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CHANGES IN CHEMICAL COMPOSITION AND SOMATIC CELL COUNT IN BOVINE MILK DURING COLOSTRUM PERIOD[16]

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Abstract

The aim of the paper was to evaluate the bovine colostrum quality and changes in composition during the first five days postpartum. Researches were carried out on a dairy farm with Holstein –Friesian heifer and multiparous cows. Samples of colostrum milk were collected at 1, 6, 12, 24, 48, 72, 96 and 120 hours postpartum. Samples were analyzed for chemical composition using an infrared spectrometer (fat, protein, lactose and dry matter), and for somatic cell count using a fluoro-optic-electronic method.

In the first colostrum the concentrations of milk fat, protein and dry matter were high (7.07%, 20.86% and 30.19% respectively) with significant reducing after 12 hours postpartum. Lactose concentration was low at the beginning (1.23%) and increased slowly until the fifth day postpartum to 3.76%. Somatic cell count was high in the first milking (1,163,330 cells/ml) and decreased after that.

Key words: colostrum, chemical composition, somatic cell count, Holstein – Friesian, cow

Introduction

Colostrum is the secretion of the mammary gland produced immediately after parturition and is vital food for the newborn of all mammals within the

[16] original scientific paper

first 5-7 days (Gerogiev P.I., 2008; Abd El –Fattah et al., 2012) or in a period of 6-10 days after parturition (Kochoski Lj., 2011). Colostrum differs greatly in composition of mature milk and meets the nutritional requirements of the newborn (Ontsouka et. al, 2003).

Bovine colostrum contains higher amounts of fats, proteins and peptides, fat soluble vitamins, and various enzymes, hormones, growth factors, cytokines, minerals and nucleotides than mature milk, and except for lactose, the levels of these compounds rapidly decrease during the first three days of lactation to those typical to mature milk (Blum J.W, Hammon H., 2000). This is the first food for neonates after the parturition that provides them with all necessary nutrients (Gerogiev P.I., 2008).

Breed, age, nutrition, and health status of the cow are well known to influence milk composition (Ontsouka et. al, 2003). Also, management practices could have an important influence on colostrum quality, and herd size influences the colostrum management and quality at the farm level (Kehoe et. al., 2007)

Milk constituents change during milking of colostrum, which need to be considered if milk samples are taken for analysis and to evaluate the health of the udder (Ontsouka et. al, 2003).

Material and methods

The objectives of this study were to evaluate the colostrum quality and changes during the first five days of lactation in Holstein –Friesian cows. Researches were carried out on Holstein –Friesian multiparlous cows during the summer. Samples of colostrum milk were collected immediately after calving after 1, 6, 12, 24, 48, 72, 96 and 120 hours after parturition, by hand milking. Milk was placed in sterile pots and carried at the laboratory at refrigeration temperature. Samples were immediately analyzed for chemical composition and somatic cell count.

The analysis of the chemical composition of the milk means determining milk fat content, proteins, lactose and dry matter using infrared analyzer Milkoscan in accordance with the IDF 141C:2000 standard.

The cell count was determined with Fossomatic 5000 and milk-enumeration of somatic cell was done according to ISO 13366/2:2006 standard. The working principle of Fossomatic 5000 consists of staining and electronic counting of somatic cells.

Results and discussion

The results in Table 1 show that the average milk fat is 6.04 (min. 4.66 up to max.7.07), proteins 10.24 (min.3.70 up to max.20.86), lactose 2.84 (min. 1.23 up to max.3.95), total dry matter 19.99 (min. 13.12 up to max.30.19) and somatic cell count 767.90 (min. 299.50 up to max.1163.33).

Table 1: Composition of bovine colostrum during the first five days after calving

	Milk fat %	**Proteins %**	**Lactose %**	**Dry matter %**	**SCC/ml x 1000**
after calving	7.07	20.86	1.23	30.19	1163.33
1h	6.87	20.00	1.44	29.33	733.38
6h	6.93	17.40	1.81	27.15	963.10
12h	5.49	13.69	2.37	21.28	504.33
24h	5.48	8.20	3.00	17.71	1054.92
48h	5.73	5.08	3.65	15.44	511.18
72h	5.52	4.07	3.66	14.25	1022.25
96h	6.38	3.86	3.95	15.15	299.50
120h	4.66	3.70	3.76	13.12	661.00
x	6.04	10.24	2.84	19.99	767.90
min	4.66	3.70	1.23	13.12	299.50
max	7.07	20.86	3.95	30.19	1163.33

