IJABR

International Journal of Advanced Biotechnology and Research (IJABR)
ISSN 0976-2612, Online ISSN 2278–599X,
Vol-10, Issue-2, 2019, pp157-172
http://www.bipublication.com

Research Article

Diagnosis of the nutritional value of colostrum in cows of different milk yield

Parshina V. I., Nontina E.A., Bykova I.A.,

Petrukhina O.A., Terekhin A.A., .

Voronina Ju. Yu., Bondareva I.V. and Zuev E.A.

Peoples' Friendship University of Russia (RUDN University),
6 Miklukho-Maklaya St, Moscow, 117198, Russian Federation

***Corresponding author:** Parshina Valentina Ivanovna,
E-mail: valentina5@mail.ru, tel.+7929001745

[Received: 21/02/2019; Accepted: 12/04/2019; Published: 15/04/2019]

ABSTRACT

When forming in an organism of a newborn calf of tentative immunity, the main source of immunoglobulins, a lysozyme, the functionally active leukocytes and lymphocytes, a colostrum is. The quality of a colostrum is a very important condition for formation of full-fledged immunity. A number of scientists claim that cows of different lactic breeds considerably differ on the level of lactic efficiency, at the same time the mass fraction of immunoglobulins negatively correlates with amount of colostrum at the first milking. Studying of dynamics of quality of a colostrum depending on the size of a milk yielding of cows for a lactation was a primal problem of researches. As an object of researches served the cows of four breeds divorced in the Samara region: Black Pied breeds, Bestuzhev, Holstein and Ayrshire. It is established that the content of immunoglobulins in a colostrum of the first yield of milk at cows of different breeds changes under the influence of the level of lactic efficiency and also with the animals' age. The highest content of immunoglobulins was in a colostrum of Bestuzhev breed – 103.35-81.38 g/l, and the lowest at Holstein breed – 74.52-42.29 g/l. Immunoglobulins of a colostrum are divided into three classes – IgG, IgA, IGM. In a colostrum of the first milk yielding of cows of Black Pied breed the share of IgG makes 84.1-85.5%, Bestuzhev breed – 85.7-86.3%, Holstein – 83.9-84.4%, Ayrshire – 85.7-86.6%. The tendency of increase in a share of IgG, in process of increase in milk yields of cows for a lactation is noted. It is established that at increase in level of lactic efficiency of cows, the quality of a colostrum decreases and the number of incidence of calves increases. As a result, the size of average daily gain of young growth live weight proportionally decreases. On the basis of the received results we recommend to estimate quality of a colostrum of the first milk yield by means of an optical or digital refractometer. Carry out the targeted selection work with breeds in the direction of colostrum upgrading.

Key words: Breed, Cow, Calves, Colostrum, Quality, Lactation, Yield of milk, Immunoglobulins, Incidence.

INTRODUCTION

Ontogenesis of an organism is strictly subject to its hereditary program[1,2], the implementation of which determines the stages of passage of all processes[3] and the degree of manifestation of various signs[4,5]. A huge role in this is played by the processes occurring in the body in the earliest periods of its existence[6,7]. They can seriously disrupt his adaptive abilities[8], and sometimes cause various pathologies[9,10]. In this regard, modern researchers pay great attention to the study of various factors that can affect the body during its early ontogenesis[11,12]. It becomes clear that the longevity of the body and the level of phenotypic manifestation of its

characteristics depend on their combination[13]. This is of particular economic importance in relation to productive animals and especially cattle[14].

From the moment of the birth of a calf and until achievement of a physiological maturity the considerable changes in a structure of all bodies and the systems of an organism happen by it[15]. The most important and responsible is the neonatality period[16]. It is important, first of all, as adaptation, the bound to activization of the immune system of an organism protecting a calf from negative impact of a surrounding medium and a pathogenic microflora[17]. The calf is born almost sterile, at the same time in his organism completely there is no immunity as antibodies are not transferred to a calf directly in mother's organism[18]. A placenta, being a natural biological barrier, not only protects a fetus organism from pathogenic microbes, but also blocks receipt to it of antibodies which are an immunity basis for a calf[19]. Antibodies come to an organism of a calf with a colostrum where they get from mother's blood some days before calving[20].

