



Milk Yield, Reproduction and Milk Quality Characteristics of Simmental and Red-Holstein Cattle Raised at a Dairy Farm in Aydın Province: 2. Milk Quality

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ARTICLE INFO	ABSTRACT
<p><i>Research Article</i></p> <p>Received : 15/04/2020 Accepted : 25/09/2020</p> <p>Keywords: Dairy cattle Milk constituents Raw milk quality Somatic cell count Casein</p>	<p>In this study, the milk quality characteristics of Simmental (SIM) and Red-Holstein (RH) breeds raised in a private farm in Aydın were determined. As milk quality properties, the percentages of protein (MPC), lactose (MLC), non-fat dry matter (NFDMC), total dry matter (TDMC), casein (MCC) contents and also milk urea nitrogen (MUN), oleic acid (OA), beta-hydroxybutyric acid (BHBA) and somatic cell count (SCC) were determined. The averages of MPC, MLC, NFDMC, TDMC, MCC, MUN, OA, BHBA and Log₁₀SCC belonging to RH and SIM breeds are 3.38 ± 0.021% and 3.40 ± 0.015%, 4.86 ± 0.028% and 4.81 ± 0.019%, 9.09 ± 0.037 and 9.09 ± 0.025, 11.18 ± 0.069 and 11.23 ± 0.048, 2.50 ± 0.020 and 2.44 ± 0.014, 12.07 ± 0.200 mg / dl and 12.28 ± 0.138 mg / dl, 0.258 ± 0.0095 g / 100 g and 0.255 ± 0.0065 g / 100 g, 0.284 ± 0.138 mmol / L and 0.269 ± 0.0093 mmol / L, and 5.417 ± 0.0173 (261216 cells / ml) and 5.401 ± 0.0118 (251768 cells / ml) were found, respectively. The breed did not differ significantly in milk quality characteristics, except for MCC. The lower SCC level in milk and the suitable level of MUN for both breeds shows that the factors such as maintenance-feeding-housing-herd management in the farm were optimal in this herd.</p>

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Aydın İlinde Bir Süt Sığırını İşletmesinde Yetiştirilen Simmental ve Kırmızı-Alaca Sığırların Süt ve Döl Verimi ile Süt Kalite Özellikleri: 2. Süt Kalitesi

MAKALE BİLGİSİ	ÖZ
<p><i>Araştırma Makalesi</i></p> <p>Geliş : 15/04/2020 Kabul : 25/09/2020</p> <p>Anahtar Kelimeler: Süt sığırını Süt bileşeni Çiğ süt kalitesi Somatik hücre sayısı Kazein</p>	<p>Bu çalışmada, Aydın ilinde özel bir işletmede yetiştirilen Simmental (SIM) ve Kırmızı-Alaca (KA) sığırların süt kalite özellikleri belirlenmiştir. Süt kalite özellikleri olarak protein (SPO), laktoz (SLO), yağsız kuru madde (YKMO), toplam kuru madde (TKMO), kazein (KO) oranları ile aynı zamanda süt üre azotu (SUA), oleik asit (OA), beta hidroksi bütirik asit (BHBA) ve somatik hücre sayısı (SHS) belirlenmiştir. KA ve SIM ırklarına ait SPO, SLO, YKMO, TKMO, KO, SUA, OA, BHBA ve Log₁₀SHS ortalamaları sırasıyla %3,38±0,021 ve %3,40±0,015, %4,86±0,028 ve %4,81±0,019, %9,09±0,037 ve %9,09±0,025, %11,18±0,069 ve %11,23±0,048, %2,50±0,020 ve %2,44±0,014, 12,07±0,200 mg/dl ve 12,28±0,138 mg/dl, 0,258±0,0095 g/100 g ve 0,255±0,0065 g/100 g, 0,284±0,138 mmol/L ve 0,269±0,0093 mmol/L ve 5,417±0,0173 (261216 hücre/ml) ve 5,401±0,0118 (251768 hücre/ml) bulunmuştur. Irklar arasında KO dışında süt kalite özellikleri bakımından önemli bir farklılık elde edilmemiş, her iki ırka ait düşük SHS ve uygun SUA düzeyleri işletmedeki bakım-besleme-barındırma-sürü yönetimi gibi unsurların uygun olduğunun göstergesi olarak değerlendirilebilir.</p>

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Introduction

It is estimated that approximately 150 million families worldwide are engaged in milk production. In developing countries, milk is produced and offered for sale by small-scale family farms, while it contributes to the family's basic livelihood, in developed countries it is produced by large-scale enterprises that are large enough to support a family.

