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Quality Of Colostrum Milk Of Large Cattle Dairy Breeds.

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ABSTRACT

Colostrum serves as the main food for the calf in the early days of its life and contains everything that is required to support the young organism. In the absence of newborn calves immunity, it is the main source of immunoglobulins, lysozyme, functionally active leukocytes and lymphocytes. The main task of the research was to study the dynamics of the constituent elements of colostrum in the first 7 days after calving, in cows of Black Pied, Bestuzhev, Holstein and Ayrshire breeds. It has been established that colostrum of the first milk yield, compared to normal milk, has a relatively high protein content (16.9-23.6%), milk fat (6.5-8.2%) and, conversely, low lactose content (2.0-2.3%). Globulins have the highest mass fraction of colostrum proteins – 6.7-10.1%, which is from the total protein content, respectively, in the breeds of cows 38.6; 42.8; 39.6; 40.2%. The high mass fraction of proteins with an acid reaction provides a high acidity of colostrum – 48.5-59.6°T. A high proportion of immunoglobulins in the colostrum and high acidity provide the calves with an increase in the concentration of gamma globulins in blood proteins and active protection of the body. In connection with the breed characteristics of cows, the quality of the colostrum varies, which leads to a decrease in the immunity of calves and an increase in the incidence of dyspepsia. Dynamic increase in the content of immunoglobulins with age is observed in all breeds. The difference between the first and the maximum lactation was in Black Pied breed 35.9 g/l (110.5%), Bestuzhev – 59.7 g/l (94.2%), Holstein – 24.1 g/l (80.9%), Ayrshire – 42.0 g/l (73.8%). Bestuzhev breed outperformed analogs of other breeds in the maximum content of immunoglobulins in colostrum, respectively, by 54.7 g/l (80.0%), 69.2 g/l (128.4%), 24.2 g/l (24.5 %). Based on the results obtained, it is recommended to plan breeding work with Holstein and Black Pied breeds in order to increase the mass fraction of milk proteins and optimize the structure of protein fractions. To assess the quality of cow colostrum during the first milking after calving.

Keywords: breed, cow, calves, colostrum, chemical composition, proteins, immunoglobulins, acidity, immunity, body weight.

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INTRODUTION

The main condition for obtaining a high yield of milk from cows is the correct raising of herd replacements, in accordance with the growth and developmental charts for the age groups for a single breed [1,2].

One of the most important stages in growing young animals is the period from birth to 6 months of age, when the main organs and systems of the calf organism are formed and the bases of genetically determined animal productivity are laid [3,4].

When the calf is born, it loses its connection with the mother at the same time as the umbilical cord breaks, and its body begins to rebuild in order to adapt to the new postnatal conditions. At the same time, the calf is born completely sterile. The placenta in the womb of the cow serves as a natural biological barrier, not only protecting the fetus from pathogenic microbes but also not allowing the antibodies contained in its blood to pass to the fetus, which is the basis of immunity for the calf. Antibodies begin to enter the secretion of the mammary gland – colostrum from the cow's blood just a few days before the calving. In addition, the ability of antibodies to penetrate the calf intestinal wall sharply decreases during the first 12 hours after birth, and after 24 hours disappears completely [5,6,7].

Colostrum serves as the main food for the calf in the early days of its life. Colostrum contains everything that is required to provide vital activities to the young organism: proteins, fats, carbohydrates, macro and microelements, vitamins, enzymes and water. In the absence of newborn calves immunity, it is the main source of immunoglobulins, lysozyme, functionally active leukocytes and lymphocytes [1,3,5,8].

Colostrum is the mammary gland secretions produced in the first few days after calving. The share of colostrum accounts for about 0.5% of the annual productivity of the cow. Until recently, colostrum was considered almost exclusively as a source of immunoglobulins needed by the calf during the first hours of extrauterine life to acquire passive immunity. However, at the present time, colostrum is also given great importance as a source of highly valuable digestible proteins. In addition to valuable nutrients, colostrum contains a large number of growth-stimulating factors and cytokines. Growth factors contained in the colostrum contribute to anabolism and stimulate cell growth, which contributes to large increases in body weight [9,10,11].

