THE COLOSTRUM QUALITY AND COMPOSITION OF SIMMENTAL AND BROWN SWISS HEIFERS

A QUALIDADE E A COMPOSIÇÃO DO COLOSTRO DE NOVILHAS SIMENTAL E DE PARDO SUIÇO

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ABSTRACT: The present study was conducted to determine the quality and composition of colostrum samples obtained from Simmental and Brown Swiss heifers on a Turkish dairy farm in Ödemiş, İzmir. The average volume of colostrum obtained from Simmental and Brown Swiss heifers at the first milking was 3.4 L and 3.8 L, respectively. Average colostrometer (Ig) and Brix values were determined as 105.1 mg/mL and 104.9 mg/mL, 29.97 % and 29.68 % of the samples (P>0.05). No significant differences were observed between colostrums' chemical compositions—including total solids, total protein, solids-not-fat, somatic cell counts (SCC), total bacterial counts (TBC), and energy values of the breeds - except for lactose concentration (P<0.05). The means of TBC were 781,000 and 634,000 CFU/mL for Simmental and Brown Swiss, respectively. The correlations between colostrometer and Brix values in Simmentals and Browns Swiss were 0.85 and 0.81, respectively (P<0.01). On the other hand, the correlations between Log_{10}SCC and Log_{10}TBC in both breeds were found to be 0.66 and 0.65 (P<0.05), respectively. According to the results of the present study, the fat, protein, lactose, and total solid concentrations of both Simmental and Brown Swiss (dual-purpose breeds) were higher than the values reported for Holstein dairy breeds. Although colostrum quality of both breeds was found to be good in terms of Ig concentration, their total bacterial counts were high. Bacterial counts can be reduced with adequate hygiene practices and good colostrum management.

KEYWORDS: Brix refractometer. Colostrometer. Somatic cell counts. Cattle.

INTRODUCTION

The placenta is an organ that connects the developing calf fetus to the uterine wall to allow nutrient uptake, waste elimination, and gas exchange via the mother's blood supply. However, it does not allow the transfer of the antibody immunoglobulin (Ig) (LANG, 2008). Therefore, calves are born with minimal immunological defense against environmental pathogens. Calves must ensure their passive immunity by consuming colostrum as soon as possible after their birth. Colostrum is a form of milk produced by the mammary glands in late pregnancy. The consumption of high-quality colostrum could reduce mortality, strengthen immunity, and increase livability of calves (QUIGLEY; DREWRY, 1998). Colostrum quality is affected by many factors such as breed, age of the dam, parity, volume of colostrum, exposure to pathogenesis, calving season, dry cow nutrition, feeding before calving, dystocia, live weight of the dam, and vaccinations before calving (QUIGLY, 1997; QUIGLY; DREWY, 1998; WATERMAN, 1998; ARTHINGTON, 1999; EARLY; FALLON, 1999; MORIN et al., 2001; KEHOE et al., 2007). The indicators of colostrum quality are concentration of IgG, an immunoglobulin type which is composed of 85-90% of immunoglobulins, and total bacterial counts (TBC) (HEINRICHS; JONES, 2003; LANG, 2008). A high-quality colostrum should contain at least 50 mg/mL of Ig (GULLIKSEN et al., 2008). TBC should be less than 100,000 colony-forming units (CFU) per mL (McGUIRK; COLLINS, 2004; HEINRICHS; JONES, 2011).

In addition to increasing immunity, colostrum is also important as the first source of nutrients (protein, fat, carbohydrates, vitamin and minerals) for the calf after birth (QUIGLEY, 1997; DAVIS; DRACKLEY, 1998). A very limited number of studies examine colostrum composition of cows (KEHOE et al., 2007); most of the studies presented in the literature on colostrum quality and composition were performed with Holsteins (KEHOE et al., 2007; FERDOWSI Nia et al., 2010; KEHOE et al., 2011; YAYLAK et al., 2017). Few studies are available concerning colostrum of Simmental and Brown Swiss breeds. Along with Simmental, Brown Swiss breed heifers have also been imported to Turkey for dual purposes during the last decade. This study was conducted to determine some quality parameters and the composition of colostrum samples obtained from

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Brown Swiss and Simmental heifers on a Turkish dairy farm.