In recent years, in Turkey, the rise of red meat prices due to the lack of red meat production, and reproductive problems and low resistance to diseases in Holstein-Friesian (HF) that is the most common breed in the country have directed producers to rear Simmental (SIM) and Red-Holstein (RH) breeds. SIM breed is one of the breeds that have come to be desired in recent years with its high milk yield and milk quality, high fattening performance, adaptation ability and docility (Koç, 2016). In recent years, another breed preferred as an alternative to Holstein-Friesian (HF) is RH.

Milk quality can be evaluated in two groups as the nutritional properties and hygienic properties of milk. While the nutritional quality of milk includes fat (MFC), protein (MPC), lactose (MLC), mineral substances, when the hygienic quality is mentioned, the number of total bacteria, somatic cell count (SCC) and antibiotic residue in milk are considered.

There are several results reported in the literature, for milk components of SIM breed by Akbulut (1998), Şekerden et al. (1999), Polanski et al. (1992). For HF and the Montbeliarde (MB) breed also known as French SIM (Koç et al., 2009) and Koç (2009; 2011), for HF and Brown-Swiss (Koç, 2007a), for HF breed (Koç, 2008) some values are reported. While Yılmaz (2010) and Koç (2015) reported some results for the milk components of RH, Yörükoğlu (2019) mentioned some results regarding the composition and quality of cattle milk coming to milk processing plants. Şekerden et al. (1999) reported the casein content (MCC) for SIM breed is $2.7 \pm 0.27\%$.

By using the devices developed to analyze the ingredients in milk in more detail, the milk urea nitrogen (MUN), freezing point (FP), oleic acid (OA), beta-hydroxybutyric acid (BHBA) and raw milk pH have begun to be determined.

Mucha and Strandberg (2011) and Spek et al. (2016) focused on MUN, Vučić et al. (2012) stating that OA has many beneficial effects on human health, and milk and dairy products contain different amounts of OA and reported that there was a significant amount of OA in cow's milk (22.94-25.57% of total fatty acid).

The cattle raw milk FP varies between -0.53 and -0.55°C . If water is added to the milk, FP rises and becomes closer to zero. It is stated that FP of the milk is fixed as -0.555°C and the melt substances in milk decrease the FP of milk and it has been stated that FP of milk can be used to reveal the tricks made in milk (Anonymous, 2019a).

It has been stated that raw cattle milk has a slightly acidic pH and its pH value varies between 6.6 and 6.8. It is mentioned that the presence of phosphoric and stearic anions, especially casein, is caused by this slightly acidic reaction in milk. The acidity of milk is affected by lactation period, feeding, and the chemical composition of milk and, is stated that 36% of the acidic property of fresh milk is due to casein, 54-59% is from phosphates, 8-15% is from carbon

dioxide, 8% is from album, 8% is due to citrates (Anonymous, 2019a). In addition, it was emphasized that the microorganisms found in milk break down lactose and cause the formation of lactic acid and some other acids, and this acidity is a subsequent acidity of milk (Anonymous, 2019a).

Taytak (2019) stated that urea, which is found in blood and body fluids as a small organic molecule, consists of carbon, nitrogen, oxygen and hydrogen, is also found in milk, and MUN is used as a biological indicator in protein-based diets of dairy cattle. In addition to being a tool for determining the source of the reproductive problem in dairy cattle, MUN is also used to evaluate whether the diets energy-protein balance is appropriate. MUN in the milk of a normal cow is 7-12 mg / dl. It was mentioned that if the MUN value was above 12 mg / dl, the ration protein content was high, and the MUN value was <5 mg / dl, the ration protein content was not sufficient and there was not enough protein for the bacteria in the rumen (Anonymous, 2019b).