The sterile organism of the calf after the birth begins to be intensively seeded with various microbes, which are abundant in the environment. Since the medium of the digestive tract of the newborn calves has a neutral reaction, and the mucus, which got there from the birth canal, is an excellent nutrient medium, the mucous membrane of the abomasum and forestomach is colonized by putrefactive and opportunistic pathogenic microflora. The microflora, which got into the body, begins to proliferate intensely in an hour, and after 4-6 hours causes a florid toxicosis. The only way to avoid this - is the timely calf rearing of the colostrum, no later than one hour after its birth. Getting into the digestive tract, colostrum creates the conditions for the growth of lactic acid bacteria, which in the process of life activity secrete lactic acid, which inhibits the progression of putrefactive microflora. In addition, the colostrum itself has an increased acidity of 40-60^{o}T, which also suppresses the progression of pathogenic microflora [12,13,14].

Many scientists were studying the effect of colostrum on the body of newborn calves, often receiving quite contradicting results. Therefore, the mechanism of colostrum influence on the organism of newborn calves and the formation of their colostral immunity requires further and more detailed study. The evidence from practice shows that the quality and properties of colostrum are influenced by numerous paratypic and genotypic factors [15,16,17].

Since the productivity of cows all over the world is continuously increasing, it can be assumed that this is accompanied by an increase in the proportion of colostrum with a reduced content of immunoglobulins in the first milking. According to Zarcula S. et al. (2010) in the colostrum of cows of local Romanian breeding, the proportion of proteins was 22.1-23.6%, and in colostrum of Holstein – 13.4-17.6%. Furthermore, a well-known fact is a higher content of immunoglobulins in the colostrum of full-grown cows compared to the colostrum of first-calf cows. In this case, the composition of colostrum is decisively influenced by the age of cows, and not by the amount of milk yield. This fact should be taken into account in connection with the current trends in

increasing the percentage of first-calf cows in the herds due to a reduction in the duration of productive use of cows, as well as the practice of total insemination of heifer calves followed by mass culling according to the results of the first lactation [18, 19, 20].

Due to the problem in the dairy cattle breeding caused by the receipt of a large number of weak and non-viable young animals, which creates certain difficulties in replacement of the milking herd, against the general background of a decline in the reproductive functions of the organism of highly productive cows with intensive milk production technology, the research task was to study the dynamics of colostrum quality during lactation and with age in animals of different breeds of dairy direction of productivity.

MATERIAL AND METHODS

Studies were carried out in the breeding farms of the natural and climatic zone of the Middle Volga region. The materials of the research were cows of the most widely used breeds in the region. From amongst the down-calving heifers, according to the method of analogs, taking into account the age and time of the calving, four groups were formed, 15 animal units each: I – Black Pied breed, II – Bestuzhev, III – Holstein, IV – Ayrshire. Black Pied and Bestuzhev – breeds of Russian breeding, Holstein and Ayrshire – breeds brought to Russia from Finland.

The same conditions of feeding and welfare were created at dairy farms for experimental animals. The feeding is conducted all-year-round by the same type of food - hay-ensilage fodder diet. The diet includes brome hay, medic haylage, corn silage, grain mixture, sunflower meal, soy oil meal, molasses, premix. Cubical-yard housing of cows, in cubicles with access to the loafing area. Milking in the milking parlor with the "Europarallel" milking machine.

The calves were kept in the maternity box together with the mother 24 hours after birth, then they were transferred to individual pens. The calving took place in the autumn period (October-November). The calves received the first portion of the colostrum by a suckling method no later than 45 minutes after birth. The calves were weighed daily during the colostrum period. The first weighing was carried out using the electronic balance "TAXATRON" immediately after birth, then at the end of each working day at 7 pm.

Medium samples of colostrum for laboratory tests were selected on the first day before the first calf sucking, the following days in the morning after the first milking. The chemical composition and physiological properties of the colostrum were studied in the officially recognized research laboratory of animal husbandry at the Faculty of Biotechnology and Veterinary Medicine of the State Federal-Funded Educational Institution of Higher Professional Training "Samara State Agricultural Academy". The methodology of colostrum research is described in the training manual: Mamaev A.V., Samusenko L.D. Dairy science. – SPb .: Publishing House "Lan", 2013. – 348 p. [21].

The fat weight fraction (FWF), the protein weight fraction (PWF), and the lactose content in the colostrum were determined using a high-speed infrared milk analyzer "Bentley 2000", the content of casein by the refractometric method using an IRF-464 refractometer, the quantitative content of protein fractions by densitometry of the received foregrams with the help of the IFO-451 microphotometer [22].