MATERIAL AND METHODS

The Simmental and Brown Swiss cattle breeds were reared on a Turkish dairy farm in the Ödemiş district in the Izmir province. The climate of Izmir is classified as Mediterranean by Köppen and Geiger (ANONYMOUS, 2017). Summers are hot and dry, and winters are mild and rainy. The average temperature is 16.7 °C, and the average rainfall is 687 mm in a year. Between July 2011 and October 2011, the dates in which the present study was conducted, the average monthly temperature was between 17.1 ºC and 28.9 ºC (degrees Celsius), while average monthly relative humidity fluctuated between 40.2 % and 56.6 % (İZMİR REGIONAL DIRECTORATE OF METEOROLOGY, 2011). Since the climatic conditions are suitable for shed type housing, this system is common in the region (YAYLAK et al., 2015). All heifers in our study were housed in a loose housing system without free stall and shed type. This study used colostrum samples obtained from 24 Simmental and 28 Brown Swiss heifers after parturition. Parturitions took place between July 2011 and October 2011. About 30-40 days before parturition, heifers were fed a total mix ration, which contained 10-15 kg corn silage, 8-10 kg triticale silage, 3-4 kg alfalfa hay, 2-3 kg hay, and 1 kg mixed feed per animal per day. Towards the end of pregnancy, the amount of mixed feed was increased, and approximately one week before calving, heifers were fed with 4-5 kg mixed feed.

The cows' udders were fully milked out mechanically in the 40-50 minutes after calving. The volume of colostrum after milking was measured. The colostrum samples for Ig were placed in 250 mL containers. Samples for microbiological and compositional analysis were collected into 50-mL sterile falcon tubes. To determine the concentration of total Ig, colostrometer (Biogenics, USA) and optical Brix refractometer (Atago Co. Ltd., Japan) measurements were performed on fresh colostrum samples according to the manufacturer's instructions. The colostrometer (Ig) values were classified as: the first grade (green zone) for >50 mg/mL of Ig; the second grade (yellow zone) for 20-50 mg/mL of Ig, and the third grade (red zone) for <20 mg/mL of Ig (HEINRICHS; JONES, 2011).

Colostrum samples were stored at -20ºC until microbiological and compositional analyses were performed. Total solid, fat, protein, lactose, and solids-not-fat contents were determined by using mid-infrared spectrometry (BENTLY 150). TBCs and SCCs were determined by using flow cytometry (BENTLEY BACTOCOUNT IBC–m) (Bentley, USA) in the laboratory of Ödemiş Milk Producers Association. The BactoCount IBC-M is a semi-automated instrument that uses a proprietary process based on flow cytometry for the rapid and highly accurate enumeration of individual bacteria and somatic cells in raw milk. The energy values of colostrum samples were calculated using the formula (Energy (kcal/lb) = 41.84 (%fat) + 22.29 (%SNF) - 25.58) (TYRRELL; REID, 1965). The values were expressed as kcal/kg. The SCCs and TBCs were tested for normality by the Kolmogorov-Smirnov test. These data showed non-parametric distribution and were transformed logarithmically. Pearson correlation coefficients among colostrums' quality and composition traits were calculated. Comparisons between cattle breeds were performed using an independent–samples t-test. This test compares the means between two unrelated groups with regard to the same dependent variable. Data were analyzed by using the SPSS (1999) statistical software.

RESULTS AND DISCUSSION

Colostrum quality

The averages and standard errors of the volume of the first milking colostrum, Ig, SCC, and TBC values of Simmental (n=24) and Brown Swiss (n=28) heifers are showed in Table 1. No significant differences were observed between the investigated parameters of the breeds. Volume of the first colostrum milked from Simmental and Brown Swiss heifers were 3.4 and 3.8 L, respectively. The similar amounts (3.3 kg) of the first colostrum of Holstein cows were reported by Levieux and Ollier (1999), but lower amounts were reported (0.9 kg) for Romanian Black and White cows by Cziszter et al. (2008). On the other hand, Kehoe et al. (2011) reported the amount of the first colostrum of Holstein cows at a different parity, ranging from 6.1 to 6.8 L.