In a study, Taytak (2019) determined the levels of MUN, BHBA and acetone in the milk samples collected from 100 different dairy farms, and stated that acetone and BHBA values are the most important parameters used in the determination of metabolic diseases such as ketosis and fatty liver syndrome in lactating cows.

SCC provides information about udder health as well as being a raw milk quality criterion. In cases where SCC is over 200 000 cells / ml, the cow's udder is considered to have mastitis (Dohoo and Leslie, 1991).

Regarding SCC content in milk for HF breed, Koç (2006) and Atasever et al. (2018; 2020), for MB and HF breeds, Koç (2007b; 2011), on the farm basis SCC level Koç et al. (2009), for RH, Yılmaz (2010) and Koç (2015) and, also Yörükoğlu (2019) reported some results regarding the SCC level of cattle milk coming to milk processing plants. In SIM breed, there are no studies reported in our country regarding SCC level.

In this study, it was aimed to determine the milk quality characteristics of RH and SIM breeds raised together in a private dairy cattle farm in Aydın, Turkey. Detailed information about the performances of these breeds will be obtained, since there has not been any previous study or sufficient work on RH breed brought from Holland and SIM breed from Austrian SIM, which has been brought to our country in the last few years.

Materials and Methods

This study was carried out on SIM and RH breeds raised in a dairy cattle farm established in 2010 in Aydın, Incirliova Town, Sınırteteke District. Milk components and SCC in milk were determined from milk samples taken from lactating animals in winter and summer seasons in 2018. The milk yield produced by the cows at the time of milk sampling was determined and it is accepted as the inspection time milk yield (ITMY). The milk samples were taken into sterile sample containers of 50 ml milk from each animal, approximately equal to each teat, after the first 2-3 squeezed milk was milked to the ground before milking, and then carried it to a special milk analysis laboratory in the cold chain in Söke District, Aydın. The samples were analyzed for milk components by DairySpec

FT (Bentley-Merkim Analytical Instruments). The samples were still preserved in the cold chain for SCC analysis done according to the Direct Microscopic Somatic Cell Count Method by bringing them to the ADU Faculty of Agriculture, Animal Science and Animal Breeding Laboratory.

Belonging to RH and SIM breeds, 94 and 204 milk samples were taken, respectively. In winter, 100 samples, in summer 198 samples were taken. By analyzing these samples, MFC (%), MPC (%), MCC (%), MLC (%), non-fat dry matter (NFDMC, %), total dry matter (TDMC, %), FP (°C), MUN (mg / dL), OA (g / 100 g), BHBA (mmol / L), pH and SCC (cell / ml) were determined.

Statistical Analysis

In the statistical analysis of the data, it was made in the SAS (1999) package program, and the differences between the subgroups were determined according to Tukey ($P < 0.05$) multiple comparison test results.

The following model was used in the statistical analysis of ITMY, MFC, MPC, MCC, MLC, NFDMC, TDMC, MUN, FP, OA, BHBA, milk pH and SCC values obtained from the milk samples taken before milking from lactating animals. Due to the high distribution of SCC data, logarithmic transformation was performed according to Log10 base before statistical analysis. The models used in the statistical analysis of the data are given below.

$$y_{ijklm} = \mu + a_i + b_j + c_k + d_l + (ab)_{ij} + (ac)_{ik} + (bc)_{jk} + (ad)_{il} + e_{ijklm}$$

Where;

y_{ijklm} : Observed value of the trait

μ : Mean

a_i : Breed effects (i =RH and SIM)

b_j : Season effects (j = winter, summer)

c_k : Parity effects (k =1, 2, 3, 4 and 5+)

d_l : Lactation period effects (l =1 (4-100 days), 2 (101-200 days) and 3 (>200 days))

$(ab)_{ij}$: Breed- season interaction effects

$(ac)_{ik}$: Breed-parity interaction effects

$(bc)_{jk}$: Season- parity interaction effects

$(ad)_{il}$: Breed- lactation period interaction effects

e_{ijklm} : Random error.