The obtained results of economic and laboratory studies were processed by the method of variational statistics using the software package Microsoft Office 2007 and STATISTICA-6.

RESULTS

Laboratory studies of colostrum showed that, in contrast with natural milk, the secretion of the mammary gland of cows in the first days after calving is significantly different in chemical composition and physical properties (Table 1).

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Table 1: The chemical composition of cow colostrums

Day of lactation	FWF, %	PWF, %	including, %			Lactose,%
			Casein	albumen	globulin	
Black Pied breed						
1	6.5±0.05	17.6±0.09	5.9±0.05	4.9±0.06	6.8±0.10	2.1±0.01
2	3.6±0.04	7.1±0.07	4.2±0.04	1.4±0.02	1.5±0.06	3.3±0.01
3	3.7±0.04	5.3±0.05	3.6±0.04	1.0±0.02	0.7±0.02	4.4±0.02
5	4.0±0.03	4.5±0.03	3.3±0.02	0.8±0.01	0.4±0.01	4.7±0.02
7	4.1±0.02	3.7±0.01	2.9±0.01	0.7±0.01	0.1±0.01	4.7±0.02
Bestuzhev breed						
1	7.9±0.05	23.6±0.13	6.8±0.07	6.7±0.05	10.1±0.13	2.0±0.01
2	4.8±0.05	10.4±0.10	4.9±0.05	3.0±0.03	3.5±0.08	3.1±0.01
3	4.1±0.03	7.7±0.08	4.3±0.04	1.5±0.01	1.9±0.02	4.2±0.02
5	4.2±0.03	5.2±0.05	3.4±0.02	1.1±0.01	0.7±0.01	4.5±0.02
7	4.3±0.01	4.2±0.02	3.2±0.02	0.8±0.01	0.2±0.01	4.6±0.03
Holstein breed						
1	6.8±0.07	16.9±0.15	5.6±0.08	4.6±0.05	6.7±0.11	2.3±0.01
2	3.4±0.05	6.6±0.11	3.8±0.04	1.2±0.02	1.6±0.07	3.6±0.02
3	3.3±0.05	4.9±0.07	3.4±0.03	0.9±0.01	0.6±0.01	4.5±0.03
5	3.7±0.03	4.0±0.05	2.9±0.01	0.8±0.01	0.3±0.01	4.6±0.02
7	3.9±0.03	3.5±0.04	2.7±0.01	0.7±0.01	0.1±0.01	4.7±0.02
Ayrshire breed						
1	8.2±0.08	22.9±0.18	6.8±0.05	6.9±0.04	9.2±0.10	2.2±0.01
2	5.4±0.06	10.7±0.13	4.7±0.04	2.7±0.02	3.3±0.05	3.2±0.01
3	4.5±0.05	8.0±0.08	4.5±0.04	1.6±0.01	1.9±0.01	4.4±0.02
5	4.6±0.05	5.6±0.04	3.6±0.03	1.2±0.01	0.8±0.01	4.7±0.03
7	4.8±0.04	4.5±0.03	3.4±0.02	0.9±0.01	0.2±0.01	4.8±0.03

Colostrum of the first milk yield after calving is characterized by a high content of the main components. In the meantime, there are very clear breed differences in the quantitative content of fat and proteins in the colostrum. It was found that the highest protein content was in the colostrum of Bestuzhev breed cows (23.6%), and the lowest in Holstein cows (16.9%). The difference was 6.7% and it was highly reliable P<0.001. The Ayrshire breed, despite being imported and in the process of adaptation, is characterized by a rather high protein content, be second only to Bestuzhev breed by 0.7%, but at the same time it leaves behind the Black Pied – by 5.3% (P <0.001), Holstein – by 6.0% (P <0.001).

Milk protein fractions can be combined into two groups – caseins, which are characterized by an acid reaction and are well coagulated by rennet enzyme, and whey proteins – lactoalbumins and lactoglobulins, which are not coagulated by the rennet enzyme, but are well digested by the calf organism. It should be noted that globulins have protective properties, protecting the body of newborns against the exposure to pathogenic microflora.

