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Original article

A comparative analysis of colostrum nutritional compositions of primipar Jersey and Holstein cows calving summer months

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Abstract. Colostrum is the first compound released by mammals after birth, nutrient composition and physicochemical properties are variable depending on many factors. Colostrum quality differs among breeds and has become more important in calf performances. The negative effects of hot environments in calves will reduce feed intake, low average daily gain, disease incidence, and morbidity. This negative effect also continues to breeding time, size and age at first calving. A limited number of studies documented the effects of hot condition on modification of colostrum, in particular referred to fatty acids contents. For this purpose, this study was designed to compare fatty acids contents of Holstein and Jersey cattle colostrum during summer months. Our results showed that saturated fatty acids (SFA), monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA) were similar in both breeds immediately after birth. However, SFA content was found to be high in Holstein 8 hours and 16 hours after birth in Jersey whereas MUFA and PUFA contents decreased in colostrum taken at 8 hours after birth in the Holstein breed and 16 hours after birth in Jersey breed. It can be concluded that colostrum immediately taken after birth are rich in fatty acids, especially, MUFA and PUFA.

Keywords: Jersey; Holstein; colostrum; composition; analysis

Introduction

Calf health and vitality in cattle breeding generally depend on drinking colostrum in the first hours after birth. However, the amount of colostrum, quality and drinking hours are of great importance. Colostrum content changes in postpartum hours. However, this level of change may vary according to breed. In hot conditions, it provides better adaptation and higher calf crop.

Colostrum is the first compound that is secreted by mammals after birth, and the content and physicochemical properties are highly variable. Colostrum accounts for about 0.5% of the annual milk production of a cow (1). Good management of high-quality colostrum and its use in calf feeding may reduce calf deaths, enhance immunity and increase animal survival (2). The consumption of high quality colostrum in the first hours after birth has a very important role in the health of calves. Delaying colostrum intake reduces the passive transfer of Ig and postpones the provision of essential nutrients for the completion of insufficient reserves in the bodies of newborn calves. Calves also need growth factors, fat and protein for energy and muscle development in the first days of life (2). The main parameters of colostrum of almost all breeds are fat, protein, lactose, total solids, ash and pH values that should be measured (3). It is observed that lactation, age, season; health status; breed and genetic characteristics of cows can affect colostrum composition

(4). The presence of proteins such as immunoglobulin, lactoferrin and lysozyme in colostrum, supports the immune system of both animals and humans. Composition of nutrients in colostrum is important in satisfying the nutritional requirements of newborn calves. The limited research results available about colostrum content. Most recent researches focus on IgG and ignore other composition such as fatty acid profiles. Kehoe (5) reported the mean percentages of fat, protein, and lactose content in cow colostrums were 6.7, 14.9, and 2.5, respectively which are all found in high concentrations and decrease over time. Nardone (6) reported that fatty acids of bovine colostrum were characterized by higher concentrations of unsaturated fatty acids in comparison to the later lactation phases. Palmquist (7) also reported that low content of short chain fatty acids (except for C4:0 acid) and a high content of C18:0 and C18:1 acids. Generally, in animals, saturated and polyunsaturated fatty acids are believed to have different metabolic events. While saturated fatty acids are metabolized by β-oxidation to provide energy, polyunsaturated fatty acids which are essential components of cell membranes, are precursors in the synthesis of prostaglandins, thromboxanes, and leukotrienes (the n6 family), and contribute to visual and neurological development (the n3 family) (8). In postpartum period, the fatty acids are mobilized in the fat tissue in order to provide energy in the body and the fatty acids formed are added to milk fat. For this reason, colostrum contains high levels of long-chain fatty acids (9). It is well known that high ambient temperature is effective on cow colostrum quality and the mortality rate is higher for calves born during summer (10). Under hot season, percentages of colostrum fat content decreased (6). Colostrum produced from heifers under hot conditions also had changes in fatty acid compositions. Greater proportions of long-chain FA were observed (6). Calves born to heat-stressed dams had reduced passive transfer of immunity and compromised cell-mediated immunity compared to calves born to warm season (10). This negative effect in calves will reduce feed intake, low average daily gain, disease incidence, and morbidity. This negative effect also continues to breeding time, size and age at first calving. Colostrum quality differs among cattle breeds and adaptation ability is also differing. Jersey and Holstein cattle are very popular milk type cattle which is preferred for many part of world. This study was designed to compare fatty acids contents of Holstein and Jersey cattle colostrum during summer months.

Materials and Methods

This study was carried out in Çukurova University Agricultural Faculty Dairy Cattle Research Unit. There were a total of 160 dairy cows in the research unit. In the study, cows without any disease, in the second and third lactation and having an average weight of 550-650 kg were selected to create a homogeneous experimental group. As animal material, healthy and similar characteristics of the 5 Holstein and 5 Jersey breed heifer were used.