Colostrum is the main food for newborn calves. Colostrum contains all necessary components for providing vital activity of a calf: proteins, fats, macro and microelements, vitamins, enzymes and water[21,22]. To form tentative colostral immunity, a colostrum is the main source of immunoglobulins, a lysozyme, the functionally fissile leukocytes and lymphocytes[23]. Besides, a colostrum contains a large number of growth factors and cytokines[24]. Therefore, the calf has to receive the first portion of a colostrum as soon as possible and no later than one hour after the birth[25]. Getting into a digestive tract, a colostrum creates the favorable conditions for development of milky sour bacteria which waste product is lactic acid, oppresses development of a sour and pathogenic microflora[26,27]. At the same time, a colostrum has high actual acidity $40\text{-}60^0$ T that also suppresses the activity of a pathogenic microflora[28,29].

Very important condition for formation in an organism of a calf of immunity, is the quality of a colostrum. It especially falls into the first portion of a colostrum after a calving. A number of scientists claim that various genotypical and paratypical factors affect on a quality of a colostrum. In the experiences of Hartmann P.E. (1973), Scammell A.W. (2001), Akers R.M. (2006) it is established that within the different breeds of cows, the size of the first yield of milk changes within 2.2-17.6 kg. Morin D.E. (1997) at the same time claims that the mass fraction of immunoglobulins negatively correlates with the amount of colostrum at the first milking. In experiences of Pritchett L.C. (1991) cows with a yield of milk in the first milking of 8 kg, at 23% of animals in a colostrum had a maintenance of IgG below physiological norm (60.0 g/l). At increase in a yield of milk more than 8 kg, the percent of cows with a colostrum of such quality increased[30-33].

As the efficiency of cows around the world continuously grows, it is followed by increase in amount of colostrum with the reduced content of immunoglobulins in the first yield of milk. According to Zarcula et.al. (2010), in a colostrum of cows of local Romanian breed the mass fraction of protein made 22.1-23.6%, and in a colostrum of Holstein breed which was selected for high yields of milk, only 13.4-17.6%[34]. A number of researchers came to a conclusion that long selection of breeds on increase in level of lactic efficiency, affects the quality of offspring, its viability and also the indexes of reproductive function of cows[35,36]. In separate herds of the USA up to 10.0% of calves perish in the first days after the birth. About 80.0% from a death toll of animals have no anatomic aberrations. These facts are bound to breed of cows and level of their lactic efficiency. On large lactic complexes the common incidence of calves reaches 91.32%, including bodies of respiration – 50.98% and digestive organs – 31.96%[37,38].

Despite the considerable study of a problem of quality of a colostrum and influence on it of various factors, the received results are rather contradictory. The mechanisms regulating the composition of colostrum and allowing to influence its quality have not been deciphered yet though the influence of many factors on this indicator is taken for granted.

Therefore this subject remains relevant so far and demands additional researches.

MATERIALS AND METHODS

Scientific and economic experiment was made in breeding farms of Samara region and the Republic of Bashkortostan. As an object of researches served the cows of four breeds of the lactic direction of efficiency, up to 50 heads in each group: the first group – Black Pied breed, the second group – Bectuzhev breed, the third group – Holstein breed, the fourth group – Ayrshire breed. Black Pied dreed and Bectuzhev were bred in the natural and climatic zone of the Middle Volga region, Holstein breed was brought to Russia from Germany, Ayrshire breed was brought from Finland.

Researches were conducted in the conditions of the modern complexes on production of milk. The cows were kept in free-stall housing, in sections with access to the loafing area. Calvings are carried out in special maternity boxes. Milking of cows in delivery ward with "Yolochka" milking machine, in the shop of production of milk with "Evroparallel" milking machine with a fast exit. The feeding of cows is conducted all- year-round by the same type of food – hay-ensilage fodder diet. The diet of cows includes brome hay, medic haulage, corn silage, grain mixture, sunflower meal, soy oil meal, molasses and premix.