The analysis of the obtained results showed that the colostrum of different breeds varies significantly in the structure of protein fractions. The Black Pied breed has a mass fraction of casein greater than the mass fraction of albumins by 1.0% (P<0.001), but less than the mass fraction of globulins – by 0.9% (P<0.001), the Bestuzhev breed has a share of casein greater than albumin by 0.1% and less than the globulin by 3.3% (P<0.001), the Holstein breed has a difference of 1.0% (P<0.001) and 1.1% (P<0.001) respectively, the Ayrshire breed – 0.1% and 2.4% (P<0.001).

Under the identical feeding conditions, the mass fraction of casein in the colostrum of Bestuzhev and Ayrshire breeds is 0.9% (P<0.001) higher than that of Black Pied cows, and 1.2% (P<0.001) higher than that of Holstein cows. The content of albumins in the colostrum of the Ayrshire cows is higher than that of the Black Pied breed by 2.0% (P<0.001), Bestuzhev – by 0.2%, Holstein – by 2.3% (P<0.001). According to the content of globulins in colostrum, the Bestuzhev breed exceeded the analogs of the Black Pied breed by 3.3% (P<0.001), Holstein – by 3.4% (P<0.001), Ayrshire – by 0.9% (P<0.01).

According to the content of the mass fraction of fat in the colostrum, the best parameters were found in the Ayrshire cows (8.2%), which exceeded the Black Pied breed by 1.7% (P<0.001), Bestuzhev – by 0.3%, Holstein – by 1.4% (P<0.001).

The content of lactose in comparison with the mass fraction of fat and protein, on the contrary, was minimal in the first milking of colostrum, after which a dynamic increase in its content was observed with each milking. It should be noted that the inter-breed difference was insignificant and statically not reliable.

A very important property that determines the biological function of the colostrum for the calf organism is a regular decrease in the concentration of its components with each subsequent milking. A study of the dynamics of the chemical composition of colostrum among cows of different breeds has shown that the changes occurring in it vary significantly in intensity and in quantitative indices.

On the second day after calving, the mass fraction of fat in the colostrum decreases 1.8 times for the Black Pied breed, 1.6 for the Bestuzhev breed, 2.0 for Holstein, and 1.5 for Ayrshire. On the third day, the fat content increases by 0.1% for cows of the Black Pied breed, for the Bestuzhev breed it decreases by 0.7%, for Holstein – by 0.1%, for Ayrshire – by 0.9%. On the fifth day of lactation, an increase in the mass fraction of fat is observed in all breeds, respectively in groups by 0.3; 0.1; 0.4; 0.1%. By the end of the colostrum period, the mass fraction of fat among the cows of the studied breeds is still increasing by 0.1; 0.1; 0.2; 0.2%.

After the first milking, the protein fractions begin to decrease considerably in the cow colostrum. On the second day of lactation, the mass fraction of the total protein decreases by 2.5 times for the Black Pied breed, for Bestuzhev – by 2.3, for Holstein – by 2.6, for Ayrshire – by 2.1 times. The fraction of casein changes the least; respectively according to breeds by 1.4; 1.4; 1.5; 1.5 times. The fraction of albumin decreases substantially – 3.5; 2.2; 3.8; 2.6 times. The mass fraction of globulins changes most, decreasing by 4.5; 2.9; 4.2; 2.8 times.

In the first milking after the calving, the fraction of globulins predominates in the colostrum proteins, thereby ensuring colostral immunity for the calf organism. In the total mass of proteins, the globulin fraction is for the Black Pied breed – 38.6%, for Bestuzhev – 42.8%, for Holstein – 39.6%, for Ayrshire – 40.2%. At the same time, by the end of the colostrum period, the greatest changes occur in the globulin fraction. On the seventh day of lactation, the mass fraction of globulins is only 0.1-0.2% regardless of the breed of cows.

The chemical composition of the colostrum provides very important properties, such as density and acidity. Low titratable acidity (less than 38°T) of colostrum is one of the main causes of dyspepsia among the newborn calves (Table 2).

