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A Study on the Changes of Colostrum Quality, Milk Constituents and Somatic Cell Count after Calving in Holstein Friesian Cows

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ABSTRACT

Colostrum quality produced by dairy cows varies considerably. The amount of immune protein content in colostrum has also high specific gravity. In this study, the specific gravity of colostrum (SGC) produced by 32 Holstein-Friesian cows with different parities in the first five milking after calving, and additionally, the fat content (FC), non-fat dry matter content (NFDMC) and somatic cell count (SCC) in the milk samples taken in the first five milking and on the fifth and 10th day milking of lactation were determined. The effects of parity and milking order on SGC, FC, NFDMC and Log_{10}SCC were detected to be statistically significant. Parity x milking order interaction effect was found to be significant for SGC, FC and NFDMC, but its effect on Log_{10}SCC was insignificant. Cows with three and upper parities had higher SGC, FC, NFDMC, and Log_{10}SCC than cows in the first and second parities. While SGC (1055.09±1.20 mg/mL), FC (6.36±0.12%) and NFDMC (18.17±0.37%) obtained at the first milking decreased gradually in advancing milking, Log_{10}SCC (5.90±0.028) level increased. The correlation coefficients of SGC with FC, NFDMC, and Log_{10}SCC were low-medium, the coefficients between FC and NFDMC were moderately too high in the first three milking, and decreased and approached zero in advancing milking. It was observed that SGC remained high even in the fourth milking in some cows, especially in the third and higher parities. In conclusion, it has been revealed that not only colostrum obtained from the first milking, but also quality colostrum produced in subsequent milking can be used in calf feeding in dairy cattle farms. However, all this depends on the adoption of the strategy of determining the quality of colostrum with the help of a colostrometer in dairy cattle farms.

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Introduction

One of the most important losses in dairy cattle farms is calf deaths and the loss rate is accepted as one of the most important criteria in animal welfare (Uetake, 2013). While the calf mortality rate varies significantly according to the herds, it has been reported that the rate in Turkey is quite high, such as 15% (Karslı and Evci, 2018). In dairy cattle farms, the most critical period of intensive management, and also the costliest period of their life, is the period of milk feeding. In this period, the successful rearing of calves and the reduction of disease and mortality rates depend on understanding the growth, feeding, health and behaviour principles of calves and developing a calf rearing system in line with these principles (Doğan and Koç, 2014).

Bovine maternal antibodies do not cross the placenta during pregnancy and they are born agammaglobulinemic (Chase et al., 2008; Schombee, 2011). Chase et al. (2008) stated that newborns should receive immunoglobulins from their mothers' colostrum in order to provide passive immunity in the first weeks after birth, since the offspring cannot have the experience of developing adaptive immunity due to the protective environment of the placenta. It is stated that mistakes made regarding colostrum management have an important place among the causes of postpartum deaths (Geiger, 2020). It has been emphasized that colostrum absorption will decrease in newborns due to factors such as cold stress, premature birth, difficult birth or caesarean delivery (Chase et al., 2008).

Neonatal diseases and early mortality seen in calves at the beginning of their lives are mainly related to the low blood immunoglobulin (Ig) level and all these conditions are due to the poor and/or insufficient amount of colostrum fed to the calves within the first day post-partum (Schombee, 2011). Other factors affecting the immunity is defined by Blood et al. (2007) as the ability to recognize and destroy harmful substances in the body. Until its own active immune system develops, Ig's in colostrum are taken into the body and protected against diseases is called passive immunity. In the first weeks of their life, calves need to defend their bodies against diseases with the help of Ig taken from their mothers' colostrum in their first feedings.

Specific gravity (SG) is used as an indicator of colostrum quality (Morin et al., 1997) and Igs are known as large molecules. Igs are absorbed by special cells in the small intestine through a process known as pinocytosis. Schombee (2011) stated that these cells were replaced by basal nuclei without pinocytosis ability approximately 12 hours after birth, and added that for passive immunity, this Ig absorption must occur before the calf's intestines become impermeable to large Ig proteins.