The calving of cows took place in October – November. The first days after the birth of calves were kept together with mother in maternity isolation ward. Calves received the first portion of a colostrum by a sucking method no later than 45 minutes after the birth. In the first days calves sucked mother of 5-7 times. The young growth was weighed daily during the colostrum period. The first weighing was carried out right after the birth, then at the end of each working day on electronic balance.

Laboratory researches of quality of a colostrum of cows were conducted in the licensed laboratory of livestock production at the Faculty of Biotechnology and Veterinary Medicine of the State Federal-Funded Educational Institution of Higher Professional Training "Samara State Agricultural Academy" by the standard techniques[39,40]. Selection of average samples of a colostrum for laboratory researches was carried out in the first day after an calving to the first calf sucking, in the next days it was done in the morning after the first milking.

RESULTS AND DISCUSSION

Researches were conducted on cows – first-calf heifers before the complete leaving from group with the age. It is established that from the first to the sixth lactation for various reasons in group of cows of Black Pied, Holstein and Ayrshire breeds all 100.0% of animals left. In group of Bestuzhev breed to the 7th lactation there were 9 heads (18.0%), two last heads (4.0%) were discarded after the 10th lactation (table 1).

Table 1. Dynamics of a livestock and milk yield of cows for a lactation in experimental groups with age

Lactation	Breed							
	Black Pied breed		Bestuzhev breed		Holstein breed		Ayrshire breed	
	n	Milk yield, kg	n	Milk yield, kg	n	Milk yield, kg	n	Milk yield, kg
1	50	4365.0±187.0	50	4047.0±148.0	50	6553.0±214.0	50	5267.0±178.0
2	42	4748.0±169.0	46	4293.0±156.0	34	7281.0±179.0	41	5739.0±217.0
3	34	5164.0±154.0	41	4545.0±132.0	21	7768.0±236.0	36	6347.0±244.0
4	19	5497.0±176.0	32	5031.0±169.0	14	7487.0±253.0	23	6744.0±192.0
5	13	5534.0±211.0	27	5267.0±157.0	10	6802.0±188.0	19	6441.0±210.0
6	5	4918.0±183.0	15	5050.0±171.0	-	-	7	5830.0±189.0

There is evidence that dynamics of milk productivity varies with age in these groups. It has been established that the size of milk yields for a lactation in cows of Black Pied breed and Bestuzhev breed

increases to the fifth lactation, respectively by 1169.0 and 1220.0 kg of milk (26.8-30.1%; p<0.001). The cows of Holstein breed show the maximum milk yields during the third lactation, Ayrshire breed – during the fourth lactation. Increase in milk yields makes, respectively 1215.0 and 1477.0 kg of milk (18.5-28.0; p<0.001). The maximum productivity is noted among animals of Holstein breed -7768.0 kg of milk which exceeded their contemporaries the Black Pied breed by 2234.0 kg of milk (40.4%; p<0.001), Bestuzhev – by 2501.0 kg (47.5%; p<0.001), Ayrshire – (15.2%; p<0.001).

By the achievement time of the maximum milk yields in the group of Black Pied breed there were thirteen cows' heads (26.0%), Bestuzhev – twenty-seven cows' heads (54.0%), Holstein – twenty-one (42.0%), Ayrshire – twenty-three cows' heads (46.0%). At the same time, it should be noted that by the third lactation, when the cows become full-age, from a tentative livestock in groups remained, respectively 68.0, 82.0, 42.0 and 72.0% of animals.

Having divided cows during the first lactation according to the size of milk yield, it was established that the studied breeds, considerably differ on the level of milk productivity (table 2).