Table 2:Dynamics of density and acidity of cow colostrums

Day of lactation	Breed			
	Black Pied	Bestuzhev	Holstein	Ayrshire
Colostrum density, °A				
1	56.5±0.74	78.2±0.98	51.3±0.69	77.6±0.87
2	31.6±0.59	46.7±0.76	29.8±0.54	48.1±0.73
3	29.7±0.52	35.9±0.70	28.6±0.52	37.2±0.66
5	28.8±0.51	31.3±0.64	27.9±0.52	32.3±0.61
7	28.4±0.48	29.8±0.61	27.1±0.49	30.4±0.57
Colostrum acidity, °T				
1	51.3±0.49	59.6±0.58	48.5±0.63	56.7±0.54
2	39.6±0.37	43.5±0.42	37.8±0.54	41.4±0.46
3	32.5±0.33	35.7±0.36	31.8±0.45	33.9±0.39
5	28.9±0.31	30.3±0.29	28.1±0.41	29.6±0.33
7	23.4±0.29	25.1±0.26	22.3±0.36	24.8±0.27

High concentration of the main components in the colostrum of the first milk yield among the cows of the experimental groups ensures its high quality and usefulness. As a result, the density of the colostrum is

within the physiologically normal state. The highest density – 78.2 °A was in the colostrum of the Bestuzhev cows, which is higher in comparison with the Black Pied breed by 21.7°A (38.4%, P <0.001), Holstein – by 26.9% (52.4%; P <0.001), Ayrshire – by 0.6 °A (0.8%).

On the second day after calving, due to a significant decrease in the concentration of the main components of the colostrum, the density decreased, respectively, pursuant to the groups by 44.1; 40.3; 41.9; 38.0% (P<0.001). The dynamic change in the chemical composition of colostrum provides a reduction in its density. By the end of the colostrum period, the density reaches a level of 27.1 – 30.4 °A, which is typical for normal milk. Since most of the dry matter of the colostrum is made up of proteins that have high acidity, its active acidity is quite high. Acidity not lower than 48°T is considered normal for the cow colostrum. The highest rates were for the colostrum of the Bestuzhev breed – 59.6 °T, which is higher in comparison with the by Black Pied breed by 8.3°T (16.2%, P<0.001), Holstein – by 11.1°T (22.9%, P <0.001), Ayrshire – by 2.9°T (5.1%, P<0.005).

As a result of a decrease in the mass fraction of proteins in the colostrum, a decrease in acidity was observed on the second day of lactation among the Black Pied breed by 11.7 °T (22.8%, P<0.001), Bestuzhev – by 16.1°T (27.0% P<0.001), Holstein – by 10.7 °T (22.1%, P<0.001), Ayrshire – by 15.3 °T (27.0%, P<0.001). By the end of the colostrum period, the titrated acidity of the colostrum of the studied cattle breeds practically reaches the physiological norm, which is typical for normal cow milk.

Three main classes of immunoglobulins (IgG, IgA, IgM) were found in the globulin fraction of the proteins of the cattle colostrum. In the case of normal lactation, 81% of immunoglobulins (antibodies) are synthesized from blood serum (Table 3).

Table 3: Change in the content of immunoglobulins in the secretion of the mammary gland during the colostrum period

Day of lactation	Breed			
	Black Pied	Bestuzhev	Holstein	Ayrshire
Immunoglobulins of class G, g/l				
1	52.90±0.59	84.67±0.67	45.28±0.56	71.64±0.69
2	26.54±0.31	47.13±0.38	26.93±0.27	37.85±0.33
3	0.10±0.001	0.15±0.001	0.08±0.001	0.13±0.001
5	-	-	-	-
7	-	-	-	-
Immunoglobulins of class A, g/l				
1	6.69±0.34	8.73±0.29	5.86±0.37	7.89±0.25
2	5.14±0.29	6.25±0.24	4.88±0.33	5.63±0.21
3	3.10±0.25	3.68±0.22	3.05±0.28	3.31±0.19
5	0.85±0.13	0.99±0.17	0.83±0.21	0.90±0.14
7	0.54±0.11	0.63±0.09	0.51±0.15	0.59±0.10
Immunoglobulins of class M, g/l				
1	3.21±0.31	4.94±0.27	2.78±0.29	4.26±0.33
2	1.12±0.23	1.65±0.19	0.96±0.20	1.42±0.25
3	0.75±0.14	1.12±0.11	0.72±0.10	0.98±0.16
5	0.31±0.08	0.43±0.05	0.29±0.06	0.40±0.09
7	-	-	-	-

Most of all in the first milking of colostrum contains IgG. It has been established that to a large extent the content of immunoglobulins in the colostrum providing humoral immunity in the calves depends on the breed of their mothers. Cows of the Bestuzhev breed in terms of IgG colostrum content exceeded the Black Pied breed by 31.77 g/l (60.1%, P<0.001), Holstein – by 39.39 g/l (87.0%, P<0.001), Ayrshire by 13.03 g/l (18.2, P<0.001).