Results and Discussion

The averages of the milk components for SIM and RH breeds are given in Table 1. The overall ITMY, MFC, MPC, MCC, MLC, NFDMC and TDMC means were calculated as 12.80 ± 0.163 kg, $2.14 \pm 0.029\%$, $3.39 \pm 0.010\%$, $2.46 \pm 0.001\%$, $4.82 \pm 0.013\%$, $9.07 \pm 0.017\%$ and $11.21 \pm 0.032\%$, respectively. The ITMY mean was found 13.99 ± 0.228 kg and 12.35 ± 0.157 kg in RH and SIM breeds, respectively, about 1.65 kg difference between the breeds was determined ($P < 0.01$).

In this study, the averages of ITMY calculated for RH and SIM breeds (13.99 ± 0.228 kg and 12.35 ± 0.157 kg, respectively) are higher than the yield reported for RH (11.38 ± 0.279 kg) by Yılmaz (2010), for morning milk yield reported for HF (9.75 ± 0.392 kg) and MB (7.69 ± 0.274 kg) breeds by Koç (2011) and higher than the milk yield of morning (11.63 ± 0.217 kg) and evening (10.23 ± 0.212 kg) milkings for RH by Koç (2015).

The effects of season ($P < 0.01$), lactation period ($P < 0.01$), breed x season ($P < 0.01$), breed x parity ($P < 0.01$), season x parity ($P < 0.01$) and breed x lactation period ($P < 0.01$) interaction effects on ITMY were found to be statistically significant, however, parity effect was not significant ($P > 0.05$).

ITMY (13.82 ± 0.234 kg) in winter is 1.3 kg higher than the time of milk sampling (12.52 ± 0.174 kg) in summer ($P < 0.01$). It can be said that the high air temperature seen in summer in the region affects the animals, resulting in heat stress in animal and as a result of that a decrease in feed consumption and accordingly a decrease in milk yield was seen. ITMY decreased significantly as expected according to the beginning, middle and end of the lactation period and was calculated as 14.85 ± 0.188 kg, 13.67 ± 0.247 kg and 11.00 ± 0.273 kg, respectively, and the differences between all periods were found to be statistically significant ($P < 0.01$).

While the milk fat is low at the beginning of milking, it rises towards the end of milking. Since milk samples were taken before milking in this study, the samples will not represent the whole milking, so no discussion was made about MFC.

The interaction effects of breed x season on MPC was statistically significant ($P < 0.05$), however, breed, sampling season, parity, lactation period, breed x parity, season x parity and breed x lactation period interaction effects were not significant ($P > 0.05$). MPC averages were calculated as 3.38 ± 0.021 and 3.40 ± 0.015 in RH and SIM breeds, respectively. MPC in the milk produced by the animals in summer (3.38 ± 0.01) was lower than the milk produced in winter (3.40 ± 0.022), but the difference between the seasons is not significant ($P > 0.05$). In this study, the general average for MPC ($3.39\% \pm 0.010$) is higher than the average reported by Yörükoğlu (2019). MPC ($3.40\% \pm 0.015\%$) found for the SIM breed is lower than the average reported by Şekerden et al. (1999), however, is similar to the season and lactation averages reported by Polanski et al. (1992) and higher than the averages reported by Koç (2011) for MB and HF breeds. In this study, the average MPC for RH breed ($3.38\% \pm 0.021$) is also higher than the value reported by Yılmaz (2010) for RH and the means of MB and HF breeds reported by Koç (2011).

In the milk samples taken in this study, MCC in milk was also determined. Casein is one of the milk proteins and is the most abundant protein in the milk. In this study, only the breed effect was found to be statistically significant on MCC ($P < 0.05$), and the effects of other factors on MCC were not significant ($P > 0.05$). MCC of RH ($2.50 \pm 0.020\%$) was higher ($P < 0.05$) than SIM breed ($2.44 \pm 0.014\%$) (Table 1). In this study, MCC obtained for SIM and RH breeds were lower than the value reported for the SIM breed ($2.7 \pm 0.27\%$) by Şekerden et al. (1999).