Table 2. Dynamics of a livestock and milk yield of cows for a lactation in experienced subgroups with age

Lactation	Breed							
	Black Pied breed		Bestuzhev breed		Holstein breed		Ayrshire breed	
	n	Milk yield, kg	n	Milk yield, kg	n	Milk yield, kg	n	Milk yield, kg
The first lactation								
up to 4000	14	3524.0	15	3052.0	1	3847.0	3	3654.0
4001-5000	22	4230.0	30	4365.0	7	4913.0	15	4669.0
5001-6000	11	5103.0	5	5129.0	10	5796.0	22	5481.0
6001-7000	3	6218.0	-	-	23	6918.0	10	6175.0
7001-8000	-	-	-	-	8	7934.0	-	-
more than 8000	-	-	-	-	1	8879.0	-	-
The third lactation								
up to 4000	3	3756.0	6	3110.0	1	3990.0	1	3879.0
4001-5000	9	4331.0	25	4487.0	1	4981.0	3	4795.0
5001-6000	14	5248.0	7	5315.0	1	5899.0	6	5624.0
6001-7000	5	6119.0	3	6092.0	2	6934.0	20	6576.0
7001-8000	3	7088.0	-	-	12	7958.0	6	7493.0
more than 8000	-	-	-	-	4	9246.0	-	-
The fifth lactation								
up to 4000	3	3580.0	4	3445.0	-	-	-	-
4001-5000	4	4754.0	7	4511.0	1	4879.0	3	4953.0
5001-6000	4	5361.0	12	5979.0	2	5796.0	3	5815.0
6001-7000	1	6173.0	3	6032.0	4	6990.0	9	6587.0
7001-8000	1	7099.0	1	7018.0	3	7864.0	4	7698.0
The sixth lactation								
up to 4000	3	3947.0	4	3881.0	-	-	-	-
4001-5000	2	4913.0	5	4895.0	-	-	3	4536.0
5001-6000	-	-	4	5658.0	-	-	4	5748.0
6001-7000	-	-	2	6572.0	-	-	-	-

In group of cows with milk yield up to 4000.0 kg of milk 28.0% of animals of Black Pied breed, 30.0% - Bestuzhev breed, 2.0% - Holstein and 6.0% of Ayrshire breed are registered. More than 6000.0 kg – 6.0, 0, 64.0, 20.0% had productivity more than 5000.0 kg of milk, respectively in groups 28.0, 10.0,

84.0, 64.0% of cows. The productivity more than 7000.0 kg of milk for the first lactation is noted only at 18% of cows of Holstein breed.

The observations showed that primarily with age the most productive animals leave the herd. At the same time, as it was noted above, with the age there is an increase in milk yields according to breed features and the level of genetic potential of milk productivity of cows. As a result, on the third lactation milk yield more than 6000.0 kg of milk from group of Black Pied breed showed 23.5% of animals, Bestuzhev – 7.3%, Holstein – 85.7%, Ayrshire – 72.2%. The level more than 8000.0 kg of milk was overcome only by 4 cows of Holstein breed with an average milk yield of 9246.0 kg.

With age, along with the size of milk yield, the quality of a colostrum and milk changes. The changes happen also according to biological and breed features of studied breeds animal (table 3).

Table 3. Chemical composition of a colostrum of the first milk yield of cows with the different level of milk productivity (III lactation)