The most important factors affecting passive transfer are postpartum colostrum uptake time, colostrum quality and amount of absorbed Ig. It is very important that calves receive colostrum as soon as possible after birth, as their capacity to absorb Ig is significantly reduced 24 hours after birth. Schombee (2011) pointed the factors related to the effectiveness of passive immunity acquired by the newborn calf as the time to start feeding the calf after birth, the amount of colostrum consumed by the calf in the first 24 hours, the quality of the colostrum consumed in the first feeding, and the degree of selectivity exerted by the epithelium of the small intestine. Poor quality colostrum with insufficient Ig concentration contributes to the failed transfer of passive immunity in calves and leads to higher calf morbidity and mortality (Drikic et al., 2018).

Calves start to produce their own immune proteins (immunoglobulins) when they are about 10 days old, and they reach normal Ig levels at the end of 8 weeks and reach the ability to produce at a sufficient level until 3-4 months old (Hopkins et al., 1984). Although the half-life of Ig's is as short as 21 days, it has been reported that the passive immunity that the calves gained by feeding quality colostrum after birth may affect the course of diseases to which they will be exposed until the age of 4-6 months (Robison et al., 1988).

It was emphasized that almost 30% of the dairy cattle colostrum being poor quality (Bartier et al., 2015) and this causes the failure of passive immunity in calves (Drikic et al., 2018). The quality of the colostrum is affected by many factors, such as breed, herd, farm management practices, parity or cow's age, season, stress, length of dry period, feeding, time period after giving birth, early calving, difficult calving, milking the cow before calving, milk leaking before calving, body condition score, mastitis, vaccinations etc. (Stelwagen et al., 2009; Schombee, 2011; Doğan and Koç, 2014; Hoyraz et al., 2014).

The quality of colostrum is evaluated according to the amount of Ig in a unit volume and Moran (2005) stated that a good quality colostrum contains more than 50 mg/ml of Ig. It has been reported that the IgG content of the consumed colostrum should be >50 mg/mL in dairy colostrum and 100 mg/mL in beef colostrum to ensure successful passive immunity transfer in calves (McGuirk and Collins, 2004). It was stated that the calves with successful passive immunity transfer and sufficient serum Ig levels will continue to grow normally in the first 6 months of their lives compared to those with insufficient serum Ig levels (Robison et al., 1988). In Holstein-Friesian (HF) cows, the average Ig content of colostrum was determined as 95.44±3.74 mg/mL by Doğan and Koç (2014) and 107.16±3.356 mg/mL by Hoyraz et al. (2014). In Simmental and Brown-Swiss cows Ig content were determined as 105.1 mg/mL and 104.9 mg/mL by Yaylak et al. (2018).

It has been stated that colostrum is rich in nutrients such as fat, protein, minerals, vitamins (Hoyraz et al., 2014; Yaylak et al., 2018), and was declared that it contains also high amounts of bioactive components such as growth factors, hormones, lactoferrin, lysozyme and lactoperoxidase (Schombee, 2011). Yaylak et al. (2018) determined the fat, protein, lactose, and non-fat dry matter content (NFDMC) in colostrum of Simmental and Brown Swiss cows and stated that the values obtained for these breeds were higher than that of HF cows.

The end of a dry period and start of lactation with the calving is a critical process. In various studies, the period in which mastitis events and somatic cell count (SCC) are highest is the first month of lactation (Deluyker et al., 1993; Nikodémusz et al., 1994; Santos et al., 2004; Sederevicius et al., 2006; Koç, 2008). This situation is related to the transition of the cow's udder tissue from a non-milk-producing state to a milk-secreting state (Sederevicius et al., 2006).

There are also somatic cells in colostrum. The increase in SCC in normal milk is associated with a decrease in milk yield and lactose percentage (Barlowska et al., 2009; Koç, 2015), which Forsbäck (2010) stated that lactose content in milk can be considered as a marker of mastitis. Since proteolytic enzymes secreted by somatic cells in milk cause partial breakdown of casein (Hurley, 2013), the amount of casein decreases while the amount of whey protein increases in milk with high SCC.

While there are many studies on the quality and composition of colostrum obtained in the first milking and also normal milk, there are not enough studies on the change of colostrum quality and composition and SCC in following milkings. It should be emphasized that the number of studies conducted both in Turkey and abroad on the level of colostrum SCC is not very large. Therefore, in this study, it was aimed to determine the specific gravity of the colostrum (colostrum quality), milk composition (fat and non-fat dry matter contents) and SCC in milk at the first five milking and at 5^{th} day and 10^{th} day of lactation in HF cows.