Only breed x parity interaction effect on MLC was found to be statistically important ($P < 0.01$). The mean MLC of RH and SIM breeds were calculated as $4.86 \pm 0.028\%$ and $4.81 \pm 0.019\%$, respectively. In this study, MLC averages determined for both breeds were higher than the results found for MB and HF breeds by Koç et al. (2009) and Koç (2011) and RH breed reported by Yılmaz (2010). Also, the overall mean calculated for MLC ($4.82\% \pm 0.013$) in this study is higher than the average reported by Yörükoğlu (2019).

Parity and lactation period effects on NFDMC were found to be statistically significant ($P < 0.05$). NFDMC mean of RH and SIM breeds were $9.09 \pm 0.037\%$ and $9.09 \pm 0.025\%$, respectively. While NFDMC was calculated as $9.14 \pm 0.030\%$ at the beginning of lactation, $9.02 \pm 0.040\%$ at the middle and $9.12 \pm 0.044\%$ at the end, NFDMC of the middle of lactation was different from the beginning of lactation ($P < 0.05$). In this study, the overall mean calculated for NFDMC ($9.07 \pm 0.017\%$) is higher than the average reported by Yörükoğlu (2019).

NFDMC averages obtained for RH and SIM breeds are higher than the mean reported for SIM by Şekerden et al. (1999), for HF and MB breeds reported by Koç (2009;

2011), for RH reported by Yılmaz (2010). However, the means of NFDMC found for RH and SIM breeds in this study are lower than the values reported by Koç (2007a) and Koç (2008) for HF breed. The effects of all factors on TDMC were statistically insignificant ($P > 0.05$). The averages of TDMC in RH and SIM breeds are 11.18 ± 0.069 and 11.23 ± 0.048 , respectively. In this study, TDMC obtained for RH and SIM breeds are lower than the means found for SIM by Şekerden et al. (1999) and for HF and MB breeds reported by Koç (2011). Again, in this study, the overall mean for TDMC ($11.21 \pm 0.032\%$) is lower than the average reported by Yörükoğlu (2019).

Table 1. Means and standard errors of inspection time milk yield (ITMY), fat (MFC), protein (MPC), casein (MCC), lactose (MLC), non-fat dry matter (NFDMC) and total dry matter (TDMC) contents