The greatest percentage of milk fat, protein, total dry matter and somatic cells were detected immediately after partus (7.07%, 20.86%, 30.19% respectively), after that they fall significantly, while the lactose have opposite results it is lowest after partus (23.1%) and then gradually increased (3.76%). This is in accordance with (Abd El Fattah et al., 2012) where concentrations of total dry matter, protein and fat after partus was 24.19%, 13.45% and 8.04% respectively, while the quantities of lactose was 1.89% with its increase until the fifth day after parturition. While the results from

Kehoe S.I., et al., (2007) indicate the following average concentrations of fat protein and lactose in colostrum 6.7%, 14.9% и 2.5% respectively. Low values of lactose match the physiology of the newborn calf, where lactose is found in low concentrations, and gradually increases (Kehoe S.I., et al., 2007). The high lipid content of colostrums allows the newborn calf to rapidly gain strength (Fisher H., 2000).

Protein and total dry matter are highly correlated (r=0,99) also positively correlated fat and proteins (r=0.75), and positively correlated fat and total dry matter (r=0.82). Protein was highly correlated negatively with lactose (r=-0.99), and also highly negatively correlated fat and lactose (r=-0.72). Among other parameters correlative dependence is very small.

Compared to milk, colostrum contains higher levels of proteins (Gerogiev, P.I., 2008), − lactalbumins, lactoglobulins and especially immunoglobulins (Ig), peptides, hormones, growth factors, prostaglandins, enzymes, cytokines, acute-phase proteins, nucleotides, polyamines, minerals, vitamins etc., and therefore the greatest changes have been in proteins which are heights after parturation (20.86%) and after the first day postpartum they starting decreased (8.20%), on the third day was 4.07%, while on the fifth day was 3.70%. The most consistent changes occur in milk protein content that is reduced more than twice by the 3rd post partum day compared to initial values (Ontsouka et al., 2003). This is mostly due to the sharp decrease in Ig fractions, whose concentration, was the highest in the first colostrum portions

Parity. stage of lactation and the month of calving were all associated with SCC. (O’Brien B., 2009). Mean percentage of somatic cell count after partus was 1163.33/ml x 1000, and decreased after that and on the fifth day after parturition the mean percentage was 661.00/ml x 1000. Elevated SCC may occur in milk in late gestation and for a few weeks following calving, regardless of infection status (Duane N.R, Bodman R.G., 1993). This SCC elevation appears to be part of a cow's natural immune system response in preparation for calving, to enhance the mammary gland defense mechanisms at this critical parturition time. Quarters with no infections generally have a rapid decline in SCC within a few weeks postpartum. Also the existence of intramammary infection (mastitis) is a real risk that colostrum may contain high amounts of somatic cells (Quigley J., 2010).

The researchers Ferdowski Nia et al., (2009), assume that very high counts of SCC were indicative of mastitis in the cows even in colostrum. In our research there was only one mastitis cow which was treated promptly with antibiotics. The high SCC could have been caused by a stress situation during cows' birth, as a consequence of increased susceptibility to the udder infection, especially with the animals whose birth was difficult, even in situations with no particular risk (Sgoiforossi *et al*., 2009). Secretion of colostrum is responsible for very high levels of somatic cells and immunoglobulins in milk for only the first 5-7 days after calving. Beyond this point, high SCC is due to intramammary infections (Fisher H., 2000).

The health of calves may be affected by the quality of colostrum. It's possible that cows with mastitis may produce colostrum containing pathogens which may cause scours in newborn calves (Quigley J., 2010). Increased colostral SCC may affect the highly sensitive and neonate small intestine, by depressing nutrient assimilation and causing diarrhea (Ferdowsi N., et al 2009).