Materials and Method

This research was carried out in a HF herd in Aydın/Turkey. The specific gravity of colostrum (SGC, colostrum quality) was determined with a colostrometer (KRUUSE) in the milk samples taken from the first five milking of the cows calved between November 2020 and April 2021. Since three cows did not produce colostrum in the first milking after birth, the data of the milk obtained in the next milking of these cows were excluded from the statistical analysis, and analyses were made on the data of the remaining 29 cows.

In addition, fat content (FC, %), non-fat dry matter content (NFDMC, %) and SCC were determined in these milk samples and also the samples taken from the same cows on the 5^{th} and 10^{th} days. SGC was measured from the colostrum samples taken from the milking bucket after the cows were fully milked, and to determine FC, NFDMC and

SCC, about 50 ml milk samples were taken and frozen in the refrigerator until analysis.

SGC was determined in fresh milk at room temperature (20°C) and according to the measured value, the amount of globulin in the colostrum was determined by using the chart suggested by Schombee (2011), using the same brand of colostrometer. According to Schombee (2011), colostrum with a specific gravity less than 1.035 mg/mL contains globulin less than 21.80 mg/mL and is classified as poor quality. Colostrum with a specific gravity of 1.036-1.047 mg/mL contains globulin between 24.35-52.36 mg/mL and are classified as moderate quality and colostrum with a specific gravity higher than 1.048 mg/mL contains more than 54.91 mg/mL globulin and are classified as good quality colostrum.

NFDMC (%) was determined with a portable refractometer (FG-103 0-32% Brix), FC (%) was determined by Gerber method (EAS, 2006), and SCC levels in the same samples were determined according to Direct Microscopic Somatic Cell Counting method (IDF, 1995) in the Animal Breeding Laboratory of Adnan Menderes University Faculty of Agriculture, Department of Animal Science, Turkey.

Statistical Analysis

Before statistical analysis, SCC data were transformed into log (Ali and Shook, 1980). Colostrum quality, FC (%), NFDMC (%) and SCC data were analysed using the SAS (9.4) package program. Comparison of subgroups was made according to Tukey (P<0.05) and the following statistical model was used in the analysis of the traits:

$$Y_{ijk}= \mu + a_i + b_j + (ab)_{jj} + e_{ijk}$$

Y_{ijk}: Observation value of the traits
μ: Overall means of the traits
a_i: Effects of parity (i=1, 2 and 3+)
b_j: Effects of milking order (j= 1., 2., 3., 4., 5. milking, milking in the 5th day and milking in the 10th day of lactation)
$(ab)_{ij}$: Interaction effect of parity and milking order,
e_{ijk}: Random error.

Results

Changes in SGC (mg/mL), FC (%), NFDMC (%) and Log_{10}SCC obtained for HF cows according to parity and milking order are given in Table 1. The means of SGC, FC, NFDMC and Log_{10}SCC in the first milking were found to be 1055.09±1.20 mg/mL, 6.36±0.12%, 18.17±0.37% and 5.90±0.028, respectively. As parity and milking order effects on specific gravity, FC (%), NFDMC (%) and Log_{10}SCC were statistically significant (P<0.01), parity x milking order interaction effect was significant for SGC, FC and NFDMC (P>0.01).

In HF cows, as expected, in all parities SGC decreased as milking progressed after calving, as well as FC and NFDMC in milk. However, in contrast to these changes in milk components, SCC increased.

In this study, SGC obtained from 29 cows at the first milking and the quality ranged from 1.045 (47.27 mg/ml) to 1.070 (110.85 mg/ml), poor quality colostrum was not obtained at the first milking. Only three cows produced moderate quality of colostrum and others were of good quality at the first milking. In the second milking, SGC decreased as expected and as 18 cows still produced high quality colostrum, 9 cows' colostrum quality was moderate and two cows' colostrum quality was poor. In the third milking, 5 cows, in the fourth milking one cow still produced high quality colostrum.

