3$ cells/mL and above can be considered as healthy or diseased (EL-TAHAWY and EL-FAR, 2010).

High SCC leads to poor-quality milk and dairy products (CINAR et al., 2015), which is caused by the reduction in milk processing ability, cheese yield and shelf life (MA et al., 2000). Poor milk quality and decreased animal welfare are important indicators of high SCC (HAGNESTAM-NIELSEN et al., 2009; ERDEM and OKUYUCU, 2019).

Recently, noteworthy increases have been observed in the milk yields of dairy cows. This advancement in the dairy industry is generally regarded as an important phenomenon. However, the increased milk yield of dairy cows under current dairy production systems has adversely affected the cattle's reproductive ability, increased their health problems, and reduced the life span of cows (OKUYUCU et al., 2023). This increase in milk yield has also caused substantial changes in the udder health and milk quality of cows. Therefore, researchers have focused on examining the udder health of cows, as well as investigating the milk quality and quantity. To the best of our knowledge, limited information exists on the relationships between SCC and milk components and milk yield in Holstein cows. Further studies are required to reveal the influences of SCC on the milk yield and components in different lactation periods of cows. We hypothesized that some environmental factors affect the SCC, milk components and yield values of Holstein cows in different lactation periods, and that the categorized SCC values are significantly negatively associated with the milk yield and milk components. The aims of this study were: (i) to evaluate SCC, milk components, and milk yields in Holstein cows, (ii) to investigate the effects of environmental factors on SCC, milk components, and yields, and (iii) to determine the relationships between SCC groups, milk yield, and milk components in cows during different lactation periods.

Materials and methods

This study was conducted on 927 milk samples from 132 Holstein Friesian cows raised on a commercial farm in the Kırşehir province of Türkiye (Turkey). Milk samples were taken at monthly intervals from each cow during the morning milking between November 2019 and August 2020.

The cows were housed in free stalls and milked three times daily with an automatic milking machine. The raw milk samples were taken during the morning milking from 30 to 240±15 days of lactation.

Samples were taken in 50-mL sterile bottles and transported to the laboratory on ice at +4^{o}C until analyzed. Milk composition parameters (fat, solids-not-fat (SNF), protein, and lactose) were analyzed by Lacto Star (Funke-Gerber, Labortechnik, Article No. 3510, Berlin, Germany), and the SCC (cells/mL) was analyzed using DCC (DeLaval Cell Counter, DeLaval, Tumba, Sweden). The SCC was log-transformed to SCS to avoid the bias of the mean due to extremely high raw SCC. Test day milk yield (MY, kg/day), fat yield (FY, kg/day), and protein yield (PY, kg/day) were used as production traits. FY and PY are used in a selection *index* to reflect changes in milk yield, fat content (FC), and protein content (PC) in dairy cattle breeding programs (GUO et al., 2010).

The cows were grouped as first, second, third and later parities. Sampling season groups were formed in autumn, winter, spring, and summer. The lactation stage was divided into three groups as early lactation (<100 days), mid-lactation (100–200 days), and late lactation (>200 days). Three different SCC groups were composed as <100, 100-200, and >200x10^3 cells/mL.

The effects of the linear evaluation of the parity, lactation stage, and sampling season on milk yield, components, and logSCC were determined on the basis of the following linear model:

$$y_{ijkl} = \mu + P_i + LS_j + SS_k + e_{ijkl}$$

where y_{ijklm} is the dependent factor; μ is the overall mean; P_i is the fixed effects of the ith parity (first, second, third parities; LS_j is the fixed effects of the jth lactation stage (<100, 100-200, and >200 days); SS_k are the fixed effects of the kth sampling season (autumn, winter, spring and summer); e_{ijkl} is the random error.

To evaluate the influence of SCC values on milk yield and components, the following model was used:

$$\gamma_{ij} = \mu + SCC_i + \varepsilon_{ij}$$

where γ_{ij} is the dependent factor; μ is the overall mean; SCC_i is the influence of SCC groups (<100, 100-200, and >200x10^3 cell/mL); ε_{ij} is the random error.

Data on milk yield, composition, and SCC were analyzed using the general linear model (GLM) procedure of the SPSS 17 package software, and differences between mean values were compared by Duncan's multiple range test. Correlations were calculated as Pearson's correlation coefficients (r).