Colostrum samples were taken from cows that gave birth in July in the experiment. The average temperature in this month was around 32 °C during the daylight (minimum = 31 °C, maximum = 34 °C) and humidity was around 55% (Minimum = 46%, maximum = 60%). In this research unit the cows are taken to the calving pen one week before parturition and were kept calve and cow together under observation during 3 days after birth. Colostrum samples were taken at birth at 8 and 16 hours after birth for fatty acid content analyses. After cleaning and disinfection of the cow's udder, colostrum samples were taken to a 15 ml sterile tube and the information on the cow was recorded on the tube and stored in the freezer at −80 °C until the analysis. For the analysis, the sample was thawed at +4 °C. pH, protein, fat, moisture, ash and fatty acid analyzes of colostrum samples from the Holstein and Jersey breed cows were carried out in the laboratory of Çukurova University, Fisheries Faculty.

Lipid Analysis

Lipid analysis was performed according to the method of Bligh and Dyer (11) with slight modification. 15 g of sample was mixed with 120 ml of methanol / chloroform (1:2 v/v) in a T25 Ultraturrax (Ika-Werke, Staufen, Germany) for 2 min. After adding 20 ml of 0.4% $CaCl_2$ solution in the mixture, Whatman filter paper (Scleicher & Schuell, 5951/2

185 mm) was used for filtering of homogenate, and then the filtrate was transferred to a separatory funnel for phase separation. The separated chloroform-lipid fraction was transferred to a rotary evaporator under vacuum for evaporation. After flasks were kept in an oven for 1 hour at 90°C and they were put in a desiccator to cool. Finally the flasks were weighed on a precision sensitive scale of 0,1 mg.

Determination of Fatty Acids

Fatty acid methyl esters of extracted lipid were carried out according to the method of Ichihara et al. (12). 4 ml of 2M KOH and 2ml of n-heptane were added to 25mg of extracted oil sample. It was then vortexed for 2 min at room temperature and centrifuged at 4000 rpm for 10 min and the heptane layers were taken up for gas chromatography (GC) analysis.

Gas Chromatography Conditions

Fatty acid composition was analyzed using a Gas Chromatography (GC) Clarus 500 device (Perkin–Elmer, USA), one flame ionization detector (FID) and SGE (60m ×0.32mm ID BP×70×0.25 μm, USA or Australia) column. Injector and detector temperatures were set as 260 and 230 °C, respectively. During this time, the furnace temperature was kept at 140 °C for 8 min. After that, it was increased by 4 °C per minute until 220 °C and from 220 to 230 °C by increasing the temperature 1 °C per minute. It was kept at 230 °C for 15 min to complete analysis. Sample scale was 1 μl and carrier gas was controlled at 16 psi. For split flow (1:50) level was used. Fatty acids were identified by comparing the retention times of FAME (Supelco, Catalogue No: 18919) with the standard 37-component FAME mixture. Three replicates of GC analyses were carried out and the results were expressed in GC area % as mean value ± standard error (SE).

pH Analysis

pH changes in colostrum were measured using a digital pH meter (WTW 315i pH Meter; Weilheim, Germany). 5 ml colostrum was taken and mixed in 50 ml of distilled water (1/10) for 5 minutes. The pH of the colostrum was measured by immersing the pH meter in this solution.

Total Crude Protein Analysis

Total crude protein was determined according to Kjeldahl method (13). Approximately 1g of sample was weighed into Kjeldahl digestion tube and digested for 2 hours with concentrated sulphuric acid (20 ml) and two 2 Kjeldahl catalyst tablets. After digestion, the digest was left to cool down a then 75 mL of distilled water was added. The distillation was performed using Kjeldahl Distilling Unit. 25 ml of 40% boric acid (H_3BO_3) solution was added into a 250 ml conical flask and placed in the distilling unit on the flask platform before the digested materials was placed into unit. 50ml of 40% NaOH was dispensed into the digest and steam valve was turned on. The boric acid solution in the flask receiving the distilled ammonia changed color from red to green. After that, the contents of the flask were titrated against HCl until a grey color end point.

Moisture Analysis

Moisture content was determined by drying the samples in an oven at 104 °C for 24 h. 5 g of sample was weighed in a dried, weighed dish a then placed in an oven at 104 °C for 24 hours. The dish was then placed in a desiccator to cool and weighed.

Crude Ash Analysis

Crude ash content was determined after ignition at 550 °C for 12 hours. 3 g of sample was weighed in a dried, weighed silica dish a then charred over a Bunsen burner. The dish was then placed in furnace at 550 °C to incinerate until the sample was free from carbon particles. The dish was then placed in a desiccator to cool down and weighed.

Statistical analyses

Data were analyzed using the SPSS 2016 program. The model included breed and time (1st, 8th and 16th hour after calving) and the interaction between the

two factors. Data were analyzed by analysis of variance (ANOVA), and Duncan's test was applied in order to determine statistical differences between means of group. Significance was determined at $P < 0.05$.