SGC (ml/mL), FC (%), NFDMC (%) and Log_{10}SCC levels increased depending on the increase in parity, and the highest SGC, FC, NFDMC and Log_{10}SCC averages were obtained for 3+ parity. In terms of SGC, the 3+ parity was different from the first and the second parities (P<0.05). As all the parities were different for FC (P<0.05), for NFDMC and Log_{10}SCC, the first parity was different from the second and third parities (P<0.05).

The effects of milking order on all traits were determined to be statistically important (P<0.05). The highest SGC, FC and NFDMC means were obtained from the first milking, and as expected, SGC, FC and NFDMC showed a gradual decrease in subsequent milkings. However, an opposite situation was observed for Log_{10}SCC, the lowest average was determined for the first milking and as the milking order progressed, Log_{10}SCC increased, and the highest Log_{10}SCC mean obtained from the milk samples taken on the 10th day.

When the changes in SGC, FC, NFDMC and SCC values according to milking order were evaluated separately for each parity, it was determined that SGC, FC and NFDMC gradually decreased, while Log_{10}SCC increased gradually depending on the milking progress for all parities (Figures 1, 2, 3 and 4). At the same time, the decreases of SGC, FC and NFDMC for each parity are also statistically significant (P<0.05).

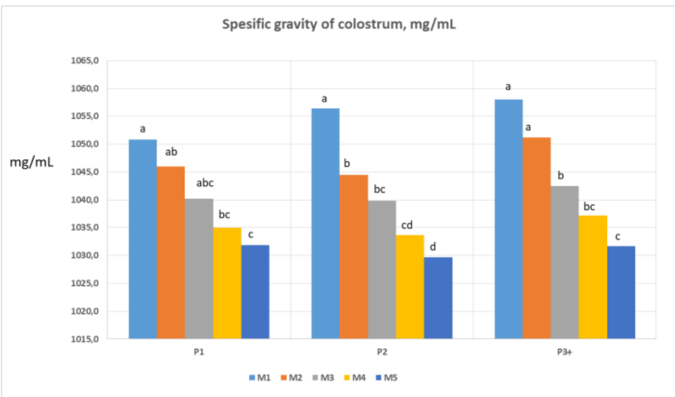

Figure 1. Changes of specific gravity of colostrum (SGC) depending on parity (P) and milking (M) order (a,b,c,d: difference between groups with different letter is significant according to P<0.05).

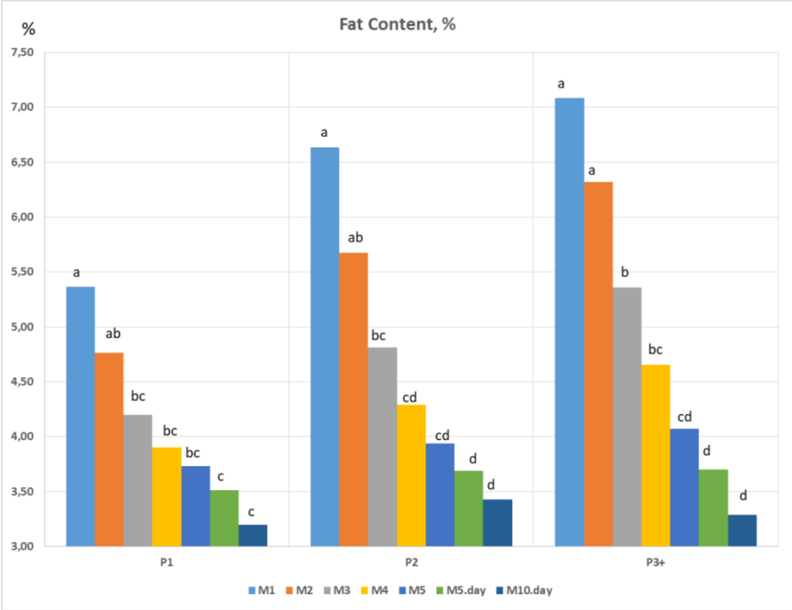

Figure 2. The changes of FC (%) according to parity (P) and milking (M) order (a,b,c,d: difference between groups with different letter is significant according to P<0.05).