The immunoglobulin concentration and the TBC of the colostrum are indicators of colostrum quality (HEINRICHS; JONES, 2011). The average and standard errors of Ig level and Brix values of Simmental and Brown Swiss breeds were 105.1 and 104.9 mg/mL, 29.97 and 29.68%, respectively (Table 1). The mean Ig concentration of samples collected from Brown Swiss and Simmental heifers was greater than that reported by Jezek et al. (2012) (88.11 g/L) and Cziszter et al. (2008) (34.48

mg/mL). With the colostrometer and Brix refractometer, Doepel and Bartier (2014) measured values of the samples from the first milking colostrum or colostrum replacer supplied to calves and reported lower values (82.3 mg/mL and 24.3%) than the present study. Present findings were also higher than the values (Brix values of 23.8-26.3%) reported by Bielmann et al. (2010), Quigley et al. (2013), and Yaylak et al. (2017). Average Ig concentrations (colostrometer values) of both breeds were over 100 mg/mL, and average Brix values were nearly 30 % According to international standards, quality colostrum should contain at least 50 mg IgG/ml (GULLIKSEN et al., 2008). In general, a Brix value of 21-22% corresponds to 50 mg IgG/mL (BIELMANN et al., 2010; QUIGLEY et al., 2013). Therefore, any colostrum with a Brix value of 21-22% or greater can be considered as good-quality colostrum for newborn calves. In the present study, the concentration of Ig in the colostrums of most heifers was adequate (> 50 mg/mL). Only 2 Brown Swiss heifers (7% of the Brown Swiss sample) had Ig concentrations or Brix values lower than the threshold values. Low-quality colostrum ratios were reported as 57.8% by Gulliksen et al. (2008); 14% by Doepel & Bartier (2014) and 29% by Morrill et al. (2012).

Table 1. Some descriptive statistics for the volume of first colostrum, Ig, Brix, SCC[1] and TBC[2] of Simmental and Brown Swiss heifers.

	Simmental (n=24)				Brown Swiss (n=28)			
Traits	$\bar{X}\pm S_{\bar{x}}$	Min	Max	CV[3]	$\bar{X}\pm S_{\bar{x}}$	Min	Max	CV
Volume of the first colostrum, L	3.4±0.32	1	7	44.2	3.8±0.38	0.7	9	51.4
Ig, mg/mL (colostrometer value)	105.1±4.16	63	135	19.0	104.9±5.14	30	150	25.9
Brix, %	29.97±0.730	23	35.6	11.9	29.68±0.906	19.3	39.2	16.1
SCC (x1000), cell/mL	895±267	134	5165	146.2	917±189	42	5165	109.2
Log $_{10}$SCC	5.73±0.080	5.13	6.71	6.8	5.76±0.083	4.62	6.61	7.7
TBC (x1000), CFU/mL	781 ±188	51	3834	118.1	634±134	51	2903	111.8
Log$_{10}$TBC	5.67±0.093	4.71	6.58	8.1	5.56±0.092	4.71	6.46	8.8

[1]Somatic cell count, [2]Total bacteria count, [3]Coefficient of variation

In general, colostrum qualities of Simmental and Brown Swiss heifers of the present study were higher than those reported in many previous studies (HEINRICHS; JONES, 2011; KEHOE et al., 2011; MORRILL et al., 2012; CONNEELY et al., 2013). The breed is an important factor affecting the Ig concentration. The Brown Swiss (6.6%) have higher Ig concentration in colostrums than the Holstein (5.6%) (MULLER; ELLINGER, 1981). In terms of milk production, breeds or cows with genetically higher potential such as Holstein have rapid milk synthesis after calving (HEINRICHS; JONES, 2011). The dual-purposes breeds used in this study have considerably lower milk yield than the Holstein dairy breed. Since the increase in colostrum volume induces the dilution effect, the quality of colostrums become poor. In the present study, the average calving-to-colostrum milking interval was 40-50 min and was shorter than some previous researches (PRITCHETT et al., 1991; KEHOE et al., 2007). Delays in the first milking increase milk synthesis, dilute the milk, and ultimately reduce IgG concentration (MOORE et al., 2005; GULLIKSEN et al., 2008). Morin et al. (2010) have reported that the IgG concentration in colostrums decreases by 3.7% per hour after birth. In general, the colostrum quality of heifers is relatively low. Multiparous cows produce higher amounts of Ig compounds, due to longer exposure to pathogens (MULLER; ELLINGER, 1981; PRITCHETT et al., 1991). Modern heifer management practices, such as greater attention to feeding, affect colostrum quality (HEINRICHS; JONES, 2011). In addition, calving season also influences Ig levels. Nardone et al. (1997) reported that Ig production decreases in warm seasons, and Gulliksen et al. (2008) reported higher quality colostrum for dairy cows calved between August and October in Norway. Calving occurred between July and October in our study.