Results and Discussion

Proximate Composition

Colostrum is a prerequisite for the newborn offspring to contain the immune agents that constitute the defense mechanism against diseases (14). Colostrum is different from the normal milk in terms of content. In the researches, it was stated that the variability in the contents of colostrum decreased 3-4 days after calving (15).

In this study, proximate composition of colostrum of Jersey and Holstein breed cows having their first birth in the summer months is given in Table 1. There were significantly differences in the proximate compositions of colostrums ($P < 0.05$) in terms of breeds and periods except the fat content of colostrum among periods.

Jersey breed cows had higher protein content (18.31%) especially immediately after birth, followed by 16.43% in colostrum taken at 8 hours after birth and 13.6% in colostrum at 16 hours after birth, indicating a decrease of approximately 25.5%. Although protein contents in both breeds were higher just after calving, protein levels decreased at both 8 and 16 hours after birth. The protein content in Holstein breed was 15.98% immediately after birth, but after 16 hours from birth it decreased to 6.95%, indicating a decrease of 56.5% in the first period. Protein level of Holstein breed significantly reduced compared to those of Jersey breed. This showed that there was a decrease in protein contents in both breeds as time progressed. These findings are similar to the results of previous studies. Csapõ (15) compared the protein levels of colostrum samples on the 1st, 3rd and 5th days after birth of different breeds and they reported that the protein level of Jersey breed decreased from 19.16% in the first day to 5.8% on the 5th day. On the other hand, the percentage of Holstein breed from 19.7% on first day decreased to 5.04% on the 5th day. Georgiev (16) stated that the chemical composition of the colostrum (dry matter, non-fat essence, lactose, milk fat and protein) changed very rapidly over time and the colostrum content changed to normal milk on the 3rd day postpartum. They determined the protein level as 11.9% on the first day after birth and 5.4% on the 3rd day. Kehoe (5) found that the protein, fat and ash contents of colostrum were 14.9%, 6.7% and 0.05% while Tsioulpas (17) found the protein, fat and ash contents as 16.2%, 3.6% and 1.25%, respectively. Patoo (18) reported the maximum mean fat, protein, total solids and ash content of cows as 6.79, 13.28, 23.02, 1.10, respectively, indicating a decrease in their contents as the postpartum day's progress.

In addition to the significant effects of the protein components in the colostrum, the fat in the colostrum also plays an important role in supplying the nutrients necessary to provide energy, increase metabolism and protect newborn calves against microbial infections (19). Table 1 shows the changes in the fat content of colostrum depending on period. According to the statistical analysis, it was observed that the differences between breeds were significant ($P < 0.05$) but not significant among periods. The colostrum fat content of Jersey breed animals was 7.39% immediately after birth, and it decreased to 6.92% at 16 hours after birth whereas its level was 2.27% immediately after birth and its level increased to 3.53% in Holstein breeds. It was reported that the colostrum's fat content was higher than that of milk (Kehoe et al. 2007). Abd-fattah (20) determined the fat content of colostrum taken from Holstein cows after birth, as 8.04% and 3.9% after 5 days from birth, and they reported a low fat content in the postnatal days. Georgiev (16) also found that the fat content was calculated as 4.8% on the 1st day of lactation and 5.3% on the 3rd day of lactation in the colostrum of Holstein breed animals.

The moisture contents of colostrum (Table 1) increased in both breeds. According to the statistical analysis, differences in moisture between breeds and periods were significant ($P < 0.05$). The moisture content of colostrum was found as 76.52%, 79.74% and 83.45% immediately after birth, 8 hours and 16 hours after birth, in Holstein breed whereas the moisture contents of colostrum were 68.91%, 72.58% and 73.1% in Jersey breed respectively. The moisture contents of

colostrum in Holstein breed were higher than those of Jersey. In addition, it was observed that moisture contents increased in both breeds depending on time.

Ash content of colostrum decreased from the initial value of 2.63% to 2.37% in Jersey whereas its level in Holstein breed decreased from 1.99% to 1.91% (Table 1). There was a decrease in the ash contents in both breeds as time progressed. The composition of colostrum ash is mainly composed of calcium, magnesium, potassium and sodium, as well as iron and phosphorus, chloride and other minerals (21). The reduction in ash content may also affect the proportion of minerals forming the ash. Some studies have shown that Ca, Mg, Na, chloride and P are high in colostrum during labor and early in lactation, but drops rapidly when the milk occurs. Calcium and phosphorus are required for bone and tooth development. In addition to acting as a major component of bone, phosphorus plays a role in energy metabolism and many other metabolic functions (21).

Chemical Analyses

pH

It was indicated that pH of colostrum is lower than normal lactation milk (22). Elfstrand (23) determined the pH of the colostrum as 6.3-6.4, which was lower than the value of normal milk (pH 6.7). Some researchers reported that the pH of the colostrum was initially low and increased with post-partum (17). The exact cause of low colostrum pH is unknown. During the pre-partum period, it was estimated that the permeability of the mammary gland membranes increased and thus more blood components passed into the milk. Considering that colostrum contains more blood components than milk, it is expected that the blood will be closer to the pH (pH 7.35 with 7.45). In this study, Table 1 shows the pH values of colostrum obtained from different breeds and time after birth. According to the statistical analysis, differences in pH values between breeds were found to be significant ($P < 0.05$) but no differences were observed among periods. Similar values were obtained from other studies (17).