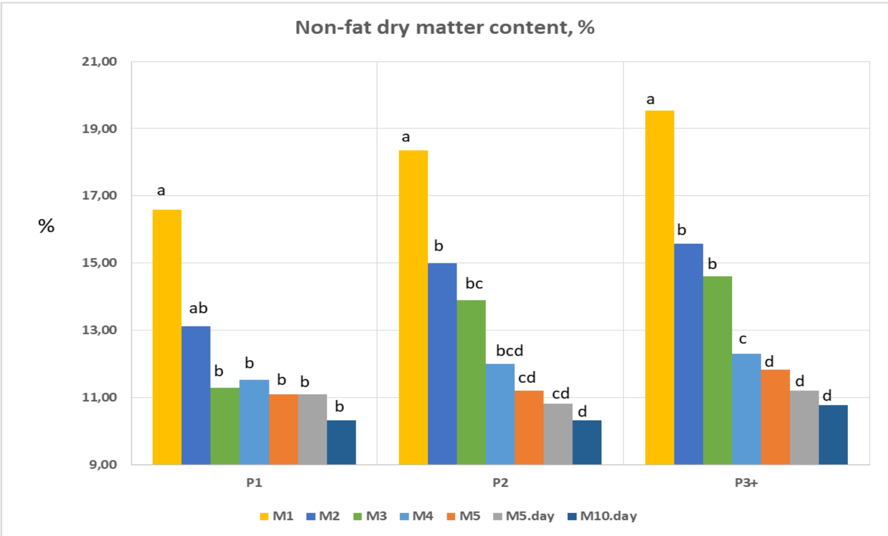

Figure 3. Changes of non-fat dry matter content (NFDMC, %) depending on parity (P) and milking (M) order (a,b,c,d: difference between groups with different letter is significant according to P<0.05).

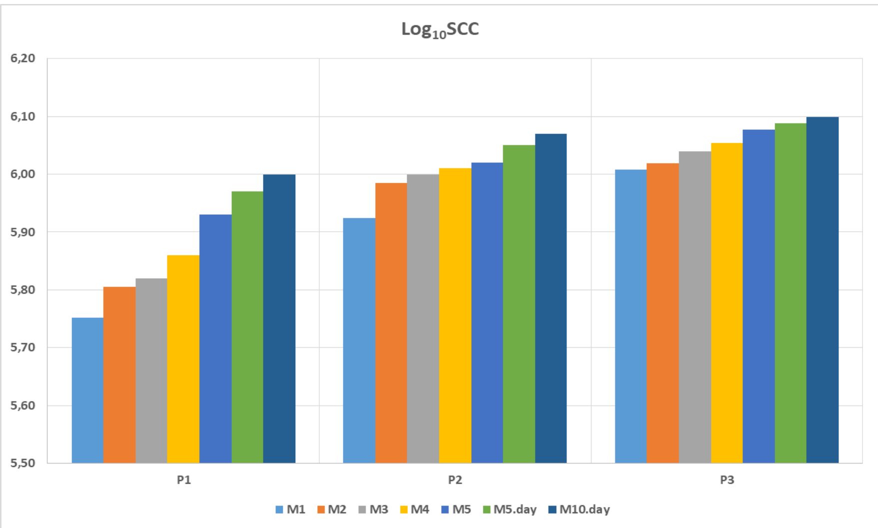

Figure 4. Changes of somatic cell count ($Log_{10}SCC$) depending on parity (P) and milking (M) order (P>0.05)

Table 1. Changes of specific gravity of colostrum (SGC, mg/mL), fat content (FC, %), non-fat dry matter content (NFDMC, %) and somatic cell count ($Log_{10}SCC$) in Holstein-Friesian cows according to parity and milking order

Factors	n	SGC, (mg/mL)	n	FC, %	NFDMC, %	$Log_{10}SCC$
Parity		**		**	**	**
1	30	1040.77±1.11[a]	42	4.10±0.10[a]	12.16±0.29[a]	5.88±0.022[a]
2	45	1040.80±0.91[a]	63	4.64±0.08[b]	13.09±0.23[b]	6.01±0.018[b]
3+	70	1044.10±0.73[b]	98	4.93±0.06[c]	13.69±0.19[b]	6.06±0.015[b]
Milking order		**		**	**	**
1	29	1055.09±1.20[a]	29	6.36±0.12[a]	18.17±0.37[a]	5.90±0.028[a]
2	29	1047.20±1.20[b]	29	5.59±0.12[b]	14.57±0.37[b]	5.94±0.028[ab]
3	29	1040.82±1.20[c]	29	4.79±0.12[c]	13.27±0.37[bc]	5.95±0.028[abc]
4	29	1035.27±1.20[d]	29	4.28±0.12[de]	11.94±0.37[cd]	5.98±0.028[abc]
5	29	1031.07±1.20[d]	29	3.92±0.12[ef]	11.38±0.37[d]	6.01±0.028[abc]
6 (5. day)	-	-	29	3.64±0.12[fg]	11.05±0.37[d]	6.03±0.028[bc]
7 (10. day)	-	-	29	3.31±0.12[g]	10.48±0.37[d]	6.06±0.028[c]
Parity x Milking order interaction	145	**	203	**	**	NS
Overall mean	145	1042.4±0.9	218	4.67±0.09	13.19±0.23	6.00±0.011