Milk yield for lactation, kg	FWF, %	PWF, %	including, %			Lactose, %
			casein	albumen	globulin	
Black Pied breed						
up to 4000	6.9±0.08	18.9±0.09	6.4±0.05	5.3±0.04	7.2±0.05	1.9±0.01
4001-5000	6.7±0.05	18.3±0.11	6.3±0.06	5.1±0.03	6.9±0.07	2.1±0.01
5001-6000	6.4±0.06	17.8±0.13	6.1±0.04	4.9±0.06	6.8±0.10	2.0±0.01
6001-7000	6.3±0.05	17.1±0.10	6.0±0.05	4.7±0.04	6.4±0.06	2.2±0.01
7001-8000	5.9±0.03	16.6±0.07	5.8±0.03	4.6±0.03	6.2±0.04	2.1±0.01
Bestuzhev breed						
up to 4000	8.4±0.04	24.2±0.10	7.0±0.05	6.7±0.05	10.5±0.12	2.2±0.01
4001-5000	8.1±0.06	23.7±0.13	6.8±0.07	6.6±0.06	10.3±0.13	2.0±0.01
5001-6000	7.9±0.05	23.3±0.15	6.7±0.08	6.3±0.04	10.3±0.15	2.1±0.01
6001-7000	7.4±0.05	22.5±0.11	6.5±0.06	6.1±0.05	9.9±0.08	2.3±0.01
Holstein breed						
up to 4000	7.5	18.4	5.9	5.1	7.4	2.3
4001-5000	7.3	17.9	5.7	5.0	7.2	2.1
5001-6000	7.1	17.5	5.6	4.8	7.1	2.3
6001-7000	6.8	16.8	5.4	4.6	6.8	2.3
7001-8000	6.4±0.06	16.4±0.12	5.4±0.05	4.5±0.05	6.5±0.13	2.4±0.01
более 8000	6.0±0.04	16.3±0.13	5.4±0.06	4.4±0.03	6.5±0.10	2.6±0.01
Ayrshire breed						
up to 4000	8.5	23.9	7.0	7.1	9.8	2.0
4001-5000	8.3±0.06	23.6±0.14	7.0±0.03	7.1±0.05	9.5±0.07	2.2±0.01
5001-6000	8.2±0.08	22.9±0.18	6.9±0.04	6.8±0.06	9.2±0.10	2.3±0.01
6001-7000	7.7±0.06	22.6±0.17	6.8±0.07	6.9±0.04	8.9±0.09	2.4±0.02
7001-8000	7.1±0.03	22.1±0.13	6.8±0.04	6.7±0.03	8.6±0.08	2.5±0.01

Colostrum, especially of the first milk yield after calving, is very important product for newborn calves, providing them with a full complement of nutrients and antibodies, necessary for maintaining of activity, providing colostral immunity in an organism[41]. It has been established that chemical composition of a colostrum varies significantly under the influence of the level of milk productivity of cows[42]. As the size of milk yield and a mass fraction of fat in a colostrum have the inverse correlation, the content of fat decreased on the increase of milk yield for a lactation[43]. The data for the third lactation were taken for research because at this age the cows are mature, reaching a physiological maturity. The difference on a mass fraction of fat in a

colostrum between cows with milk yield up to 4000.0 kg and the maximum milk yield up to 8000.0 kg and more was in group of Black Pied breed 1.0% ($p<0.001$), Bestuzhev – 1.0% ($p<0.001$), Holstein – 1.5% ($p<0.001$), Ayrshire breed – 1.4% ($p<0.001$).

The highest fat content of colostrum was found in the Ayrshire and Bestuzhev cows and the lowest fat content of colostrum had Black Pied and Holstein cows.

Even more essential differences between breeds were revealed on a mass fraction of protein in a colostrum of the first milk yield. It was found that the highest content of the total protein was in a colostrum of Bestuzhev (24.5-22.5%) and Ayrshire breeds (23.9-22.1%), and the lowest in Holstein (18.4-16.3%) and Black Pied (18.9-16.6%) cows. At the same time, in a colostrum of cows with milk yield up to 4000.0 kg it was established the highest content of protein, but with milk yield up to 8000.0 kg and more it was the lowest one. The difference was, respectively on breeds 2.3% ($p<0.001$), 2.3% ($p <0.001$), 2.1% ($p <0.001$), 1.8% ($p <0.001$).

Colostrum protein is very composite on its structure and constitution substance which can be divided into three main fractions: caseins, albumins and globulins[44]. Caseins are differ in acid reaction and are well coagulated by rennet enzyme, forming a casein clot[45]. Albumins and globulins belong to the group of serous proteins which do not clot under the effect of rennet enzyme, but are well digested in a stomach of calves and are assimilated by an organism[46]. Besides globulins provide formation of colostral immunity, performing a protective properties, protecting the body of newborns from the influence of conditionally pathogenic microflora[47].

It was discovered that the cows colostrum of the studied breeds considerably varies in the structure of protein and protein fractions depending on the size of milk yield for a lactation. In the colostrum of the first milk yield the maintenance of a casein decreases in process of increase in level of milk productivity of cows in group of Black Pied breed by 0,6% ($p<0.001$), for Bestuzhev – by 0.5% ($p<0.001$), for Holstein – by 0.5% ($p<0.005$), for Ayrshire – by 0.2% ($p<0.005$). At the same time the casein share in structure of the total protein is, respectively according to breeds 33.9-35.1; 28.7-28.9; 31.8-33.1; 29.7-30.8%.