Fatty acids profile

Table 2 shows the fatty acid contents of colostrum samples obtained from Jersey and Holstein breed cows and the hours after calving. As a results of fatty acids analyses of colostrum taken immediately after birth in both breeds, capric acid (C10:0), lauric acid (C12:0), myristic acid (C14:0), palmitic acid (C16:0) and palmitoleic acid (C16:1) contents decreased, whereas their levels increased in colostrum taken at 8 and 16 hours after birth. Margaric acid (C17:0), stearic acid (C18:0), oleic acid (C18:1n9), arachidic acid (C20:0) and docosahexaenoic acid (C22:6n3) levels were high in the colostrum taken immediately after birth while their levels decreased in the colostrum taken at 8 and 16 hours after birth.

According to the results of statistical analysis (Table 2), differences in the levels of lauric acid (C12:0), myristic acid (C14:0), myristoleic acid (C14:1), methylpentadecanoate (C15:1), palmitoleic acid (C16:1), margaric acid (C17:0), stearic acid (C18:0), vaccenic acid (C18:1n7), linoleic acid (C18:2n6), alpha linolenic acid (C18.3n3), arachidic acid (C20:0) and eicosanoic acid (C20:1n9) between breeds were statistically significant ($p<0.05$). Among periods caproic acid (C6:0), caprylic acid (C8:0), capric acid (C10:0), lauric acid (C12:0), myristic acid (C14:0), myristoleic acid (C14:1), methylpentadecanoate (C15:1), palmitic acid (C16:0), palmitoleic acid (C16:1), margaric acid (C17:0), stearic acid (C18:0), oleic acid, (C18:1n9), vaccenic acid (C18:1n7), alfa linolenic acid (C18.3n3), gama linolenic acid (C18:3n6), arachidic acid (C20:0), eicosanoic acid (C20:1n9), eicosadienoic acid, erucic acid, eicosapentaenoic acid (EPA) (C20:2) and docosahexaenoic acid (DHA) (C22:6n3) were found to be significant ($p<0.05$). Caproic acid (C6:0), caprylic acid (C8:0), capric acid (C10:0), lauric acid (C12:0), myristic acid (C14:0), myristoleic acid (C14:1), methylpentadecanoate (C15:1), palmitic acid (C16:0), margaric acid (C17:0), heptadecenoic acid (C17:1), stearic acid (C18:0), oleic acid (C18:1n9), vaccenic acid (C18:1n7), linoleic acid (C18:2n6), arachidic acid (C20:0), eicosanoic acid (C20:1n9) and docosahexaenoic acid (C22:6n3) in the breed and period interaction effects were statistically significant ($p<0.05$).

Saturated fatty acids (SFA) were similar in both breeds immediately after birth (Figure 1, Table 1). However, SFA content of colostrum was found to be high in Holstein 8 hours after birth and 16 hours after birth in Jersey. Among SFA, palmitic acid (C16:0) and stearic acid (C18: 0) are predominant. Palmitic acid content increased in colostrum taken at 16 hours after birth in both breeds, while stearic acid content declined steadily. Varga-Visi (24) stated that there was no significant difference between Holstein-Friesian and Jersey breeds in SFA's group but myristic acid (C14:0) (dominant in SFA group) was a significant difference between breeds. They stated that the highest content of palmitic acid (C16:0) was found in the Jersey breed. The high proportion of palmitic acid (C16:0) in the SFA group means that the differences in the SFA level are affected by the variation of this fatty acid. The abundance of palmitic acid (C16:0) in the colostrum lipid of Jersey is due to the excess of saturated fatty acids (24). Similar results were obtained from the current study (Table 3). Palmitic acid (C16:0) levels were higher in Jersey and increased in both breeds depending on time.

The percentages of total monounsaturated fatty acids (∑MUFA) were similar in both breeds after birth (Figure 2). However, the rate of MUFA falls down in