Results and discussion

In the study, logSCC, MY, FC, SNF, PC, lactose content (LC), FY, and PY were recorded as 5.12±0.01, 37.54±0.34 kg, 3.59±0.02%, 9.08±0.01%, 3.35±0.01%, 4.99±0.01%, 1.33±0.01 kg, and 1.26±0.01 kg, respectively. As seen in Table 1, MY was significantly affected by parity (P<0.05). The highest MY was detected in the second and third parities, and the lowest was detected in the first parity. However, the FC detected in the second parity and the MY detected in the first parity are similar (P>0.05). MY tends to rise with increasing parity. This study's results were similar to the results of many studies (YOON et al., 2004; CINAR et al., 2015; KUL et al., 2019). MY increasing with progressive parity can be explained as milk yield increases as the age of the cow increases. The observed increase in milk yield as parity increases may be associated with changes in the physiological factors that support the performance of cows when they reach mature equivalents. These statements, reported by DO NASCIMENTO RANGEL et al. (2014), support our hypothesis. ÖNAL et al. (2021a) stated that there was an increase in milk yield until the third parity, and a partial decrease after the fourth parity. Similarly, there was an increase in FC in the subsequent parities. The highest FC was obtained in the third parity, and the lowest was obtained in the second parity. Similar results were obtained by CINAR et al. (2015) and KUL et al. (2019). Although FY and PY increased in subsequent parities, SNF, PC, and LC were at their highest in the second parity, while they were lower in the second and third parities (P<0.05). LogSCC was highest in the second and third parities (P<0.05) compared with the first parity. The results determined in the present study were compatible with most research results (KUL and ERDEM, 2008; NASR and EL-TARABANY, 2017, KUL et al., 2019). ÖNAL et al. (2021b) reported the highest SCC in the fourth parity, and then in the second, third, and first parity, respectively. The increase observed in SCC values as the parity increased may be associated with cows with higher parity being more exposed to environmental contamination and the milking process than those with lower parity. Multiple factors, such as loose feces, poor bedding conditions, and unsuitable barn floors, can adversely affect cows' body hygiene (RAHAMAN et al., 2021). Considering that poor body hygiene may cause an increase in the SCC value (ERDEM and OKUYUCU 2019), the barn's hygiene and the cow's hygiene should be carefully observed for quality milk production.

In the present study, the effects of the lactation period on logSCC, FC, SNF, PC, LC, FY and PY were significant (P<0.05). While MY, FY and PY were the highest in the first period of lactation, they decreased in later lactation periods. In contrast, logSCC, FC, SNF, PC and LC increased with the progression of lactation. In other words, it can be stated that as the milk yield increases, the ratio of milk components decreases (Table 1). This can be explained by the antagonistic relationship between milk yield and dry matter ratio of milk, as well as by the negative energy balance during the post-partum period (FEKADU et al., 2005). These results are similar to those of BOHMANOVA et al. (2009) and KUL et al. (2019). HAGNESTAM-NIELSEN et al. (2009) detected that the lactation period had a significant effect on SCC, and that it especially increased in the last period of lactation. It has been reported that the increase in logSCC with the progression of lactation is due to mastitis, involution of the udder, and less dilution of milk leukocytes (KUL et al., 2019).

Table 1. Somatic cell count, milk yield and milk components values according to parity, lactation period and sampling season