There was no difference between Simmental and Brown Swiss SCCs (917,000 vs 895,000; P>0.05) (Table 1). Colostrum in general is rich in immune cells, and the SCC of colostrum is usually much higher than that of normal milk (QUIGLEY, 2010). The upper limit for quality milk is <200,000 SCC/mL (KEHOE et al., 2007). SCC decreases gradually during milking. In a study conducted by Cziszter et al. (2008), SCCs that were more than 1.5 million in the first colostrum gradually dropped to 616,575 cells/mL in the second milking, and then to 212,506 cells/mL on the seventh day. Mastitis infections may also influence colostrum quality (MORRILL et al., 2012). The SCC in the colostrum may be related to mammary gland infections or mastitis (CZISZTER et al., 2008; FERDOWSI NIA et al., 2010). Lower SCCs are also observed at low environmental temperatures (YAYLAK et al., 2017). The present study was done from July to October, and during first two months (July and August) temperatures were high. SCCs obtained during this study were lower than those of Ferdowsi Nia et al. (2010) and Morrill et al. (2012) but higher than those of Yaylak et al. (2017) for Holsteins.

Average TBCs obtained in this study (634,000-781,000 CFU/mL) were 6-8 times higher than the specified upper limit of 100,000 CFU/mL (McGUIRK; COLLINS, 2004; HEINRICHS; JONES, 2011). About 87% of the samples had bacteria counts over the critical value (<100,000 CFU/mL). Poulsen et al. (2002) also reported excessive TBCs (about 82% of samples had bacteria counts over standard threshold value of 100,000 CFU/mL). However, Stewart et al. (2005) reported significantly lower bacterial counts (<100,000 CFU/mL) in samples collected directly from the udder. Log_{10}TBCs (5.67 and 5.56 CFU/mL) determined during the present study were higher than the values reported by Stewart et al. (2005) for samples taken after milking (1.44 CFU/mL), samples taken from floor buckets (4.66 CFU/mL), and samples from esophageal feeders (4.99 CFU/mL). Current findings are lower than the average values reported by Houser et al. (2008) (1 million CFU/mL) but higher than the values reported by Morrill et al. (2012) (Log_{10}TPC 4.9), and Cziszter et al. (2008) (46,834 CFU/mL). The TBC was high in colostrum and showed time-dependent decrease upon milking, as with SCC (CZISZTER et al., 2008). Bacteria in colostrum have a negative impact on IgG absorption and may cause pathogen-induced diseases like diarrhea (DOEPEL; BARTIER, 2014). The number of bacteria in colostrum is the indicator of barn hygiene, healthiness, and contamination (CONRAD et al., 2011). Colostrum management practices may also result in higher bacterial counts (STEWART et al., 2005; CONRAD et al., 2011). Storage temperatures and longer durations between sampling and analysis may result in such higher bacterial counts. Clean and dry conditions, proper udder preparation, and adequate sanitation of equipment can help to prevent bacteria and other microorganism contaminations in dairy facilities (STEWART et al., 2005; MORRILL et al., 2012).

Colostrum composition

The major nutrients of colostrum from Simmental and Brown Swiss heifers were total solids, fat, protein, lactose, and solids-non-fat, as presented in Table 2. In this study, no significant differences were observed between the colostrum composition traits of the breeds. However, lactose concentration of Simmental heifers was higher than that of Brown Swiss heifers (3.21% vs 3.05%) (P<0.05). The present findings of fat, protein, lactose, and total solids concentrations of both breeds were higher than the values reported by previous researchers (PARRISH et al., 1950; FOLEY; OTTERBY, 1978; KEHOE; et al., 2007; MORRILL et al., 2012; YAYLAK et al., 2017) for Holstein cows for fat (4.5-6.89%), protein (11.1-14.9%), lactose (1.7-3.0%), and total solids (18.7-27.6%).

