

Influence of Breed, Parity and Food Intake on Chemical Composition of First Colostrum in Cow

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Abstract

The aim of this research was to establish the influence of breed, parity and food intake on chemical composition of first colostrum. We observed that fat, proteins, lactose and dry matter were higher in cows from second and third lactation compared to those in fourth lactation. Cow's breed also influenced the colostrum composition, superior quality being obtained in case of Romanian White and Black comparing Holstein Friesian cows. The unbalanced energo-proteic ratio had a negative impact on chemical composition of first colostrum.

Keywords: breed, colostrum, parity, feed intake.

1. Introduction

Colostrum is probably the „single most important feed in the world”, because for the newborn means everything, excepting oxygen. Colostrum is the udder secretion in the first 5-7 days after calving [1, 2].

Bovine colostrum contains various nutrients (proteins, essential and non-essential amino acids, lipids, lactose, vitamins, minerals, oligoelements) and non-nutrient substances (immunoglobulins, enzymes, nucleotides, peptides-lactoferrin, transferrin, growth factors, hormones-insulin, prolactin, thyroid hormones, cortisol and cytokins-tumor necrosis factor α) which are important for adaptation of neonatal calves to the new environmental factors after birth related to drastic change from primarily parenteral nutrition during fetal period to exclusively enteral provision of nutrients at birth (Blum and Hammon, 2000; Blum et al., 2002; Levieux, 1999; Blum and

Baumrucker, 2002 cit. by Piccione and al., 2009; Georgiev, 2005) [3, 4].

Colostrum has the ability to fight disease, to promote growth and well-being, to speed up the recovery process following injury and stress, has anti-aging properties, balanced blood sugar levels, ensuring increased performance [2].

Colostrum is richer in dry matter 2,5 times, in fat 2 times more, proteins 6 times, has 4-10 times more vitamins A, D and E, 2-4 times more Ca, P and Mg and has 10-17 times more iron than milk [1, 5].

From non-nutritive substances, immunoglobulins are the most important. They protect the calf till his own immunity system is completely active (6 weeks). IgG₁ is the main immunoglobulin from colostrum (50 mg/ml in Holstein breed) coming directly from the blood; IgM (5-8.7 mg/ml) and IgA (4 mg/ml) are synthesised in udder [6].

Colostrum composition is affected by age, breed, nutrition, health status of the cow and health status of the udder [7]. Protein and fat content from feeding ratio in dry period influence the milk composition, but not colostrum [8].

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2. Materials and methods

The study was carried out in two dairy farms from West region of Romania on Holstein Friesian and Romanian Black and White cows in 2008 and 2009. In this research was studied the influence of parity, rase and feed intake on first colostrum chemical composition. Researches were carried out on 11 Romanian Black and White cows and 18 Holstein Friesian multiparous cows. Samples of colostrum were collected at calving using milk machine.

Concentrations of fat, protein, lactose, solid non-fat extract in colostrum were determined with automatic milk analyser (LactoScan, Delta Intrumentes). Percentage of dry matter from colostrum was calculated by adding fat to the solids non-fat content. Values of colostrum components were expressed as means \pm SEM. The data were evaluated using the general ANOVA procedure.

3. Results and discussion

Feed intake in dry period has to be easy to digest, low volume and relish. Maximum ratio volume is 2-2.5 DM/100 kg body weight and silage has to be below 25% from nutritive value of ratio. Energy and protein demands are rising pre partum, but the feed intake decreases. That means ratio has to have high nutritive substances. Energetic and protein demands are high because they ensure the calf growth and the new lactation. [5, 9].

The nutrient necessary for cows (500-550 kg body weight after parturition) within 4 weeks before parturition are: 9.35 DM (kg/day), 5.9 g UFL, 490 g PDI, 54 g Ca, 31 g P after INRA (L'Institut National de la Recherche Agronomique), 1998 cit. by CRAINICEANU, 2002 [9].

Ingredient and nutrient composition of diets are presented in Table 1.

In both farms diets are unbalanced. Food ratio from farm A contains too much dry matter (12.04 DM/kg/day, compare with 11 DM/kg/day, quantity that cow can consume) and PDI is less than normal. In farm B food ratio is unbalanced ergo-proteic, there is less dry matter, also Ca and P. All of this can reflect in colostrum quality. Chemical composition of cow first colostrum is presented in Table 2. After the second lactation, the values of the main constituents of colostrum are lower, in both breeds, but are not significantly

different. The only significant difference was between fat content of colostrum from fourth lactation compared with second lactation, in Romanian Black and White cows ($p < 0.01$).

Different from other ingredients, lactose in colostrum is lower than in milk, because lactose has osmotic effects; it causes water influx in milk. Lower values of lactose in colostrum ensure high viscosity of colostrum and prevent diarrhea in newborn [10].