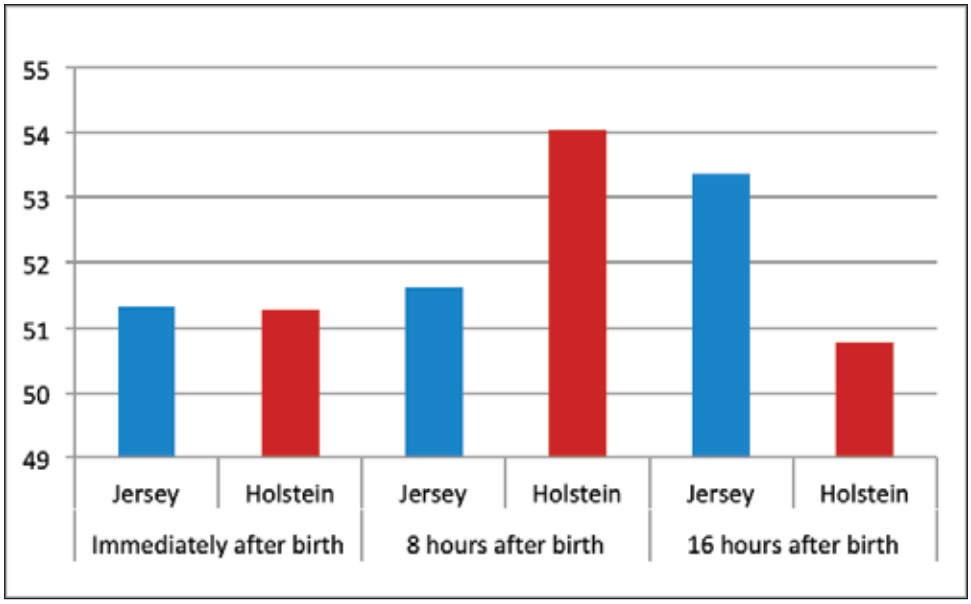

Figure 1. ∑SFA ratios of fatty acids of colostrum of Jersey and Holstein cows in the summer months
$X \pm S_x$: Mean ± standard error

Table 1. Chemical composition of colostrums in Jersey and Holstein cows having their first birth in summer

Time	**Immediately after birth**		**8 hours after birth**		**16 hours after birth**		****P value**		
Breeds / content	**Jersey *X±S$_x$**	**Holstein X±S$_x$**	**Jersey X±S$_x$**	**Holstein X±S$_x$**	**Jersey X±S$_x$**	**Holstein X±S$_x$**	**Breed**	**Hours**	**Breed X Hours**
Protein (%)	18.31±3.92	15.98±2.70	16.43±3.85	12.99±1.29	13.6±5.20	6.95±3.02	.000	.000	.168
Fat (%)	7.39±1.77	2.27±1.32	5.87±0.69	3.13±1.20	6.92±1.85	3.53±1.40	.000	.345	.055
Moisture (%)	68.91±6.43	76.52±6.75	72.58±4.79	79.74±3.97	73.1±5,86	83.45±2.70	.000	.008	.666
Ash (%)	2.63±0.40	1.99±0.78	2.26±0.83	1.15±0.15	2.37±1.34	1.91±0.63	.000	.000	.199
pH	6.6±0.21	6.035±0.07	6.365±0.29	6.036±0.07	6.30±0.156	6.161±0.085	.000	.460	.107

*X±S$_x$: Mean ± standard error, ** $p<0.05$

Table 2. The fatty acid contents of colostrum samples in Jersey and Holstein breed cows in the summer months.