Table 2. Some descriptive statistics for the colostrum compositions and energy values of Simmental and Brown Swiss heifers

	Simmental (n=24)				Brown Swiss (n=28)			
Traits	$\bar{X} \pm S_{\bar{x}}$	Min	Max	CV[1]	$\bar{X} \pm S_{\bar{x}}$	Min	Max	CV
Total solids, %	27.92±0.441	22.71	30.44	7.7	27.74±0.396	22.55	31.38	7.5
Fat, %	8.50±0.597	3.53	17.05	34.4	8.53±0.489	4.14	16.71	30.3
Total protein, %	16.72±16.62	12.51	18.79	12.0	16.62±0.450	10.28	19.43	14.5
True protein, %	16.41±0.402	12.23	18.45	11.9	16.31±0.446	10.03	19.10	14.3
Lactose, % *	3.21±0.050	2.94	3.73	7.6	3.05±0.040	2.46	3.44	6.9
Solids-not-fat, %	19.42±0.481	12.49	22.53	12.1	19.20±0.506	11.91	22.73	13.9
Energy, kcal/kg	1682±43	1211	2130	12.4	1675±33	1158	2111	12

* P<0.05 indicates significant differences between the breeds. [1]Coefficient of variation

The present findings were lower than the values reported by Parrish et al. (1950) for total solids (30.4%), solids-not-fat (23.0%), and total protein (20.0%) of Guernsey cows, and the values for milk fat (11.6%), protein (17.7%), and total solids (32.1%) for Romanian Black and White cows (CZISZTER et al., 2008). Kovacs (2000) reported higher protein (22.4%), lactose (4.37%), and total solids (32.4%) for the first colostrum milked after calving of Hungarian Grey Cattle, but lower fat (4.5%) concentrations than the values of the present study. Since the Hungarian Grey Cattle are mostly raised for beef, they may have had higher values. Nutrients such as fat and protein in colostrum are important for energy, growth, and development of calves (QUIGLEY; DREWRY, 1998). The lactose concentration (3.21%) in colostrums of Simmental heifers was higher as compared to the other researchers' reports (PARRISH et al., 1950; FOLEY; OTTERBY, 1978; KEHOE et al., 2007; MORRILL et al., 2012). The lactose concentration in colostrum is lower than that in whole milk. Claeys et al. (2014) stated that average lactose concentration of cows' milk varies between 4.4% and 5.6%. Higher lactose concentration in colostrum increases diarrhea, because digestion of lactose is quite difficult for newborn calves (LANG, 2008).

Among the compositional parameters, the greatest variation was observed in fat (30.3-34.4%) and the least variation in lactose (6.9-7.6%). Similarly, Parrish et al. (1950) and Mechor et al. (1992) also reported greatest variations in fat concentrations. Coefficients of variation reported by Mechor et al. (1992) for total solids (19.3%), total protein (27.2%), IgG (35.7%), and fat (46.5%) were higher than the values of the present study. In that study, the high variation coefficients could be due to the fact that the analyses were carried out on the colostrum samples obtained within the first 24 hours; however, in our study the colostrums were milked within about 1 hour after calving. Energy content of the colostrum is generally 1.5-2.2 times higher than normal milk (PARRISH et al., 1950). Blum and Hammon (2000) measured the gross energy values of colostrum as 6 Mj/L by using bomb calorimetry, and this value was lower than our colostrum energy values (6.9-7.0 Mj/kg).

Correlations among colostrum traits

The correlation coefficients among colostrum traits of Simmental and Brown Swiss heifers are provided in Tables 3 and 4, respectively. Medium- and high-level correlations were observed among the experimental parameters of the present study. For instance, significant correlations were observed between total solids and total protein (r=0.53-0.65, P<0.01), and between total protein and solids-not-fat (r=0.92-0.96, P<0.01), of Simmental and Brown Swiss heifers. Since immunoglobulin has a protein structure, a high correlation was observed between Ig and total protein (r=0.81-0.74, P<0.01). Quigley et al. (1994) also reported a similar correlation between these two parameters (r=0.83). The correlation coefficients among colostrum parameters of both breeds were similar to each other and in the same direction.