NS: not significant, **: Significant for P<0.01. a,b,c,d,e,f,g: Different letters in the same column shows significance at P<0.05.

Table 2. Correlations between specific gravity of colostrum (SGC, mg/mL), fat content (FC, %), non-fat dry matter content (NFDMC, %) and somatic cell count ($Log_{10}SCC$) calculated separately for each milking in Holstein-Friesian cows

Milking order	Traits	FC, %	NFDMC, %	$Log_{10}SCC$
1	NFDMC,%	0.815**		
	$Log_{10}SCC$	0.665**	0.516**	
	SGC, mg/mL	0.308	0.336	0.378*
2	NFDMC,%	0.755**		
	$Log_{10}SCC$	0.507**	0.570**	
	SGC, mg/mL	0.484**	0.229	0.139
3	NFDMC,%	0.613**		
	$Log_{10}SCC$	0.524**	0.600**	
	SGC, mg/mL	0.409*	0.379*	0.200
4	NFDMC,%	0.200		
	$Log_{10}SCC$	0.415*	0.297	
	SGC, mg/mL	0.307	0.153	0.301
5	NFDMC,%	0.247		
	$Log_{10}SCC$	0.368*	0.274	
	SGC, mg/mL	0.261	0.070	0.309
5. day	NFDMC,%	-0.042		
	$Log_{10}SCC$	0.314	0.286	-
10. day	NFDMC,%	0.000		
	$Log_{10}SCC$	0.145	0.240	-

*: P<0.05, **:P<0.01

In all three parity groups, the SGC averages of the cows at the first milking were found above 1048 mg/mL. While the SGC means are above 1055 mg/mL in the second and 3+ parities at the first milking, the mean of the cows in the first parity was close to 1055 mg/mL. It means that in all three parities, the SGC values at first milking have sufficient amount of IgG content. Although the SGC averages of all three parities decreased in the second milking, it was determined that the SGC average of the cows with 3+ parity at the second milking was close to the SGC value obtained at the first milking of the cows in the first parity. From this, unlike the first and second parity cows, it is understood that the colostrum obtained from the second milking of the cows with 3+ parity is still of good quality and contains sufficient amount of IgG in colostrum. Based on this determination, parity causes a significant variation in the quality of colostrum produced by cows, and in order to ensure adequate passive immunity transfer in calves, colostrum obtained only in the first milking of cows with first and second parity, and in the first two milking in cows with 3+ parity can be used.

While the FC (%) in the first milking of the cows in the first parity was 5.37%, values in the second and third parities were 6.63% and 7.09%, respectively. For all parities, similar to SGC the FC at the first milking was higher and different from the FC at the third and following milkings (Figure2).

Similar to SGC and FC, NFDMC (%), which was higher in the first milking, decreased in the following milkings for all parities (Figure 3), but the decrease from first to the second milkings was higher compared to the following milkings. The decrease seen in NFDMC was mainly due to the decrease in the protein content (immunoglobulins) and mineral content in milk. NFDMC was the highest in the 3+ parity with 19.54%, it was 18.36% in the second parity and 16.60% in the first parity and reduced to 15.57%, 15.00% and 13.13% at the second milking, respectively (Figure 3).

In all parities, SCC increased as parity and milking order progressed, and it was seen that the variation of $Log_{10}SCC$ according to milking order in the first parity was higher than other two parity groups (Figure 4).