*Fatty Acid Ratios In Colostrum After Calving										
		Immediately After Calving		8 Hours After Calving		16 Hours After Calving		**P Value		
	Formula	Jersey	Holstein	Jersey	Holstein	Jersey	Holstein	B	H	B X H
Caproic acid	C6:0	0.90 ±0.13	1,20±0,26	1,46±0,21	0,46±0,10	0,09±0,05	0,66±0,09	,349	,000	,000
Caprylic acid	C8:0	0.42 ±0.08	0,42±0,07	0,67±0,08	0,39±0,05	0,43±0,04	0,46±0,10	,692	,004	,000
Capric acid	C10:0	0.83 ±0.12	0.51±0.07	1.10±0.71	1.18±0.08	1.24±0.08	0.86±0.13	.004	.000	.011
Laurik acid	C12:0	1.38±0.23	1.10±0.07	1.79±0.48	2.05±0.18	2.51±0.29	1.76±0.26	.000	.000	.004
Myristic acid	C14:0	6.62±0.56	6.64±0.62	7.66±0.89	10.4±0.92	13.54±1.11	9.73±1.32	.000	.000	.000
Myristoleic acid	C14:1	0.50±0.06	0.41±0.09	0.59±0.11	0.43±0.08	0.29±0.03	0.33±0.04	.000	.000	.000
Pentadecanoic acid	C15:0	0.80±0.06	0.85±0.06	1.00±0.07	1.20±0.14	0.93±0.08	1.05±0.04	.000	.000	.005
Methylpentadecanoat	C15:1	0.32 ±0.02	0.30±0.02	0.33±0.05	0.43±0.08	0.28±0.01	0.36±0.06	.000	.000	.002
Palmitic acid	C16:0	30.69±1.24	30.47± 1.57	31.20±0.79	33.30±2.87	35.58±1.56	31.62±0.66	.085	.000	.000
Palmitoleic acid	C16:1	1.53±0.25	1.21±0.08	1.64±0.27	1.41±0.09	1.64±0.12	1.44±0.10	.000	.000	.265
Margaric acid	C17:0	1.08±0.07	1.12±0.05	1.05±0.08	0.10±0.03	0.83±0.08	1.02±0.06	.000	.000	.000
Heptadecenoic acid	C17:1	0.42 ±0.03	0.27±0.02	0.42±0.05	0.37±0.08	0.3±0.05	0.41±0.06	.436	.106	.000
Stearic acid	C18:0	14.63±1.23	15.64±1.01	13.08±1.62	13.96±0.60	9.51±1.13	12.46±0.33	.000	.000	.005
Oleic acid	C18:1n9	27.11±0.52	26.27±0.90	26.07±1.46	21.98±2.40	20.88±0.63	25.33±1.07	.224	.000	.000
Vaccenic acid	C18:1n7	1.22±0.04	1.15±0.04	1.26±0.06	0.82±0.06	0.83±0.05	0.94±0.03	.000	.000	.000
Linoleic acid	C18:2n6	3.22±0.06	3.08±0.11	2.88±0.28	3.27±0.16	3.24±0.51	2.80±0.37	.014	.141	.000
Alfa Linolenic acid	C18.3n3	0.27±0.03	0.24±0.03	0.26±0.05	0.27±0.04	0.23±0.05	0.22±0.02	.026	.003	.487
Gama Linolenic acid	C18:3n6	0.12± 0.01	0.13±0.02	0.13±0.03	0.12±0.03	0.09±0.01	0.10±0.01	.086	.001	.793
Arachidic acid	C20:0	0.53±0.06	0.42±0.11	0.52±0.13	0.19±0.06	0.27±0.01	0.25±0.08	.000	.000	.000
Eicosanoic acid	C20:1n9	0.10±0.02	0.10±0.01	0.10±0.02	0.22±0.12	0.07±0.01	0.10±0.03	.001	.001	.006
Eicosadienoic acid	C20:2	0.07±0.02	0.06±0.01	0.05±0.00	0.06±0.01	0.07±0.02	0.07±0.01	.323	.003	.054
Erucic acid	C22:1n9	0.74±0.10	0.08±0.01		0.07±0.21	0.75±0.07	0.79±0.14	.563	.000	.538
Eicosapentaenoic acid (EPA)	C20:5n3	0.08±0.02	0.23±0.03	0.06±0.01		0.07±0.01	0.08±0.02	.153	.001	.762
Docosahexaenoic acid	C22:6n3	0.23±0.04	0.25±0.04	0.16 ± 0.01	0.12±0.04	0.17±0.03	0.22±0.07	.463	.000	.012

*$X \pm S_x$: Mean ± standard error, ** $p<0.05$, B: Breed, H: Hours

Table 3. ∑SFA, ∑MUFA and ∑PUFA ratios of fatty acids found in colostrum of Jersey and Holstein cows in the summer months