Table 3. Correlations among the colostrum volume, composition, Log_{10}SCC, Log_{10}TBC, and energy values of Simmental heifers

Traits	Ig, mg/mL	Brix, %	T. solid, %	Fat, %	T. protein, %	Lactose, %	Solids not fat, %	Log_{10}SCC	Log_{10}TBC	Energy Kcal/kg
First milking colostrum volume, L	-0.47*	-0.45*	-0.14	0.29	-0.45*	-0.10	-0.49*	0.32	0.09	0.10
Ig, mg/mL		0.85**	0.46*	-0.24	0.81**	-0.28	0.73**	-0.34	-0.36	0.09
Brix, %			0.74**	-0.01	0.89**	-0.54**	0.69*	-0.23	-0.30	0.37
Total solids,				0.61**	0.53**	-0.57**	0.16	-0.01	0.05	0.88**
Fat, %					-0.35	-0.21	-0.69**	0.21	0.28	0.91**
Total protein, %						-0.51*	0.92**	-0.23	-0.27	0.06
Lactose, %							-0.26	-0.20	-0.04	-0.42*
Solids-not -fat, %								-0.27	-0.30	-0.33
Log_{10}SCC									0.66**	0.12
Log_{10}TBC										0.20

* P<0.05, ** P<0.01.

The correlation coefficient in the present study between volume of the first milking colostrum and Ig for Brown Swiss and Simmental breeds were found to be -0.33 (P>0.05) and -0.47 (P<0.01), respectively. Quigley et al. (1994) reported the correlation between IgG and colostrum volume as -0.19 and Pritchett et al. (1991) reported the correlation between IgG_1 and weight of the first milking as -0.29. A one-kilogram increase in the first milking colostrum resulted in a 1.7-fold decrease in IgG concentration (CONNEELY et al., 2013). The negative relationship between colostrum volume or weight and Ig could be due to the dilution effect (PRITCHETT et al., 1991).

Table 4. Correlations among the colostrum volume, composition, $Log_{10}SCC$, $Log_{10}TBC$, and energy values of Brown Swiss heifers

Traits	Ig, mg/mL	Brix, %	T. solid, %	Fat, %	T. protein, %	Lactose, %	Solids not fat, %	$Log_{10}SCC$	$Log_{10}TBC$	Energy Kcal/kg
First milking colostrum volume, L	-0.33	-0.34	0.10	0.33	-0.16	-0.19	-0.24	0.04	-0.07	0.26
Ig, mg/mL		0.81^{**}	0.54^{**}	-0.27	0.74^{**}	-0.18	0.68^{**}	-0.11	-0.11	0.15
Brix, %			0.62^{**}	0.07	0.55^{**}	-0.10	0.42^{*}	0.03	0.06	0.40^{*}
Total solids, %				0.36	0.65^{**}	-0.17	0.43^{*}	0.08	0.05	0.81^{**}
Fat, %					-0.47^{*}	0.24	-0.68^{**}	-0.02	0.12	0.84^{**}
Total protein, %						-0.41^{*}	0.96^{**}	0.09	-0.04	0.08
Lactose, %							-0.36	0.17	-0.01	0.05
Solids-not-fat, %								0.08	-0.08	-0.18
$Log_{10}SCC$									0.65^{**}	0.01
$Log_{10}TBC$										0.10

$^{*}P<0.05$, $^{**}P<0.01$

Furthermore, in both breeds, the correlation coefficient between Ig and Brix value (r=0.85-0.81), between Ig and total solids (r=0.46-0.54), between Ig and total protein (r=0.81-0.74), and between Ig and solids-not-fat (r=0.73-0.68) were found to be significant (P<0.01). Bartier et al. (2013) reported the correlation coefficient of the colostrometer with radial immunodiffusion and the Brix refractometer as 0.77 and 0.62, respectively. As shown in Tables 3 and 4, the correlations between these two methods (r=0.81-0.85, P<0.01) were quite high; thus, both the colostrometer and the Brix refractometer were found to be sufficient and reliable for indirect measurement of colostrum Ig content. However, the colostrometer is a fragile glass instrument, and results may not be reliable when either refrigerated or warm colostrum is used during quality tests (MECHOR et al., 1992). The Brix refractometer can yield results with a couple of drops of colostrum and is not as sensitive as the colostrometer to the variations in colostrum temperature (BARTIER et al., 2013). This makes it practical to use in farms (BIELMAN et al., 2010).