	Groups	N	LogSCC	MY (kg/d)	FC (%)	SNF (%)	PC (%)	LC (%)	FY (kg/d)	PY (kg/d)
Parity	1	483	5.11^{b}	36.18^{b}	3.59^{ab}	9.16^{a}	3.39^{a}	5.03^{a}	1.28^{b}	1.22^{b}
	2	243	5.15^{a}	38.60^{a}	3.52^{b}	8.99^{b}	3.31^{b}	4.93^{b}	1.34^{b}	1.28^{a}
	3≤	201	5.13^{a}	39.54^{a}	3.70a	9.00^{b}	3.32^{b}	4.94^{b}	1.44^{a}	1.31^{a}
Lactation stage	<100 d	312	5.05^{c}	42.74^{a}	3.47^{b}	8.96^{c}	3.31^{c}	4.94^{c}	1.48^{a}	1.41^{a}
	100-200 d	327	5.12^{b}	39.01^{b}	3.58^{b}	9.10^{b}	3.36^{b}	4.99^{b}	1.39^{b}	1.31^{b}
	>200 d	288	5.21^{a}	30.25^{c}	3.74^{a}	9.20^{a}	3.39^{a}	5.04^{a}	1.11^{c}	1.03^{c}
Sampling season	Autumn	43	5.04^{c}	37.88^{b}	3.48^{b}	9.05^{bc}	3.34^{b}	4.95^{b}	1.30^{b}	1.26^{b}
	Winter	316	5.06^{c}	43.09^{a}	3.47^{b}	8.97^{c}	3.32^{b}	4.95^{b}	1.49^{a}	1.43^{a}
	Spring	358	5.13^{b}	37.24^{b}	3.64^{ab}	9.08^{b}	3.35^{b}	4.98^{b}	1.34^{b}	1.25^{b}
	Summer	210	5.22^{a}	29.63^{c}	3.72^{a}	9.26^{a}	3.41^{a}	5.06^{a}	1.08^{c}	1.01^{c}
Overall		927	5.12	37.54	3.59	9.08	3.35	4.99	1.33	1.26
		SEM	0.01	0.34	0.02	0.01	0.01	0.01	0.01	0.01

a,b,c: means with different letters in the same column differ significantly (P<0.05); SEM: standard of error of mean; logSCC: logarithmic somatic cell count; MY: test day milk yield; FC: fat content; SNF: solids-not-fat, PC: protein content; LC: lactose content; FY: fat yield; PY: protein yield

The logSCC was highest in summer and lowest in autumn and winter (P<0.05). In studies conducted on different genotypes, it was reported that the highest SCC was in summer (GÖNCÜ and ÖZKÜTÜK, 2002; EYDURAN et al., 2005; ÖNAL et al., 2021b) and this result is compatible with this study. ERDEM et al. (2007) determined that cow's milk had a higher SCC in summer, and this may be due to heat stress and the density of pathogenic microorganisms in the environment depending on the season. Some researchers reported the highest SCC in winter months (EL-TAHAWY and EL-FAR, 2010; KUL et al., 2019). It has been stated that the high SCC in the winter may be due to the fact that the cows are kept indoors (KUL et al., 2019).

The sampling season significantly affected MY (P<0.05). In this study, the lowest MY was determined in the summer and the highest in winter. Many studies have determined similar results (YOON et al., 2004; CATILLO et al., 2002; KUL et al., 2019). It has been reported that low milk yield in summer is associated with heat stress, which has a negative effect on milk yield in cows (KOÇ, 2011). In this study, FC, SNF, PC, and LC increased with decreasing MY in the summer months (Table 1).

The influence of SCC on milk yield and milk composition in early lactation is presented in Table 2. As can be seen, the influence of SCC was not found to be significant on milk yield and composition in early lactation (P>0.05). However, although not statistically significant, MY, PC, LC, FY, and PY decreased as SCC increased and were higher in cows with <100x10^3 cells/mL. According to GUNER et al. (2022), the critical threshold level for SCC in the early period is 100x10^3 cells/mL in evaluating the loss of the milk components. GONÇALVES et al. (2018) reported that the lowest milk yield was observed in milk with SCC below 200x10^3 cells/mL between 5 and 19 days postpartum. Since cows are more susceptible to udder infection during early lactation, further decreases in milk yield are expected. However, the results of this study were not detected here. The low SCC can be partly explained by the dilution effect of the high milk yield in this period (HAGNESTAM-NIELSEN et al., 2009).

SCC did not have a significant influence on MY, FC, SNF, PC, and LC in mid-lactation (P>0.05). However, FY and PY were affected by the SCC levels (P<0.05). FY and PY were the highest in cows with SCC<100x10^3 cells/mL and the lowest in cows with >200x10^3 cells/mL. As can be seen, FY and PY decreased linearly as SCC increased. According to the results, it is possible to say that milk yield components tend to decrease as SCC increases, although it is not statistically significant (P>0.05).