	*(%) Ratio of Fatty Acids After Calving								
	Immediately After Calving		8 Hours After Calving		16 Hours After Calving		**P Value		
Fatty acids	**Jersey**	**Holstein**	**Jersey**	**Holstein**	**Jersey**	**Holstein**	**B**	**H**	**B X H**
C10:0	0.83 ±0.12	0.51±0.07	1.10±0.71	1.18±0.08	1.24±0.08	0.86±0.13	.004	.000	.011
C12:0	1.38±0.23	1.10±0.07	1.79±0.48	2.05±0.18	2.51±0.29	1.76±0.26	.000	.000	.004
C14:0	1.38±0.23	1.10±0.07	1.79±0.48	2.05±0.18	2.51±0.29	1.76±0.26	.000	.000	.000
C15:0	0.80±0.06	0.85± 0.06	1.00±0.07	1.20±0.14	0.93±0.08	1.05±0.04	.000	.000	.005
C16:0	30.69±1.24	30.47±1.57	31.20±0.79	33.30±2.87	35.58±1.56	31.62±0.66	.085	.000	.000
C17:0	1.08±0.07	1.12±0.05	1.05±0.08	0.10±0.03	0.83±0.08	1.02±0.06	.000	.000	.000
C18:0	14.63±1.23	15.64±1.01	13.08±1.62	13.96±0.60	9.51±1.13	12.46±0.33	.000	.000	.005
C20:0	0.53±0.06	0.42±0.11	0.52±0.13	0.19±0.06	0.27±0.01	0.25±0.08	.000	.000	.000
∑SFA	**51.32±1.55**	**51.21±0.37**	**51.53±0.55**	**54.03±0.52**	**53.37±0.44**	**50.78±0.23**	.000	.000	.000
C14:1	0.50±0.06	0.41±0.09	0.59±0.11	0.43±0.08	0.29±0.03	0.33±0.04	.000	.000	.000
C15:1	0.32 ±0.02	0.30±0.02	0.33±0.05	0.43±0.08	0.28± 0.01	0.36±0.06	.000	.000	.002
C16:1	1.53±0.25	1.21±0.08	1.64±0.27	1.41±0.09	1.64±0.12	1.44±0.10	.000	.000	.265
C17:1	0.42 ±0.03	0.27±0.02	0.42±0.05	0.37±0.08	0.30±0.05	0.41±0.06	.436	.106	.000
C18:1n7c	1.22±0.04	1.15±0.04	1.26±0.06	0.82±0.06	0.83±0.05	0.94±0.03	.000	.000	.000
C18:1n9c	27.11±0.52	26.27±0.90	26.07±1.46	21.98±2.40	20.88±0.63	25.33±1.07	.224	.000	.000
C20:1	0.10±0.02	0.10±0.01	0.1±0.02	0.22±0.12	0.07±0.01	0.1±0.03	.001	.001	.006
∑MUFA	**31.2**0±0.12	**29.71±0.25**	**30.41±0.29**	**25.66±0.42**	**24.29±0.87**	**28.91±0,20**	.000	.000	.000
C18:2n6	3.22±0.06	3.08±0.11	2.88±0.28	3.27±0.16	3.24±0.51	2.80±0.37	.014	.141	.000
C18:3n6	0.12± 0.01	0.13±0.02	0.13±0.03	0.12±0.03	0.09±0.01	0.10±0.01	.086	.001	.793
C18:3n3	0.27±0.03	0.24±0.03	0.26±0.05	0.27±0.04	0.23±0.05	0.22±0.02	.026	.003	.487
C20:2 cis	0.07±0.02	0.06±0.01	0.05±0.00	0.06±0.01	0.07±0.02	0.07±0.01	.323	.003	.054
C20:5n3	0.08±0.02	0.23±0.03	0.06±0.01		0.07±0.01	0.08±0.02	.153	.001	.762
C22:6 n3	0.23±0.04	0.25±0.04	0.16 ± 0.01	0.12±0.04	0.17±0.03	0.22± 0.07	.463	.000	.012
∑PUFA	**3.99±0.03**	**3.99±0.04**	**3.64±0.06**	**3.84±0.04**	**3.87±0,10**	**3.49±0,09**	.000	.000	.000
MUFA/SFA	0.60	0.57	0.59	0.47	0.45	0.56			
PUFA/SFA	0.07	0.07	0.07	0.07	0.07	0.06			
PUFA/MUFA	0.12	0.13	0.12	0.15	0.16	0.12			
∑n6	3.34	3.21	3.01	3.39	3.33	2.90			
∑n3	0.58	0.72	0.48	0.39	0.47	0.52			
n6/n3	5.75	4.45	6.27	8.69	7.05	5.57			

*$X \pm S_x$: Mean ± standard error, ** $p<0.05$, B: Breed, H: Hours

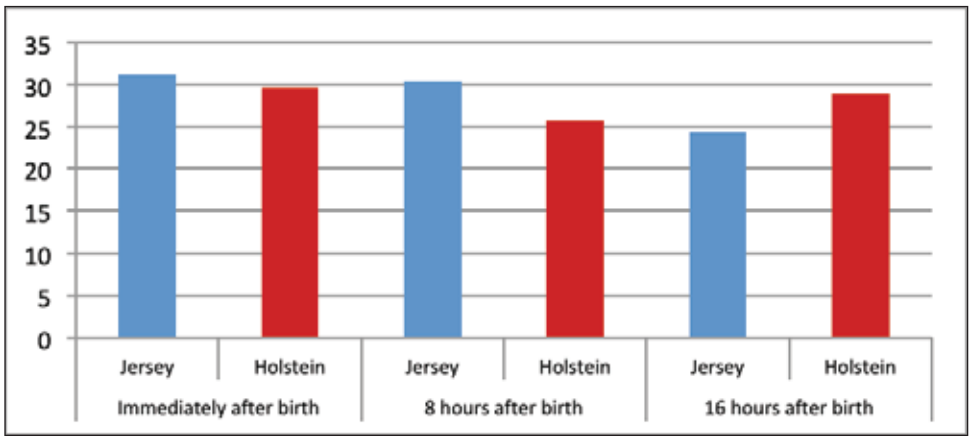

Figure 2. ∑MUFA ratios of fatty acids in colostrum of Jersey and Holstein cows in the summer months
*X ± S_x: Mean ± standard error