Factor	n	ITMY kg	MFC %	MPC %
Breed		**	NS	NS
RH	94	13.99±0.228 ^{Aa}	2.09±0.062	3.38±0.021
SIM	204	12.35±0.157 ^{Bb}	2.14±0.043	3.40±0.015
Season		**	NS	NS
Winter	100	13.82±0.234 ^{Aa}	2.07±0.64	3.40±0.022
Summer	198	12.52±0.174 ^{Bb}	2.16±0.48	3.38±0.016
Parity		NS	NS	NS
1	84	13.14±0.240	2.03±0.066	3.357±0.022
2	63	13.09±0.265	2.10±0.073	3.376±0.025
3	44	13.56±0.297	2.11±0.081	3.365±0.028
4	31	13.56±0.413	2.19±0.113	3.415±0.039
5+	76	12.50±0.283	2.16±0.078	3.433±0.027
Lac. Period		**	NS	NS
1 (4-100 days)	127	14.85±0.188 ^{Aa}	2.11±0.052	3.40±0.018
2 (101-200 days)	72	13.67±0.247 ^{Bb}	2.11±0.068	3.36±0.023
3 (>200 days)	99	11.00±0.273 ^{Cc}	2.13±0.075	3.41±0.026
Breed x Season	298	**	NS	*
Breed x Parity	298	**	NS	NS
Season x Parity	298	**	NS	NS
Breed x Lac. Period	298	**	NS	NS
Overall	298	12.80±0.163	2.14±0.029	3.39±0.010
Factor	MCC %	MLC %	NFDMC %	TDMC %
Breed	*	NS	NS	NS
RH	2.50±0.020 ^a	4.86±0.028	9.09±0.037	11.18±0.069
SIM	2.44±0.014 ^b	4.81±0.019	9.09±0.025	11.23±0.048
Season	NS	NS	NS	NS
Winter	2.48±0.0214	4.85±0.029	9.12±0.038	11.20±0.071
Summer	2.47±0.0159	4.82±0.021	9.06±0.029	11.22±0.053
Parity	NS	NS	*	NS
1	2.45±0.0219	4.82±0.029	9.03±0.038 ^{ab}	11.07±0.072
2	2.44±0.0242	4.79±0.032	9.98±0.042 ^a	11.08±0.080
3	2.48±0.0271	4.92±0.036	9.16±0.048 ^b	11.26±0.089
4	2.52±0.0378	4.84±0.051	9.16±0.066 ^{ab}	11.36±0.013
5+	2.48±0.0259	4.81±0.035	9.12±0.045 ^{ab}	11.28±0.086
Lac. Period	NS	NS	*	NS
1 (4-100 days)	2.48±0.0171	4.86±0.023	9.14±0.030 ^a	11.26±0.057
2 (101-200 days)	2.47±0.0225	4.79±0.030	9.02±0.040 ^b	11.13±0.074
3 (>200 days)	2.47±0.0250	4.86±0.034	9.12±0.044 ^{ab}	11.25±0.083
Breed x Season	NS	NS	NS	NS
Breed x Parity	NS	**	NS	NS
Season x Parity	NS	NS	NS	NS
Breed x Lac. Period	NS	NS	NS	NS
Overall	2.46±0.001	4.82±0.013	9.07±0.017	11.21±0.032

RH: Red-Holstein, SIM: Simmental, NS: Not significant, *: Significant for $P < 0.05$, **: Significant for $P < 0.01$, a,b,c: The difference between the groups with the same letter is insignificant for $P < 0.05$. A, B, C: The difference between the groups with the same letter is insignificant for $P < 0.01$.

Table 2. Means and standard errors of milk urea nitrogen (MUN), freezing point (FP), oleic acid (OA), beta-hydroksybutyric acid (BHBA), pH and somatic cell count (Log₁₀SCC)

Factor	n	MUN (mg/dL)	FP (°C)	OA (g/100 g)
Breed		NS	NS	NS
RH	94	12.07±0.200	-0.577±0.0012	0.258±0.0095
SIM	204	12.28±0.138	-0.579±0.0009	0.255±0.0065
Season		NS	NS	NS
Winter	100	12.07±0.206	-0.577±0.0013	0.257±0.0097
Summer	198	12.28±0.153	-0.579±0.0010	0.256±0.0072
Parity		NS	NS	NS
1	84	12.13±0.210	-0.581±0.0013	0.255±0.0099
2	63	11.84±0.232	-0.581±0.0015	0.251±0.0110
3	44	12.36±0.261	-0.576±0.0016	0.239±0.0123
4	31	12.28±0.363	-0.572±0.0023	0.296±0.0172
5+	76	12.70±0.249	-0.579±0.0016	0.243±0.0118
Lac. Period		NS	NS	NS
1 (4-100 days)	127	12.27±0.165	-0.578±0.0010	0.256±0.0078
2 (101-200 days)	72	12.07±0.217	-0.580±0.0014	0.261±0.0102
3 (>200 days)	99	12.19±0.241	-0.577±0.0015	0.252±0.0114
Breed x Season	298	NS	NS	NS
Breed x Parity	298	NS	*	NS
Season x Parity	298	NS	*	NS
Breed x Lac. Period	298	NS	NS	NS
Overall	298	12.26±0.093	-0.579±0.001	0.256±0.0044