Table 2. Milk yield and milk composition values according to somatic cell count groups during early lactation

SCC group (x10^3 cells/mL)	n	MY (kg/d)	FC (%)	SNF (%)	PC (%)	LC (%)	FY (kg/d)	PY (kg/d)
<100	170	43.67	3.49	8.97	3.32	4.95	1.52	1.45
100–200	102	41.10	3.52	8.91	3.28	4.89	1.44	1.35
>200	40	41.10	3.52	8.91	3.28	4.89	1.44	1.35
SEM		0.55	0.04	0.02	0.01	0.01	0.03	0.02

MY: test day milk yield; FC: fat content; SNF: solids-not-fat, PC: protein content; LC: lactose content; FY: fat yield; PY: protein yield

Table 3. Milk yield and milk composition values according to somatic cell count groups during mid-lactation

SCC group (x10^3 cells/mL)	N	MY (kg/d)	FC (%)	SNF (%)	PC (%)	LC (%)	FY (kg/d)	PY (kg/d)
<100	125	40.22	3.62	9.14	3.38	5.02	1.44^{a}	1.36^{a}
100–200	136	38.44	3.59	9.07	3.34	4.97	1.37^{ab}	1.28^{ab}
>200	66	37.86	3.50	9.06	3.34	4.97	1.32^{b}	1.27^{b}
SEM		0.46	0.04	0.02	0.01	0.01	0.02	0.02

a,b: means with different letters in the same column differ significantly (P<0.05); MY: test day milk yield; FC: fat content; SNF: solids-not-fat, PC: protein content; LC: lactose content; FY: fat yield; PY: protein yield

Table 4. Milk yield and milk composition values according to somatic cell count groups during late lactation

SCC group (x10^3 cells/mL)	N	MY (kg/d)	FC (%)	SNF (%)	PC (%)	LC (%)	FY (kg/d)	PY (kg/d)
< 100	71	33.97^{a}	3.75	9.34^{a}	3.46^{a}	5.13^{a}	1.25^{a}	1.17^{a}
100–200	132	29.62^{b}	3.77	9.22^{b}	3.39^{b}	5.04^{b}	1.10^{b}	1.00^{b}
> 200	85	28.12^{b}	3.70	9.07^{c}	3.34^{c}	4.96^{c}	1.02^{b}	0.94^{b}
SEM		0.55	0.04	0.02	0.01	0.01	0.02	0.02

a,b,c: means with different letters in the same column differ significantly (P<0.05); MY: test day milk yield; FC: fat content; SNF: solids-not-fat, PC: protein content; LC: lactose content; FY: fat yield; PY: protein yield

As seen in Table 4, SCC had a highly significant influence on MY, SNF, PC, LC, FY, and PY in late lactation (P<0.05). However, FC was not affected by the SCC groups (P>0.05). Of milk yield characteristics, the highest MY, FY, and PY were observed in cows with SCC<100 x10^3 cells/mL. Again, cows with SCC<100x10^3 cells/mL had the highest PC and LC, and the lowest were in cows with SCC>200x10^3 cells/mL. In this study, SCC occurred at the lowest level during the peak period of lactation. Similarly, REKIK et al. (2008) observed that SCC was lowest during the peak period of lactation milk yield and increased toward the end of lactation. The milk content decreased with increasing SCC in late lactation (P<0.05). These results showed that high SCC in late lactation had the most significant influence on milk yield, and that the results of HAGNESTAM-NIELSEN et al. (2009) were found to be compatible with the present study. The higher milk loss associated with an increase in SCC in late lactation may be due to permanent damage from previous infections, and may have a significantly worse impact on udder health with new infections (HORTET et al., 1999; HAGNESTAM-NIELSEN et al., 2009). HAMANN and REICHMUTH (1990) observed that the compensatory ability of uninfected quarters was indeed lower in the late lactation period as compared to the early lactation period. Therefore, it may be said that the milk yield and its content losses, which were related to high SCC were observed in lactation.