Correlations

The correlation coefficients calculated between the traits for each milking in HF cows are given in Table 2. The coefficients of SGC with FC, NFDMC and $Log_{10}SCC$ for all milking were determined to be small to moderate.

Statistically significant coefficients calculated between SGC and FC in the second milking (r=0.484; P<0.01) and in the third milking (r=0.409; P<0.05). The highest and only statistically significant coefficient of SGC with NFDMC was determined in the third milking (r=0.379; P<0.05). Between SGC and $Log_{10}SCC$, the coefficient was the highest and significant only in the first milking (r=0.378; P<0.05).

The correlation coefficients between FC and NFDMC tended to be positive, higher and statistically significant for the first three milking, but in later milking the coefficients were small for the fourth and fifth milking and close to the zero for the 5th and 10th day milking. From this, it can be interpreted that although NFDMC and FC were found at a higher level in colostrum than in normal milk, there is a relationship between each other in the colostrum, and this relationship decreases as the colostrum turns to normal milk and disappears in normal milk.

In the first five milking, moderate to high and statistically significant correlation coefficients determined between FC and $Log_{10}SCC$ and the coefficient was the highest for the first milking (R=0.655; P<0.01). The coefficients between these two traits at 5th and 10th day milking were positive and small.

The correlation coefficients between NFDMC and $Log_{10}SCC$ were moderate to high and positive for the first three milking (r=0.516-0.600; P<0.01), but the coefficients were small and positive in the later milking. As it is known, there is an inverse relationship between lactose content and SCC in normal milk, and as SCC increases, lactose content decreases, significantly. At the beginning of lactation, while colostrum evolves into normal milk, immune proteins, casein, FC and mineral substances decrease and lactose content increases. These changes in milk composition at the beginning of lactation may have caused a high correlation between NFDMC and $Log_{10}SCC$ at the beginning but a lower correlation in subsequent milking.

Discussion

There is a linear relationship between SGC and the immune protein globulin found in milk, and according to Schombee (2011), colostrometer value of ≥1.047 mg/mL of colostrum containing ≥50 mg/mL globulin has been demonstrated. Schombee (2011) reported that each unit change of the colostrometer value corresponds to a 2.55 mg/mL change in the globulin content of the colostrum. In this study, it was determined that the quality of colostrum in the first milking ranged between 1.045-1.070 mg/mL, thus its globulin content was between 47.27 and 110.95 mg/mL.

While SGC in the first milking produced by the majority of the cows in the study was at a good level, 9.38% of them did not produce colostrum in their first milking (n=3) and 9.38% of the cows' colostrum quality was in moderate quality (n=3) but was not at the desired level. This result is inconsistent with Bartier et al. (2015), which reported that 30% of dairy cows had poor colostrum quality. However, the proportion of cows producing colostrum of insufficient quality determined in this study is in consistent with Doğan and Koç (2014) and they reported that 19.44% of HF cows produced either no or low quality colostrum.

In this study, although the quality of colostrum decreased in subsequent milkings in all parities, it was determined that some of the cows with high parity had high colostrum quality even in the fourth milking. Another point that should be mentioned here is that the colostrum quality obtained in the second milking of the cows with 3+ parity is also sufficient. However, this is only an average value and it is necessary to give sufficient amount of proven colostrum to ensure adequate passive immunity transfer in calves after birth. Thus, a strategy for determining the quality of colostrum in farms has been developed and it has been demonstrated that high quality colostrum stored can be used in the feeding of calves of cows that do not produce colostrum or that produce low quality colostrum. The only condition for the realization of this strategy is to determine the quality of the colostrum produced in at least the first few milking after birth, by using a colostrometer, especially in cows with high parities.

In this study, the quality of colostrum obtained at the first milking for HF cows was 72.74 mg/ml (1055.09 mg/mL) was lower than the mean (95.44 mg/mL) reported by Doğan and Koç (2014) and mean (107.16 ± 3.356 mg/mL) reported by Hoyraz et al. (2014) and the SGC mean (1.058±0.0013 g/ml) by Okuyucu and Erdem (2016) for the same breed For Simmental (105.1 mg/mL) and Brown-Swiss (104.9 mg/mL) cows Yaylak et al. (2018) reported higher values than the colostrum quality determined in this study at the first milking.