In Romanian Black and White cows, variation of chemical composition regarding lactation number are: for fat content in 3rd lactation compared with 2nd lactation (III/II) is -7.74%, ($p < 0.66$), IV/II is -33.96%, ($p < 0.01$), IV/III is -28.41%, ($p < 0.25$). For protein content in III/II lactation is +5.55%, ($p < 0.55$), IV/II is -0.80%, ($p < 0.93$), IV/III is -6.02%, ($p < 0.67$). Lactose in 3rd lactation compared with 2nd lactation (III/II) is +1.29%, ($p < 0.84$), in IV/II is +2.59%, ($p < 0.75$), IV/III is +1.28%, ($p < 0.96$), for solids non-fat in III/II lactation is +1.88%, ($p < 0.79$), IV/II is -9.55%, ($p < 0.24$), IV/III is -11.23%, ($p < 0.43$).

In Holstein Friesian cows, variation of chemical composition regarding lactation number is: for fat content in 3rd lactation compared with 2nd lactation (III/II) is -31.63%, ($p < 0.29$), in IV/II is -34.43%, ($p < 0.25$), IV/III is -4.08%, ($p < 0.93$). For protein content in III/II lactation is -5.33%, ($p < 0.74$), IV/II is -23.89%, ($p < 0.15$), IV/III is -19.60% ($p < 0.33$), for lactose in III/II lactation variation is +4.95%, ($p < 0.77$), IV/II is +32.43%, ($p < 0.06$), IV/III is +26.18%, ($p < 0.18$), for solids non-fat content in III/II lactation is -12.00%, ($p < 0.41$), IV/II is -22.39%, ($p < 0.14$), IV/III is -11.80% ($p < 0.60$).

Differences between breeds (Holstein Friesian/Romanian Black and White cows), regarding colostrum composition from second parity are for fat -12.94%, ($p < 0.42$), for protein is -21.05%, ($p < 0.01$), for solid non-fat -15.61% ($p < 0.05$), but lactose content is higher in Holstein Friesian with +44.15% ($p < 0.008$). In third parity Holstein Friesian cows had chemical composition of colostrum less than Romanian Black and White cows: for fat -12.94%, ($p < 0.42$), for protein -29.20%, ($p < 0.08$), solids non-fat -25.24%, ($p < 0.13$), but lactose increased with +49.35%, ($p < 0.28$). In fourth lactation Holstein Friesian cows had less fat content -13.56 ($p < 0.64$), less protein -39.43% ($p < 0.05$), more lactose +86.07% ($p < 0.02$)

and less solid non-fat -25.24% ($p < 0.13$) than Romanian Black and White cows.

The results from farm B are in accordance with those of Foley and Otterby (1978). They found in Holstein cow colostrum: 6.7% fat, 14% protein, 2.7 % lactose, solids non-fat 16.7% and dry matter 23.9% [11].

Studies regarding colostrum in Romanian Black and White cows were made by Czister and col.

(2008) and their results revealed 11.56% fat, 17.73% protein, 1.89% lactose, 20% solids non-fat and 32.18% total solids (dry matter) [12].

Other factor that influences the quality of first colostrum is the quantity of colostrum. In Romanian Black and White cows the average of first colostrum production per cow was 3.98L, comparative with Holstein cows were it was 7.06L.

Table 1. Ingredients and nutrient composition of diets

Item	Farm A	Farm B
Diet ingredient (kg/cow /day)		
Graminaceae hay	8	-
Corn silage	-	10
Triticosecale silage	-	6.0
Concentrates	2	1.5
Straw	4	3.0
Nutrient composition		
DM (kg/day)	12.04	8.20
UFL (g)	9.56	8.32
PDI (g)	382.37	495.80
Ca (g)	47.43	24.96
P (g)	32.01	22.48

DM = dry matter, PDI = intestinal protein, UFL = unit of net energy

Table 2. Chemical composition of cow colostrum (%)

Breed	No. of cows	Parity	Fat	Protein	Lactose	Solids non-fat	Dry matter
Romanian	5	2	9.04 ± 1.21	22.32 ± 2.42	1.54 ± 0.47	32.86 ± 1.97	41.90 ± 1.59
Black and White	2	3	8.34 ± 3.34	23.56 ± 1.98	1.56 ± 0.62	33.48 ± 4.70	41.82 ± 4.02
(farm A)	4	4	5.97* ± 1.75	22.14 ± 4.05	1.58 ± 0.54	29.72 ± 5.11	35.69 ± 3.43
Holstein	14	2	7.87 ± 3.04	17.62 ± 3.77	2.22 ± 0.48	27.73 ± 5.32	35.60 ± 4.18
Friesian	2	3	5.38 ± 2.37	16.68 ± 2.19	2.33 ± 0.40	24.40 ± 4.16	29.78 ± 3.26
(farm B)	2	4	5.16 ± 2.29	13.41 ± 2.97	2.94* ± 0.17	21.52 ± 5.11	26.68 ± 3.70

* significantly different, $p < 0.05$

4. Conclusions

Cow's breed, parity, feed intake and yield production influenced the chemical composition of first colostrum in farm A and B, but the differences are not significantly, except protein values. In Holstein cows, for all three parity studied, protein was lower ($p < 0.05$) than in Romanian Black and White cows.

Other factor that may influence the chemical composition of colostrum is the yield. As the yield of milk is lower, the chemical composition improves. In farm A the average daily milk production per cow was 12L, comparative with farm B were it was 20L milk/day/cow.

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