Similarly, EL-TAHAWY and EL-FAR (2010) determined that SCC significantly affected MY, FC, SNF, PC, and LC (P<0.05). GARCIA et al. (2015) reported that high SCC correlated with lower FC, solids, and LC. GUNER et al. (2022) observed a decrease in milk components when the SCC exceeded the level of >100x10^3 cells/mL. SANTOS et al. (2003) reported that SCC greater than >200x10^3 cells/mL might cause changes in milk composition compared with SCC lower than ≤200x10^3 cells/ml. KOLDEWEIJ et al. (1999) reported that observations with SCC≤200x10^3 cells/mL and without clinical signs of mastitis were categorized as healthy udders. KUL et al. (2019) detected that high SCC (>201x10^3 cells/mL) was associated with lower MY than low SCC (<100x10^3 and 100-200x10^3 cells/mL). Similar results were detected by GAJDUSEK (1996), who did not record any influence of SCC on FC. In contrast, ALBENZIO et al. (2005) did not demonstrate any difference in milk content in milk with low or high SCC.

High SCC causes epithelial cell damage, thereby increasing vascular permeability and proteolytic activities (MALEK DOS REIS et al., 2013). Reductions in PC due to infections was mostly related to the fraction of serum PC (GUO et al., 2010). A reduction of casein synthesis in general related to the higher proteolytic activity associated with higher SCC during mastitis was stressed by RAMOS et al. (2015). LC is usually reduced due to mastitis (GAJDUSEK, 1996; GARCIA et al., 2015). Lactose is milk's main carbohydrate and is responsible for the osmotic balance between the alveolar lumen and blood (GUNER et al., 2022). Decreased productivity is also related to a reduction in lactose synthesis (GARCIA et al., 2015). Lactose also negatively correlates with the milk's chloride ion (GUNER et al., 2022). Therefore, lactose in milk could indicate healthy udders (HANUS et al., 1994).

Table 5. Correlations between SCC and milk yield and milk composition in different lactation stages

Lactation stage	MY (kg/d)	FC (%)	SNF (%)	PC (%)	LC (%)	FY (kg/d)	PY (kg/d)
Early lactation	-0.063 (P=0.269)	-0.011 (P=0.853)	-0.013 (P=0.818)	-0.049 (P=0.384)	-0.059 (P=0.296)	-0.050 (P=0.374)	-0.076 (P=0.181)
Mid-lactation	-0.141* (P=0.011)	-0.027 (P=0.625)	-0.121* (P=0.029)	-0.153** (P=0.005)	-0.133* (P=0.016)	-0.127* (P=0.021)	-0.167** (P=0.003)
Late lactation	-0.213** (P=0.001)	-0.043 (P=0.471)	-0.232** (P=0.001)	-0.257** (P=0.001)	-0.278** (P=0.001)	-0.234** (P=0.001)	-0.243** (P=0.001)

*P<0.05, **P<0.01; SCC: somatic cell count, MY: test day milk yield, FC: fat content; SNF: solids-not-fat, PC: protein content; LC: lactose content; FY: fat yield, PY: protein yield

As seen in Table 5, the correlations between SCC with milk yield and component characteristics were negative. The greatest correlations were determined in the late lactation period as compared with early and middle lactation. Correlations in early-lactation (-0.076 to -0.011) and mid-lactation (-0.027 to -0.167) were low and negative (P>0.05). The correlations between logSCC with MY, PC, LC, FY, and PY in late lactation were higher (P<0.01) and ranged from -0.278 to -0.213 (P<0.01) except for FC (-0.043, P>0.05). No significant correlations were found between the SCC and the FC. Consistent with previous studies, in this study increased SCC resulted in reduced milk yield (ATASEVER and STÁDNÍK, 2015; CINAR et al., 2015; SILVA et al., 2018), FC (KUL et al., 2019), PC (RAMOS et al., 2015; GUNER et al., 2022), and LC (PAURA et al., 2002; CINAR et al., 2015; MIKÓ et al., 2016;

SILVA et al., 2018). Similarly, GONZALO et al. (2005) reported that milk yield, FC, PC, LC, total solids and SNF were negatively affected by SCC. In contrast with these results, a positive correlation between FC and PC with SCC has been reported by some authors (PAURA et al., 2002; MIKÓ et al., 2016). Also, CINAR et al. (2015) observed that the correlations between SCC with FC, PC, and total solids were 0.164, 0.103, and 0.291, respectively. It was demonstrated in this investigation that except for FC, milk yield and its composition decreased as SCC increased, in mid- and especially the last period of lactation.