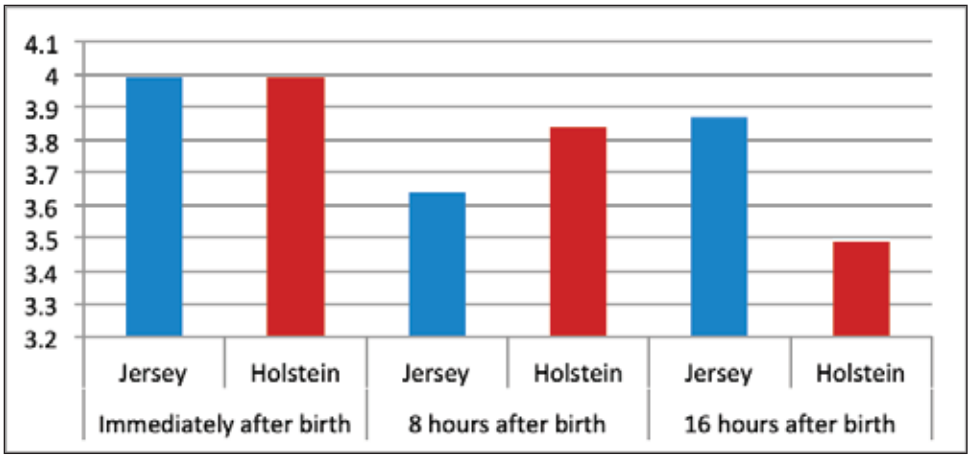

Figure 3. ∑PUFA ratios of fatty acids in colostrum of Jersey and Holstein cows in the summer months

colostrum taken at 8 days after birth in the Holstein breed and 16 hours after birth in Jersey breed. The main fatty acid among MUFA was oleic acid (86%, C18:1n9) and its level decreased in colostrum taken at 16 hours after birth, thus decreasing MUFA value. Varga-Visi (24) reported that oleic acid in colostrum is the main component of MUFA and found 26.0% for colostrum of the Holstein Friesian breed and 18.8% for Jersey.

The fatty acid composition of colostrum may be affected by various factors. As in normal milk, the fatty acid composition in colostrum is also dependent on the lipid profile of the feed. Some of the long-chain n3-unsaturated fatty acids (n3-PUFA) from fish oil in feeds pass through the colostrum (25). In current study, the percentages of total n-3 FA and n-6 FA at first hour is higher than at 16 hour in both breeds. The highest concentration of n-3 FA is alfa linolenic acid (18:3n-3) and the highest concentration of n-6 FA is linoleic acid (C18:2n6) (Table 3). Contarini (19) stated that the highest concentration of n-3 FA was due not only to linolenic acid (18:3n-3) but also to

high concentrations of 20:4n-3, 20:5n-3 (eicosapentaenoic acid, EPA), 22:4n-3, 22:5n-3 (docosapentaenoic acid, DPA), and 22:6n-3 (docosahexaenoic acid, DHA). Fatty acids are essential for the newborn calf, and fats are taken with foods and the animal's fat tissue helps to provide a certain level of long-chain PUFA in the colostrum (26). In the current study, the total polyunsaturated fatty acids (∑PUFA) levels were similar in both breeds after birth but there is a decrease in the Jersey breed at 8 hours after birth, in the Holstein breed at 16 hours after the birth. Varga-Visi (24) stated that poly-unsaturated fatty acid (PUFA) ratio of Holstein-Friesian breed is higher than that of Jersey breeds. In their studied, in the case of PUFA occurring in smaller quantities, the ratio of dihomo-gamma-linolenic acid (20:3n6), eicosapentaenoic acid (EPA) (20: 5n3), docosapentaenoic acid (22: 5n3) and docosahexaenoic acid (22: 6n3) in the colostrum fat did not differ by breeds. The only exception was arachidonic acid. Contarini (19) found that Among the PUFA class, the content of n-6 FA (mainly composed of linoleic acid) of samples at 24 h was higher than that at 120 h from calving. In contrast, the n-3 FA content of samples at 24 h was higher than that of all the other samples.

Elfstrand (23) indicated that during the first two days after birth, the colostrum fatty acid composition gradually changed and the ratio of saturated and polyunsaturated fatty acids decreased with time postpartum, while the content of monounsaturated fatty acids increased. Laakso (27) stated that stearic acid, oleic acid and short-chain fatty acid (C4-C10) ratios were low in the colostrum during the first week after birth and these rates increased in the following weeks. They also reported that the amounts of C12-C16, especially myristic acid (C14:0) and palmitic acids (C16:0) in the colostrum were initially high, and this ratio decreased in time. Similarly, Palmquist (7) reported that in the colostrum taken after delivery, the ratios of short-chain fatty acids, except C4, were low but increased in the following weeks, reaching > 90% of the maximum levels during the 8th week of lactation and also reported that colostrum contains high levels of stearic acid (C18:0) and oleic acid (C18:1).

Conclusion

Fatty acids are essential for the newborn calf, and fats are taken with foods and the animal's fat tissue helps to provide a certain level of long-chain PUFA in the colostrum. The fatty acid composition of colostrum can be affected by various factors, especially the feed. Our results showed that saturated fatty acids (SFA), monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA) were similar in both breeds immediately after birth. However, SFA content was found to be high in Holstein 8 hours after birth and 16 hours after birth in Jersey whereas MUFA and PUFA contents decreased in colostrum taken at 8 days after birth in the Holstein breed and 16 hours after birth in Jersey breed. The fact that colostrum taken immediately after birth is rich in fatty acids, especially MUFA and PUFA, indicates that colostrum taken at this period has high nutritional value for the offspring.

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