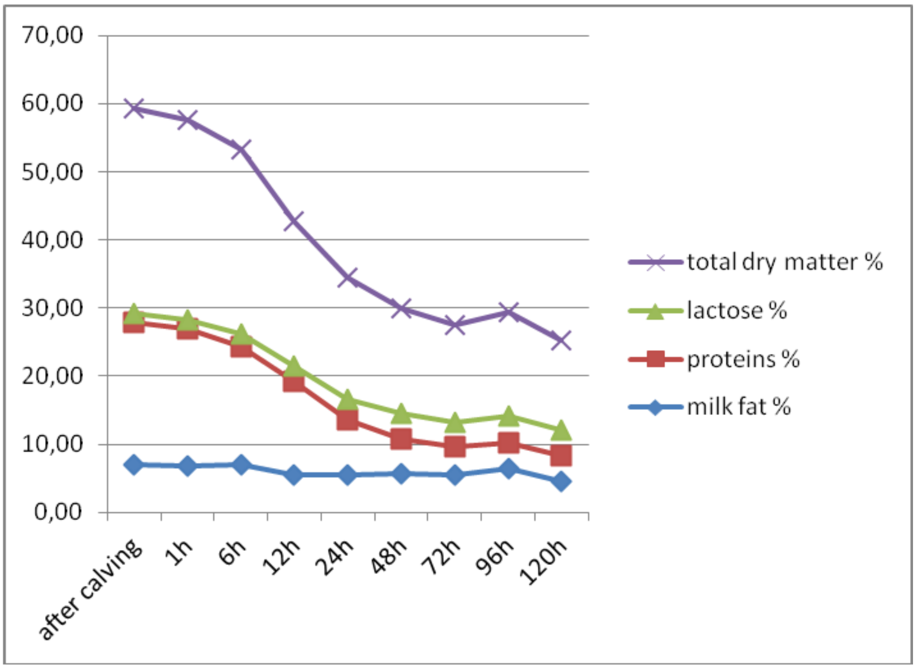

Figure 1: Fat, protein, lactose and total dry matter content evolution during the first five days after calving

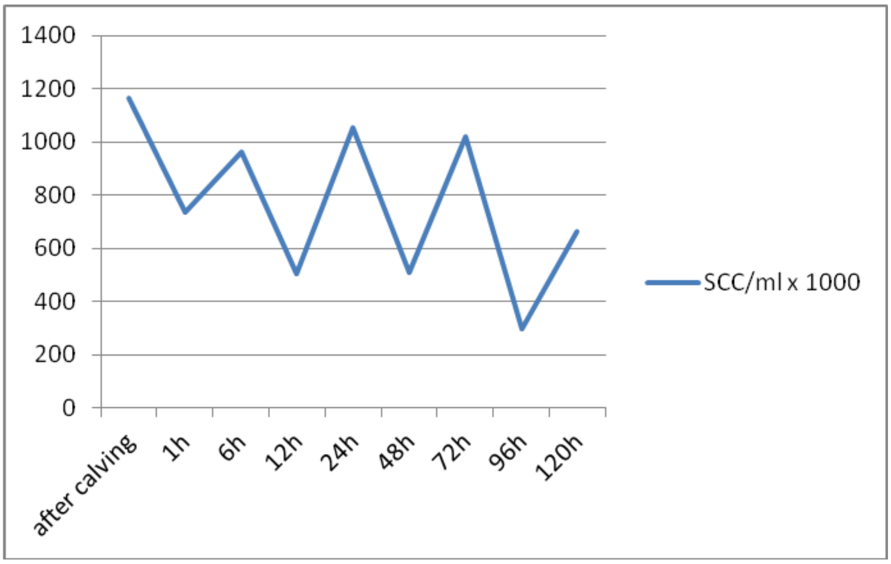

Figure 2: Somatic cell count (SCC/ml x 1000) evolution in milk during the first five days after calving

Conclusion

Results showed significant changes in colostrums composition from the first milking right after calving until fifth day postpartum. In the first colostrums the concentration of milk fat, protein and dry matter were high (7.07%, 20.86% and 30.19% respectively) and were almost half in the second milking, after hours. Lactose concentration was low at the beginning (1.23%) and increased slowly until the fifth day postpartum (3.76%). SCC were high in the first milking (1,163,330 cells/ml) and decreased after that. SCC continually oscillates due to the physiological condition of the cows. Protein and total dry matter are highly correlated (r=0,99) also positively correlated fat and proteins (r=0.75), and positively correlated fat and total dry matter (r=0.82). Protein was highly correlated negatively with lactose (r=-0.99), and also highly negatively correlated fat and lactose (r=-0.72). Among other parameters correlative dependence is very small.

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11.