ANALYSIS OF FACTORS INFLUENCING IMMUNOGLOBULIN CONCENTRATION IN COLOSTRUM OF DAIRY COWS

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Abstract

Colostrum is the first natural food for the newborn calf. Colostrum with high immunoglobulin concentration provides passive immunity to the calf. The aim of research was to estimate immunoglobulin concentration in blood serum and colostrums of dairy cows and its influenced factors. The research was carried out at Latvia University of Agriculture, in dairy farm of Research and Study Farm. The research is carried out from December 2010 to January 2011 (winter time) and July to September 2011 (summer time). There are 34 samples of dairy cow's blood and colostrums used in the research. Blood samples of cows were collected from a tail vein during one hour after calving. They were centrifugated 15 min to determine the total amount of immunoglobulin's (Ig). According to Ig concentration in blood serum cows were classified into four groups: 1st group – 0.05 till 0.09; 2nd group - 0.10 till 0.14; 3rd group – 0.15 till 0.19; 4th group – 0.20 and > mg mL-1. Colostrum samples (50 mL-1) were collected during one hour after calving. They were frozen 18 °C and stored for 1 week. Total immunoglobulin (A, G and M) concentration was determined in colostrums by turbid metric method. The average immunoglobulin's concentration in blood serum was 0.13 ± 0.01 mg mL-1, but in colostrums 16.4 ± 2.26 mg mL-1. Immunoglobulin's concentration in colostrums was not significantly different among various age and breeds of cows (p > 0.05). Immunoglobulin's concentration in colostrum was not significantly different to cows with various dry period and calving season (p > 0.05).

Key words: cow, calf, colostrum, serum, immunoglobulin

INTRODUCTION

One of the most significant tasks to get a high – quality herd is a healthy rearing of calf. The aim of each farmer is to breed productive cows in situations when they have used much money to purchase pedigree cattle. Calves are genetically and economical investment for future. One of the most significant factors which allows to express their inherit skills or genetically potential is right and rich feeding of calf. Colostrum is the first and irreplaceable food for calf. Colostrum consists of biologically active components which provide a health and growth of new – born calf. Colostrum contains antivirus, antibacterial and anti inflammation influence. A passive immunity is provided by colostrum. The most significant antibacterial components are lactoferin, lactoperixidase, lysozyme and immunoglobulins. Immunoglobulins are specific proteins of immune system, which are transferred from blood serum into colostrum produced by cow before calving. Immunoglobulin's A, M and G is in cow's blood and colostrum. They are two isotopes of immunoglobulin G: G_1 and G_2, the most dominated immunoglobulin is G_1 and it makes 80% of total Ig G concentration [13].

To compare with milk, colostrums contains more proteins, fat, vitamins and immunoglobulins, but lactose is twice less in it [6]. It is important to feed a calf with colostrums of high Ig concentration. Quality colostrums consist of 60 - 101 mg mL^{-1} immunoglobulins concentration. It is recommended to feed a calf during the first day of life, at least 6 litres, in 3 – 4 meal times. With this amount Ig concentration 10 mg mL^{-1} [12] in calf's blood is provided during 24

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hours after calving. Cows age and breed, age of the first lactation, the length of dry period, season of calving, amount of milked colostrum, dry cows feeding, body condition, provoked stress, milk flowing out before calving, cows vaccination and other factors can influence immunoglobulin's concentration in colostrum [14].

The aim of research was to evaluate Ig concentration and its influencing factors in cow's colostrums and blood serum.

MATERIAL AND METHODS

The research was carried out at Latvia University of Agriculture, in dairy farm of Research and Study Farm. The research is carried out from December 2010 to January 2011 (winter time, n = 17) and July to September 2011 (summer time, n = 17). There are 34 samples of dairy cow's blood and colostrums used in the research.

Blood samples of cows were collected from a tail vein during one hour after calving. They were centrifugated 15 min to determine the total amount of immunoglobulin (Ig). According to Ig concentration in blood serum cows were classified into four groups: 1st group – 0.05 till 0.09; 2nd group - 0.10 till 0.14; 3rd group – 0.15 till 0.19 and 4th group – 0.20 and > mg mL^{-1}. Colostrum samples (50 mL^{-1}) were collected during one hour after calving. They were frozen 18°C and stored for 1 week. Obtained results about Ig concentration in colostrums are classified considering cows age: from the 1st till 4th lactation. Results of dry period length influence are classified from cows of two groups: 1st group - cows with optimal dry period length (45 till 60 days), 2nd group - cows with lengthen dry period (above 60 days). Obtained results are performed by using Microsoft Excel. Descriptive statistics is performed to analyse results: arithmetical mean and Standard Error of arithmetical mean ($\bar{X} \pm S_{\bar{x}}$). The data were subjected to one – way analysis of variance (ANOVA) to determine the significance of differences of means among immunoglobulin concentration. Linear correlation coefficient is used to determine results connection.

RESULTS AND DISCUSSIONS

Immunoglobulin concentration in bovine blood serum was wide from 0.05 to 0.27 mg mL^{-1}. It was important to determine whether cows with higher Ig concentration in blood serum it is higher in colostrums (Table 1).