On the second day after calving, the content of IgG in the colostrum decreased, respectively, by 2.0; 1.8; 1.7; 1.9 times, and on the third day there were only remains of IgG (0.08-0.15 g/l).A similar sequence is

observed in the dynamics of immunoglobulins of class A and M. IgM disappears in the colostrum of cows after the fifth day of lactation. By the end of the colostrum period, only immunoglobulins of class A remain in the colostrum.

The quality of the colostrum of the studied cattle breeds significantly influenced the adaptive abilities of the newborn calves. In the group of a young stock of the Bestuzhev breed, no calves got affected by dyspepsia during the colostrum period, in the group of the Black Pied breed, there were 4 such animals, Holstein breed – 6 animals, Ayrshire – 1 animal. The disease adversely affected the growth and development of calves (Table 4).

Table 4: Dynamics of body weight of calves during the colostrum period

Day of life	Breed			
	Black Pied	Bestuzhev	Holstein	Ayrshire
Body weight of calves, kg				
Newborns	34.03±0.46	29.80±0.34	38.50±0.54	35.64±0.37
1	33.80±0.48	29.60±0.34	38.21±0.53	35.39±0.37
2	33.66±0.49	29.68±0.36	38.06±0.55	35.42±0.38
3	39.74±0.46	29.78±0.37	37.97±0.58	35.53±0.40
4	33.84±0.49	29.97±0.35	38.05±0.60	35.70±0.39
5	33.97±0.51	30.17±0.34	38.18±0.59	35.88±0.39
6	34.12±0.50	30.41±0.32	38.32±0.57	36.10±0.38
7	34.31±0.50	30.68±0.32	38.49±0.56	36.35±0.36
Average daily growth in body weight of calves, g				
1	-231.4±1.56	-199.7±1.24	-293.6±1.93	-249.5±1.49
2	-139.8±1.28	83.6±1.31	-151.5±1.78	32.3±1.18
3	80.0±1.12	101.3±1.25	-89.7±1.56	110.5±1.27
4	100.3±1.34	189.7±1.29	82.3±1.63	170.8±1.33
5	131.5±1.36	198.9±1.30	130.1±1.59	181.3±1.40
6	149.8±1.41	241.3±1.42	141.3±1.61	220.3±1.44
7	190.1±1.48	269.7±1.44	168.9±1.68	252.0±1.53

The calf after birth falls into the aggressive environment and its body begins to adapt intensively to these conditions. The studied breeds are divided into three categories according to body size: small, medium and large. Bestuzhev breed with a body weight of cows of 525 kg can be attributed to small breeds, Black Pied and Ayrshire breed with a body weight of 550 and 580 kg – to medium, Holstein with a body weight of 640 kg – to large breeds. Concerning this, the largest calves were born with the cows of Holstein breed (38.21 kg), which is more by 4.41 kg (13.0%, $P<0.001$) compared to Black Pied breed, to Bestuzhev – by 8.61 kg (29.1%, $P<0.001$), to Ayrshire – by 2.82 kg (8.0%, $P<0.005$).

In the first day after birth, as a result of calf adaptation, the body weight is reduced by 199.7-293.6 g. The calves of Bestuzhev and Ayrshire breed begin to increase the body weight from the second day of life, of the Black Pied breed, weight loss is observed for two days, and Holstein – for three days. The average daily increase in body weight in the group is associated with the presence of calves with dyspepsia.

There is evidence that the quality of cow colostrum varies significantly with age. According to Fallon R. [18], the colostrum of full-grown cows contains significantly more immunoglobulins than the colostrum of first-calf cows (Table 5).