Factor	BHBA (mmol/L)	pH	Log ₁₀ SCC	
			n	(SCC, cells/ml) #
Breed	NS	NS		NS
RH	0.284±0.0138	6.47±0.0064	66	5.417±0.0173 (261,216)
SIM	0.269±0.0093	6.48±0.0044	133	5.401±0.0118 (251,768)
Season	NS	NS		**
Winter	0.290±0.0138	6.47±0.0066	100	5.495±0.0168 ^{Aa} (312,608)
Summer	0.263±0.0103	6.48±0.0049	99	5.322±0.016 ^{Bb} (209,894)
Parity	NS	NS		NS
1	0.296±0.0142	6.48±0.0068	53	5.423±0.0176 (264,850)
2	0.277±0.0157	6.47±0.0075	40	5.414±0.0194 (259,418)
3	0.272±0.0176	6.47±0.0084	34	5.425±0.0236 (266,073)
4	0.254±0.0245	6.47±0.0117	20	5.361±0.0310 (229,615)
5+	0.284±0.0168	6.47±0.0080	52	5.420±0.0214 (263,027)
Lac. Period	NS	NS		NS
1 (4-100 days)	0.273±0.0111	6.48±0.0053	95	5.413±0.0145 (258,821)
2 (101-200 days)	0.266±0.0146	6.48±0.0070	52	5.399±0.0196 (250,611)
3 (>200 days)	0.291±0.0162	6.46±0.0077	52	5.414±0.0238 (259,418)
Breed x Season	NS	NS	199	**
Breed x Parity	NS	NS	199	NS
Season x Parity	NS	NS	199	**
Breed x Lac. Period	NS	NS	199	NS
Overall	0.273±0.0062	6.48±0.003	199	5.406±0.0108

RH: Red-Holstein, SIM: Simmental, NS: Not significant, *: Significant for P<0.05, **: Significant for P<0.01, #: Back-transformed SCC value. a,b: The difference between the groups with the same letter is insignificant for P<0.05. A, B: The difference between the groups with the same letter is insignificant for P<0.01.

Other substances found in milk are MUN, OA, BHBA and other traits focused on FP and pH averages are given in Table 2. The overall means of MUN, FP, OA, BHBA and pH are 12.26 ± 0.093 mg / dL, -0.579 ± 0.001°C, 0.256 ± 0.0044 g / 100 g, 0.273 ± 0.0062 mmol / L and 6.48 ± 0.003, respectively. The effects of all factors on MUN are found to be statistically not significant (P>0.05). The mean MUN of the RH and SIM breeds were 12.07 ± 0.200 mg / dl and 12.28 ± 0.138 mg / dl, respectively. Considering that

MUN in raw milk is 7-12 mg / dl in dairy cattle, the average of MUN obtained for RH and SIM breeds were not higher than MUN upper value reported by Anonymous (2019b) and Taytak (2019) for dairy cattle. From here, it can be said that the energy-protein balance of the diet given to the cows in this enterprise is appropriate.

In this study, FP, OA, BHBA and pH of the milk were also analyzed. For all of these traits, only the breed x parity and season x parity interaction effects on FP were

significant ($P < 0.05$), the effects of other factors were not significant ($P > 0.05$). The mean FP was calculated as $-0.577 \pm 0.0012^{\circ}\text{C}$ and $-0.579 \pm 0.0009^{\circ}\text{C}$, respectively for RH and SIM breeds. The overall mean of FP obtained in this study ($-0.579 \pm 0.001^{\circ}\text{C}$) was lower than the average reported by Yörükoğlu (2019). The averages of FP obtained for RH and SIM breeds in this study were lower than the average of FP reported for normal raw cattle milk, which can be explained as lower the freezing point in the milk (Anonymous, 2019a).

The differences between breeds used in this study in terms of OA and BHBA in milk are also not significant ($P > 0.05$). The averages of OA in the milk of RH and SIM breeds were calculated as $0.258 \pm 0.0095 \text{ g} / 100 \text{ g}$ and $0.255 \pm 0.0065 \text{ g} / 100 \text{ g}$, respectively.

BHBA averages of the breeds were $0.284 \pm 0.0138 \text{ mmol} / \text{L}$ and $0.269 \pm 0.0065 \text{ mmol} / \text{L}$, respectively. In this study, the BHBA averages in the milk of RH and SIM breeds were higher than those reported by Taytak (2019) who reported MUN values for dairy cattle.