Mechor et al. (1992) reported lower correlation between IgG and total solids (r=0.36) than the present study (r=0.46-0.54), and higher correlations of IgG with total protein and fat concentrations. No significant correlations were found among $Log_{10}SCC$ - $Log_{10}TBC$ and colostrum traits (composition and Ig) in this study. However, Gulliksen et al. (2008) reported higher SCC values in low quality colostrum. Kehoe et al. (2007) indicated higher nutrient quality for herds with low SCC (<200,000) values. Despite the lack of correlation between SCCs and colostrum composition in our study, Ferdowsi Nia et al. (2010) pointed out the relationships between high SCC levels and lower fat ratios of the colostrum.

Finally, in Simmental and Brown Swiss breeds, the correlation coefficients between $Log_{10}SCC$ and $Log_{10}TBC$ were found to be 0.66 and 0.65 (P<0.05), respectively. While the SCC reflects a response to contagious mastitis pathogens, bacteria counts can indicate a high level of environmental pathogens. Therefore, the SCC can be expected to increase with the increasing number of bacteria.

There were significant correlations between energy values and total solids (r=0.81-0.88), and between energy values and fat (r=0.84-0.91), of both breeds (P<0.01). The highest contribution to energy value was provided by fat and total solids (Tables 3 and 4). Tyrrell and Reid (1965) showed the relationship observed between the fat percentage and the gross energy value of Holstein milk.

CONCLUSIONS

The present study provides useful information to the literature about the composition and some of the quality parameters of colostrums from Brown Swiss and Simmental heifers. According to the results of this study, the fat, protein, lactose, and total solids concentrations of both Simmental and Brown Swiss breeds were higher than the values reported for Holstein cows.

No significant differences were observed between the investigated parameters of the breeds, except in lactose concentration. Most of the colostrum milked from Simmental and Brown Swiss heifers contained adequate levels of immunoglobulin; however, colostrums had high bacterial counts. Insufficient hygiene conditions, longer durations between sampling and analysis, and colostrum temperature may have led to such high bacterial counts. The quality of colostrums may be improved by proper herd management and hygiene practices. The Brix refractometer is recommended to determine colostrum quality parameters, since it is easy to use and is not influenced by the variations in colostrum temperature as much as the colostrometer is.

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RESUMO: O presente estudo foi realizado para determinar a qualidade e a composição das amostras de colostro obtidas de novilhas Simental e Pardo Suíço em uma fazenda leiteira turca em Ödemiş, İzmir. O volume médio de colostro obtido das novilhas Simental e Pardo Suíço na primeira ordenha foi de 3,4 L e 3,8 L, respectivamente. Os valores médios do colostrômetro (Ig) e de Brix foram determinados como sendo 105,1 mg/mL e 104,9 mg/mL, 29,97% e 29,68% das amostras ($P > 0,05$). Não foram observadas diferenças significativas entre as composições químicas do colostro, incluindo sólidos totais, proteína total, sólidos não gordurosos, contagens de células somáticas (SCC), contagens bacterianas totais (TBC) e valores energéticos das raças - exceto para a concentração de lactose ($P < 0,05$). As médias para as TBC foram de 781.000 e 634.000 CFU/mL para Simental e Pardo Suíço, respectivamente. As correlações entre os valores do colostrômetro e de Brix em Simental e Pardo Suíço foram de 0,85 e 0,81, respectivamente ($P < 0,01$). Por outro lado, as correlações entre Log10SCC e Log10TBC em ambas as raças foram de 0,66 e 0,65 ($P < 0,05$), respectivamente. De acordo com os resultados do presente estudo, as concentrações de gordura, proteína, lactose e sólidos totais das raças Simental e Pardo Suíço (raças de dupla aptidão) foram maiores do que os valores relatados para raças leiteiras de Holstein. Embora a qualidade do colostro de ambas as raças tenha sido boa em termos de concentração de Ig, sua contagem total de bactérias foi alta. As contagens bacterianas podem ser reduzidas com práticas de higiene adequadas e boa gestão do colostro.

PALAVRAS-CHAVE: Refratômetro Brix. Colostrômetro. Contagem de células somáticas. Gado.

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