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Table 5: Change in the content of immunoglobulins in cow colostrum with age, g/l

Lactation	Breed				Limit
	Black Pied	Bestuzhev	Holstein	Ayrshire	
1	32.5±0.42	63.4±0.39	29.8±0.37	56.9±0.46	8-79
2	49.3±0.49	78.6±0.51	36.5±0.44	65.8±0.54	13-87
3	62.8±0.56	98.3±0.67	53.9±0.58	83.8±0.71	15-112
4	68.4±0.64	112.3±0.72	47.4±0.53	98.9±0.85	18-139
5	56.2±0.51	123.1±0.78	38.9±0.42	92.6±0.89	14-142
6	48.5±0.43	95.8±0.67	-	83.3±0.73	11-128

It has been established that the highest content of immunoglobulins in colostrum was found in cows of Bestuzhev breed – 63.4 g/l, which exceeded the Black Pied cows by 30.9 g/l, (995.1%; P<0.001), Holstein – by 33.6 g/l (112.8% P<0.001), Ayrshire – by 6.5 g/l (11.4%, P<0.001). Dynamic increase in the content of immunoglobulins with age is observed in all breeds. Moreover, the maximum content of immunoglobulins in different breeds is manifested in different age periods. The maximum content of immunoglobulins was noted among the cows of the Black Pied breed during the fourth lactation, of the Bestuzhev breed – during the fifth, Holstein – during the third, and Ayrshire – during the fourth lactation. The difference between the first and maximum lactation was, respectively, 35.9 g/l (110.5%, P<0.001), 59.7 g/l (94.2%, P<0.001), 24.1 g/l (80.9%, P<0.001), 42.0 g/l (73.8%, P<0.001). Bestuzhev breed outperformed analogs of other breeds in the maximum content of immunoglobulins in colostrum, respectively, by 54.7 g/l (80.0%; P<0,001), 69.2 g/l (128.4%; P<0,001), 24.2 g/l (24.5 %; P<0,001)

According to Morin D.E. et al. [8], the mass fraction of IgG, the most numerous of the immunoglobulin group, is negatively correlated with the amount of colostrum in the milk. This indicates a very important problem in dairy cattle breeding – a worldwide continuous increase in the dairy productivity of cows. An increase in the level of milk productivity leads to a premature exclusion of cows from the herd, a reduction in the period of their productive use, and a decrease in the profitability of milk production (Table 6)

Table 6: The main reasons for the culling of cows, %

Reason	Breed			
	Black Pied	Bestuzhev	Holstein	Ayrshire
Low productivity	25.0	32.4	8.5	18.6
Gynecological disorders and infertility	23.7	17.9	39.2	28.2
Udder trouble	17.4	15.6	19.5	20.4
Disease of the extremities	9.4	5.8	15.2	7.6
Leukemia	8.3	1.2	10.4	6.8
Other reasons	16.2	27.1	7.2	18.4

The first four reasons for excluding cows from the herd are directly related to the level of milk productivity of cows. Modern milk production makes very high demands on this indicator. The highest percentage of culling was found in the group of Bestuzhev cows – 32.4%, and the lowest among Holstein breeds – 8.5%. With the increase in milk yields, the share of culled cows is increasing, which is associated with gynecological diseases and infertility. Here the inverse dependence is observed and the highest percentage of culling in Holstein cows – 39.2%, and the lowest among Bestuzhev breed – 17.9%. Previous studies confirm that the increase in milk productivity negatively affects the reproductive qualities of cows. At the same time, it was established that an increase in milk yield for lactation of more than 6 thousand kg of milk leads to an increase in the number of udder troubles among cows. The increase in milk yields also requires changing the conditions of feeding by increasing the level of feeding and increasing the proportion of concentrated fodder in the diet. Feeding cows of a large number of concentrated fodders cause an increase in the acidity of the paunch manure, the occurrence of acidosis and ketosis, and as a result – laminitis and disease of the

extremities. The largest number of cows with limb disease – 15.2% – was in the group of Holstein cows with a milk yield of 8368 kg, and the smallest among Bestuzhev breed – 5.8% – with a milk yield of cows of 4931 kg per lactation.

DISCUSSION

As a result of the study of the chemical composition of the colostrum at different stages of the colostrum period, it is established that its composition at the first milking is characterized by a high content of fat, proteins of different fractions and, conversely, low lactose content.

Milk fat is a source of energy and is considered the most valuable colostrum component. However, in the context of biology and nutrition physiology, proteins exceed fat in terms of biological and nutritional value. In milk and colostrum, fat is in the form of fat globules, which are covered with a protein coat. Colostrum fat globules are much smaller than in normal milk. This ensures their better digestibility in the calves. The smallest fat globules were in the colostrum of the Bestuzhev breed, and the larger ones in the Ayrshire cows.