None of the factors had statistically significant effects on pH of the milk. The pH averages in RH and SIM breeds were calculated as 6.74 ± 0.0064 and 6.48 ± 0.0044 , respectively. In this study, pH average for RH was found to be quite close to the pH value (6.6-6.8) that the cattle raw milk should have (Anonymous, 2019b), while pH average for SIM breed was lower than this limit. It can be said that when RH and SIM breeds are considered to be close to one of each other for the means of MCC and SCC, this low pH value found for SIM breed could be due to the presence of more phosphoric and stearic anions in the milk, because the acidic feature of the fresh milk is reported that 54-59% is caused by phosphates, 8-15% is from carbon dioxide, 8% is from album and 8% is from citrates (Anonymous, 2019b). In this study, the overall average for pH (6.48 ± 0.003) is lower than the value reported by Yörükoğlu (2019).

Somatic cell count (SCC)

The effects of season ($P < 0.01$), breed x season ($P < 0.01$) and season x parity ($P < 0.01$) interaction effects on $\text{Log}_{10}\text{SCC}$ were statistically significant, and breed, parity, lactation period, breed x parity and breed x lactation period interaction effects were not significant ($P > 0.05$). $\text{Log}_{10}\text{SCC}$ averages of RH and SIM breeds were 5.417 ± 0.0173 (261216 cells / ml) and 5.401 ± 0.0118 (251768 cells / ml), respectively.

The mean SCC in the milk samples taken during the winter and summer seasons of cows in the lactation in the enterprise was calculated as 5.495 ± 0.0168 (312508 cells / ml) and 5.322 ± 0.0161 (209894 cells / ml), respectively, and the difference between the seasons was significant ($P < 0.01$). Due to the high correlation with mastitis, the level of SCC in the milk samples taken in the summer, or in other words, lower than the winter season, due to the fact that the precipitation in the region is generally intense in the winter and accordingly, it can be said that due to the milk sample taken in the rainy period, the number of animals that caught mastitis were high.

In this study, if the overall mean of SCC (5.406 ± 0.0108) is transformed backwards, 254683 cells / ml are found and this average is lower than the average reported by Yörükoğlu (2019). The average of SCC (251768 cells /

ml) obtained for SIM breed was compared with the studies reported in other breeds since there was no previous study on SIM breed in our country. The average of SCC belonging to the SIM breed is lower than the averages of SCC reported for HF breed by Koç (2006; 2007a).

In addition, Koç et al. (2009) reported lower averages in some dairy farms in Aydın than the average found in his study and the overall mean of SCC found in this study is higher than the average of SCC reported by Koç (2007a) for MB and for HF and MB breeds by Koç (2011).

The average of SCC (261216 cells / ml) found in this study for RH breed is higher than results of Yılmaz (2010) for the same breed, Koç (2011) for HF and MB breeds and Koç (2015) for RH. The overall mean found in this study is lower than the averages reported by raw milk quality and influencing factors in some dairy farm in Aydın (Koç et al., 2009) and HF breed reported by Koç (2006), and HF by Koç (2007a).

Conclusion

This study was focused on milk quality characteristics of RH and SIM breeds preferred as alternatives to HF in Turkey in recent years. There were not much significant differences in milk quality characteristics between the breeds used in this study. It can also be said that both breeds also have low SCC values, which leads to the preference of RH and / or SIM breeds rather than the HF breed, which is more likely to have diseases such as mastitis. In the farm where this study was carried out, the high performances of SIM and RH breeds in almost all features show that environmental factors such as maintenance-feeding-housing-herd management offered to the animals in the enterprise are also quite good. The breeds showed that this high performance makes them possible because the owner of the farm is a veterinarian and it may also be linked to the availability of a full-time veterinary health technician working in the enterprise. It can be said that the traits such as MCC, OA, BHBA and MUN, which are among the traits in this study, will come out as more features that will be emphasized in the future. In this sense, it can be said that these traits will make important contributions to determine the quality of the milk produced with more practical analysis methods.

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