Conclusions

This study showed that some environmental factors (parity, lactation stage and sampling season) affect the yield traits and milk quality traits investigated. While milk yield traits tended to increase with the progression of lactation, milk components decreased. In contrast, logSCC, FC, SNF, PC, and LC increased with the progression of lactation, but MY, FY, and PY decreased. It was concluded that milk yield and some milk quality characteristics may be affected depending on the variations in the physiological and metabolic status of cows in different parities and lactation periods. In addition, MY, FY, and PY were lowest in the warm seasons, while logSCC, FC, SNF, PC, and LC were the highest in warm seasons, especially in summer. Additionally, no significant correlations were found between SCC and the investigated data regarding milk yield traits and milk components in cows during the early lactation period. However, the negative correlations observed between SCC and investigated milk yield traits and milk components in cows during the mid- and especially the late lactation period were noteworthy. As a result, we suggest that prevalence measures must focus on reducing the incidence of SCC toward the end of lactation.

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Conflict of Interest

The authors declare that they have no conflicts of interest and that they have all contributed equally to this article.

Orcid ID

O. Ermetin: https://orcid.org/0000-0002-3404-0452

E. Kul: https://orcid.org/0000-0003-4961-5607

I. C. Okuyucu: https://orcid.org/0000-0002-2138-6577

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ERMETIN, O., E. KUL, I. C. OKUYUCU: Odnos broja somatskih stanica te prinosa i sastava mlijeka u različitim stadijima laktacije u holštajnskih krava. Vet. arhiv 94, 21-32, 2024.

SAŽETAK

Proizvodnja mlijeka holštajnskih krava znatno je porasla na globalnoj razini, što je smanjilo otpornost krava na čimbenike okoliša i time negativno utjecalo na zdravlje vimena i kvalitetu mlijeka. Cilj je istraživanja bio odrediti utjecaj broja somatskih stanica (SCC) na prinos i sastav mlijeka u krava u ranoj laktaciji (<100 dana), srednjoj fazi laktacije (100–200 dana) i kasnoj laktaciji (>200 dana). U razdoblju od studenoga 2019. do kolovoza 2020. prikupljeno je 927 podataka od 132 krave holštajnske pasmine s komercijalne farme za proizvodnju mlijeka u pokrajini Kırşehir u Turskoj. SCC je kategoriziran u tri skupine: <100x10^3 stanica/mL, 100–200x10^3 stanica/mL i >200x10^3 stanica/mL. Vrijednosti SCC-a logaritamski su transformirane u bazu $\log_{10}$. Za pojedine pokazatelje su utvrđene sljedeće vrijednosti: logSCC 5,12±0,01, dnevni prinos mlijeka (MY) 37,54±0,34 kg, udio masne tvari (FC) 3,59±0,02%, udio nemasne čvrste tvari (SNF) 9,08±0,01%, sadržaj bjelančevina (PC) 3,35±0,01%, sadržaj laktoze (LC) 4,99±0,01%, prinos masti (FY) 1,33±0,01 kg i prinos bjelančevina (PY) 1,26±0,01. Na logSCC, MY, FC, SNF, PC, LC, FY i PY znakovito (P<0,05) su utjecali paritet, stadij laktacije i sezona u kojoj je uzorkovanje provedeno. Na prinos i sastav mlijeka u kasnoj laktaciji negativno je utjecao visok SCC u usporedbi s laktacijom u ranoj i srednjoj fazi. Pokazalo se da su vrijednosti MY, SNF, PC, LC, FY i PY bile najveće u krava sa SCC-om manjim od 100x10^3 stanica/mL, a najmanje u krava sa SCC-om većim od 200x10^3 stanica/mL. Može se stoga pretpostaviti da gubitak mlijeka povezan s povećanjem SCC-a raste kako se bliži kraj laktacije. Zaključuje se da bi u krava holštajnske pasmine preventivne mjere trebalo usmjeriti na smanjenje pojavnosti SCC-a u razdoblju prema kraju laktacije.

Ključne riječi: holštajnska pasmina; broj somatskih stanica; prinos mlijeka; sastav mlijeka