High protein content is a very important element of colostrum. As already mentioned, proteins are divided into two groups: caseins and serum proteins (albumins and globulins). However, the main part of normal milk proteins is represented by caseins – 82% and albumins account for 12%, globulins – 6%, while the share of casein in the colostrum of the first milk yield is, respectively, according to the breeds of cows 33.5; 28.8; 33.1; 29.7%.The fraction of globulins in colostrum proteins has the largest percent, respectively 38.6; 42.8; 39.6; 40.2%. Immunoglobulins of colostrum compensate the immune deficiency of newborn calves and form a colostral immunity in their bodies. Immunoglobulins (antibodies) are complex protein fractions that can bind to foreign substances – antigens and provide humoral immunity.

In addition, it should be noted that milk proteins have acid reaction and with a significant increase in the mass fraction of protein in the colostrum of the first milk, it acquires high acidity. The normal acidity of colostrum is not less than 48°T. High acidity of the colostrum creates a difficult environment for the development of pathogenic microflora in the abomasum of calves.

A high proportion of immunoglobulins in the colostrum and high acidity provide the calves with an increase in the concentration of gamma globulins in blood proteins and active cell protection of the body. As a result, not a single case of dyspepsia was detected among the Bestuzhev breed calves consuming colostrum with a content of globulins of 10.1% and acidity of 59.6°T. Among the calves of other breeds, from 1 to 6 cases of gastrointestinal diseases were noted as the quality of the colostrum decreased, especially in the first hours after calving. The calves of Holstein and Black Pied breeds, which received less than full colostrum, were poorly adapted to new environmental conditions, had weak immunity and were more susceptible to the influence of pathogenic microflora, in comparison with the analogs of Bestuzhev and Ayrshire breeds.

What is the reason for the low quality of colostrum of Holstein and Black Pied breeds? First of all, the reason lies in the constant increase in milk productivity of cows to solve the problem of providing the population with milk, not at the expense of increasing the number of livestock, but at the expense of raising the milk yield. It does not take into account that the amount of milk is negatively correlated with the main components of both milk and colostrum [8,15].

A high level of milk productivity destroys the cow's body. At the same time, as a result, the period of productive use is shortened and there are fewer cows able to give full colostrum in the herd. The need to feed the calves with a colostrum, which does not meet the physiological standards, leads to an increase in the number of diseases of the gastrointestinal and respiratory tracts. In turn, it is practically impossible to grow a highly productive cow from weak, unhealthy calves. In order to increase the yield of calves, we are forced to inseminate all the number of heifers grown, followed by mass culling due to their low milk production. Attempts to "improve" the composition of colostrum by changing the level of feeding and the composition of the diet at the end of the dry period did not lead to success. According to Quigley I.D.et al. [12,13,14], increased feeding leads to an increase in the amount of colostrum in the first milking and a significant decrease in the concentration of immunoglobulins in it.

In accordance with the physiological norm, the content of immunoglobulins of class G in colostrum should not be less than 60 g/l. In our studies, it was established that none of the breeds studied did not meet these requirements during the first lactation. During the second lactation, only colostrum of the Bestuzhev breed approached the lower threshold of the physiological norm. During the third lactation and older, colostrum of the Bestuzhev and Ayrshire breeds was recognized as healthful, with a total content of immunoglobulins, respectively 98.3-123.1 g/l and 83.8-98.9 g/l, immunoglobulins of class G –84.67 and 71.64 g/l. Colostrum of Black Pied and Holstein cows in all age periods was recognized as incomplete.

CONCLUSION

Cows of different breeds and different geographical origin have significant differences in the quality of colostrum. The Black Pied Dutch breed of cattle was used to breed all studied breeds to a greater or lesser degree. Differences between them are based on the direction of selection work when creating and breeding these breeds. Therefore, to improve the quality of colostrum and reduce the incidence of calves dyspepsia during the colostrum period, it is recommended that breeding work with Holstein and Black Pied breeds should be planned in the direction of increasing the mass fraction of proteins in milk and optimizing the structure of protein fractions. To assess the quality of cow colostrum during the first milking after calving. When breeding highly productive cows, consider that the value of milk yields is negatively correlated with the content of the main colostrum components, and especially with the concentration of immunoglobulins, which ensure the formation of colostral immunity in the body of newborn calves.

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