Table 1 Immunoglobulin concentration of dairy cows in blood serum and colostrum

Research group	n	Lactation	Ig concentration in blood serum, mg mL^{-1}	Ig concentration in colostrum, mg mL^{-1}
1.	11	2.0 ± 0.33	0.07 ± 0.004	20.0 ± 2.85^{a}
2.	10	2.7 ± 0.17	0.12 ± 0.004	14.2 ± 1.96^{a}
3.	9	2.4 ± 0.24	0.17 ± 0.01	9.6 ± 1.79^{b}
4.	4	2.7 ± 0.88	0.24 ± 0.02	17.6 ± 3.70^{a}
Average	34	2.4 ± 0.16	0.13 ± 0.01	15.1 ± 1.42

[a, b] averages of immunoglobulin concentration in cows blood serum with different superscripts differ significantly ($p < 0.05$)

In average Ig concentration in cows blood serum was 0.13 ± 0.01 mg mL^{-1} to compare with other scientists [5; 11] published results (22.2 – 22.9 mg mL^{-1}), it is significantly lower. In average Ig concentration in cows colostrums was 15.1 ± 1.42 mg mL^{-1}, the lowest was 2.52 mg mL^{-1}, but the highest – 34.88 mg mL^{-1}. It is showed in literature, that Ig concentration in colostrums is 60 - 101 mg mL^{-1} [4; 9; 14]. Group No. 1, where Ig concentration in blood serum was 0.07 mg mL^{-1}, the average cow's age was two lactations. A negative correlation (r = - 032) was between Ig concentration in cows blood serum and colostrums, which contradicted to the literature results, r = 0.42 [1].

Milk production in farm becomes more intensive and the average time of cow's usage decreases. In Latvia the average age of cattle is 2.9 lactations, but in the research

group it was 2.4 lactations. In the sources of scientific literature there is a cognition that higher immunoglobulin concentration is in colostrums of older cows [2]. Research results of immunoglobulin concentration of different age groups of cows are shown in the figure 1.

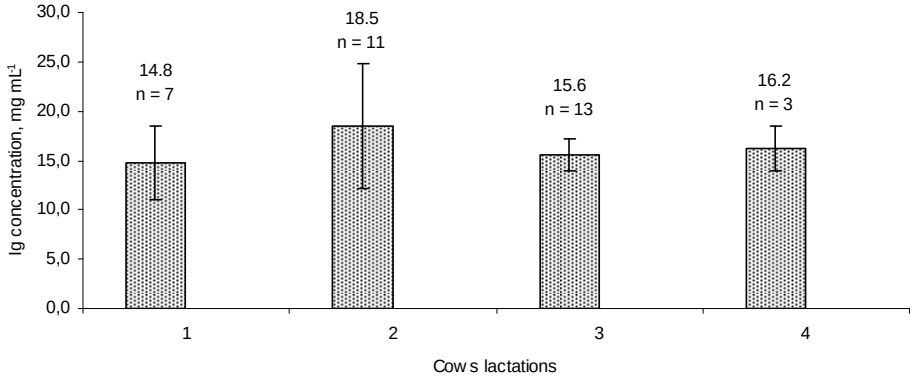

Figure 1. Immunoglobulin concentration in colostrums of different lactation cows.

Ig concentration in colostrums didn't vary significantly of different age group cows used in the research. The obtained average results were ranged from 14.8 mg mL^{-1} (1st lactation cows) to 18.5 mg mL^{-1} (2nd lactation cows). Calculated congruency between cows age and Ig concentration in colostrums was not significant (r = 0.02).

To get the qualitative colostrums, it is necessary to provide a cow with an optimal, length of dry period 45 - 60 days, for maximal yield and genetic progress [7]. The scientist [5] considers that immunoglobulins and other proteins in colostrums accumulate 3 to 4 weeks before calving. There were two groups of cows formed to analyse the influence of dry period (Table 2).

Table 2 Immunoglobulin concentration in colostrum at different dry period length

Group	Lactation	n	Dry period, days	Ig concentration, mg mL^{-1}	Min	Max
			$\bar{x} \pm s_{\bar{x}}$	$\bar{x} \pm s_{\bar{x}}$		
1.	2.6	17	54.5 ± 1.12[a]	15.7 ± 1.87	5.03	34.9
2.	2.8	10	77.6 ± 6.06[b]	14.2 ± 2.71	2.52	23.8

The results show that Ig concentration in colostrum of cows with an optimal dry period was 1.5 mg mL^{-1} higher, but it was not significantly higher than it was to cows with the lengthen dry period. The length of dry period (60 days and >) does not leave positive influence of Ig concentration in colostrum, it is confirmed by close negative correlation between mentioned items (r = - 0.87). The results confirm previous published results [3].

In other researches it is confirmed that higher colostrum is to Jersey cows, but lower quality colostrum is to Holstein cows [8]. It can be explained by different protein content in milk and milk yield. The similar tendency was expected in red, black and white cows colostrum. Latvian brown and Danish red cows are included in red cows group, but in black and white group – Holstein cows. The average Ig concentration in colostrum of red cows group was 17.8 ± 2.85 mg mL^{-1}, but Holstein cows colostrum 12.2 ± 2.40 mg mL^{-1},

the difference was not significant - 5.6 mg mL^{-1} ($p > 0.05$).

The quality of cow's colostrum is influenced by calving season. Ig concentration in colostrum decreases in hot and dry weather. During winter the amount of biologically active components in forage decreases, but these components are very important to provide cows immunity [10]. Higher Ig concentration in colostrums (18.9 ± 1.55 mg mL^{-1}) was to cows which were calved in summer time. The difference of Ig concentration in colostrum was not statistically significant between calving seasons.

CONCLUSIONS

The factors carried out in this research did not influence Ig concentration in cows serum and colostrums significantly. To get high quality colostrums, cows must be provided with optimal feeding and keeping, especially during cow's dry period. Quality of colostrums has an important influence on immune status of newborn calves.

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