It is thought that the differences between the quality of colostrum obtained in this study for HF cows and the results of Doğan and Koç (2014) and Hoyraz et al. (2014) are due to the differences of management and nutritional factors between the farms used in this study and their farms, as well as whether vaccination was done as a preventive measure against various common diseases. Because, contrary to what is known, Hoyraz et al. (2014) found the colostrum quality of the cows in the first lactation to be higher than the cows in other parities, and stated that this may be due to the vaccination of young females against common diseases in the region in their farm. Another important difference is that low colostrum quality detected in this study than the mentioned studies could be due to the fact that the distribution of cows according to the parities is different. In this study, almost half of the cows used in this study consisted of the first (5 heads) and second (9 heads) parities.

The colostrum quality determined in this study for the cows with 3+ parity had higher than the other parities, which is consistent with Phipps (2017). Phipps (2017) stated that the quality of colostrum produced by cows with fourth parity is twice more likely to be of high quality than cows in the first parity. It was also reported in Victoria dairy cattle farms by Phipps (2017) that only 39% of the colostrum samples were of high quality, the quality of colostrum milked within the first 12 hours after calving was 6 times more likely to be of good quality than colostrum milked later.

In this study, FC (6.36±0.12%) obtained from the first milking colostrum in HF cows was lower than the values determined by Hoyraz et al. (2014) for the same breed (6.99±0.588%), and Yaylak et al. (2018) for Simmental % (8.50±0.597) and Brown-Swiss (8.53±0.489) breeds in the first parity.

In this study, the changes in the NFDMC depending on the milking order were also emphasized. The NFDMC obtained from HF cows in the first milking (18.17±0.36%) was lower than the results reported by Yaylak et al. (2018) for Simmental (19.42±0.481) and Brown-Swiss (19.20±0.506) cows in the first parity.

In this study, colostrum $Log_{10}SCC$ level (5.90±0.028) obtained from the first milking in HF cows was determined to be very closed to the value reported by Hoyraz et al. (2015) for the same breed (5.95±0.122), but the value found in this study was found higher than Yaylak et al. (2018)'s results reported for Simmental (5.73±0.080) and Brown-Swiss (5.76±0.083) cows in the first lactation.

Contrary to what was found in this study, Yaylak et al. (2018) between colostrum Ig level and FC for Simmental (r=-0.24) and Brown-Swiss (r=-0.27) breeds, and between Ig and $Log_{10}SCC$ for Simmental (r=-0.11) and Brown-Swiss (r=-0.34) breeds reported low and negative correlations. Again, contrary to this study, between Ig and NFDMC, Yaylak et al. (2018) reported high correlation coefficients for Simmental (r=0.73) and Brown-Swiss (r=0.68) breeds.

Contrary to what was found in this study between colostrum FC and NFDMC, Yaylak et al. (2018) reported negative but high correlations for Simmental (r=-0.69) and Brown-Swiss (r=-0.68) breeds. In contrast to what was found in this study for HF between FC and $Log_{10}SCC$, Yaylak et al. (2018) estimated lower correlations for Simmental (r=0.21) and Brown-Swiss (r=-0.02) breeds. The correlations estimated by Yaylak et al. (2018) between colostrum NFDMC and $Log_{10}SCC$ for Simmental (r=-0.27) and Brown-Swiss (r=0.08) cows were lower than the parameter estimated (0.516; P<0.01) in this study.

Conclusion

While FC and NFDMC of milk produced by HF cows after calving varies significantly according to the milking order and parity, it has been determined that SGC and, accordingly, the immune substance content and FC and NFDMC of some cows with higher parity are of high not only in the first milking, but also in the following milking. This situation offers significant advantages to breeders in feeding calves of cows with low colostrum quality or not producing colostrum at all, with high quality colostrum. Based on this determination, it has been determined that while feeding the calves with colostrum, colostrum obtained from the first milking can be preferred, as well as the colostrum obtained from the second milking of the cows with 3+ parity. However, considering that there are individually significant differences in terms of colostrum quality, it has been determined that even colostrum obtained from some cows in the third or even fourth milking can be used in calf feeding. From this point, with the help of a colostrometer a strategy that will ensure not only to determine the colostrum quality obtained from the first milking, but also to determine the quality colostrum produced in subsequent milkings, should be adopted in dairy cattle farms.

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