The mass fraction of albumins and globulins also decreases in process of increase in milk yields of cows for a lactation. In the structure of the total protein, unlike casein, there is a decrease tendency of albumins share for Black Pied breed, from 28.0 to 27.5%, for Bestuzhev – from 27.7 to 27.1%, for Holstein – from 40.2 to 39.6%, for Ayrshire – from 41.0 to 38.9%. In the first days of calves' life a very important role in life support of an organism and protection it from negative impact of a surrounding medium is carried out by a fraction of globulins. In structure of colostrum proteins, the globulin fraction is the greatest and it is from 37.3% (Black Pied breed) to 44.2% (Bestuzhev breed). In comparison with other proteins the dynamic of globulins under the action of milk yields size of different breeds cows occurs variously. Black Pied breed has a slight, but stable decrease in a share of globulins, at Bestuzhev breed, on the contrary, there is an increase in a share of globulins from 43.4 to 44.2%, Holstein breeds with a milk yield up to 6000.0 kg of milk have the greatest share of globulins – 40.6% then there is its decrease to 39.6%, and Ayrshire breeds have the dynamic tendency of decrease in a share of globulins from 41.0% to 38.9%.

Unlike the protein content and fat in colostrum of cows, the mass fraction of lactose in dry matter is 2.4-1.8 times less, than, in regular milk.

It is very important from the biological point of view as in an organism of calves, a lactose enzyme, which promotes the lactose digestion, has not been produced yet. High content of lactose in a colostrum leads to the digestive disorder and developing of various gastrointestinal diseases.

High content of principal components in a colostrum of the first milk yield, provides a high content of dry matter in it (table 4).

Table 4. Dynamics of density and acidity of cows colostrums depending on the level of milk productivity (the III lactation)

Milk yield for lactation, kg	Breed			
	Black Pied breed	Bestuzhev	Holstein	Ayrshire
Colostrum density, ^{0}A				
up to 4000	57.1	78.5	52.7	78.6
4001-5000	56.8	78.2	51.9	78.4
5001-6000	56.6	77.6	51.5	77.5
6001-7000	56.5	76.8	51.3	77.0
7001-8000	56.3	-	51.1	76.4
more than 8000	-	-	51.0	-
Colostrum acidity, ^{0}T				
up to 4000	53.5	60.4	52.8	58.5
4001-5000	52.8	59.6	51.7	57.3
5001-6000	51.3	60.2	50.1	56.7
6001-7000	50.5	58.9	48.5	55.8
7001-8000	49.4	-	48.0	54.5
more than 8000	-	-	47.3	-

The analysis of the received results showed that a colostrum of the first milk yield of different dairy breeds has essential distinctions on the content of the dry matter. The highest colostrums density – 78.2^{0}A was in the colostrum of Bestuzhev cows, which is higher in comparison with the Black Pied breed by 21.7^{0}A (38.4%; $p<0.001$), Holstein – by 26.9 ^{0}A (52.4%; $p<0.001$), Ayrshire – by 0.6 ^{0}A (0.8%).

Along with the breed features, the size of milk yield of cows for a lactation, considerably influences on colostrum density, i.e. the level of milk productivity of animals caused by intensity of all bodies activities and the systems of an organism. It was established that in process of increase in milk yields of cows, the density of a colostrum decreases in group of Black Pied breed by 0.8^{0}A (1.4%), Bestuzhev – by 1.7^{0}A (2.2%), Holstein – by 1.7^{0}A (3.2%), Ayrshire – by 2.2^{0}A (2.8%). It explains once again, a difference between the breeds in dry matter of a colostrums, as the breeds considerably differ in size of milk yield for a lactation (table 1).

As the majority of dry matter of a colostrum is made by proteins, respectively according to the breeds 63.5; 67.4; 61.5; 65.8% which have the acid reaction, the actual acidity of it is rather high. As in process of increase in milk yields there is a decrease in a mass fraction of proteins in a colostrum, it is observed the decrease in titratable acidity at Black Pied breed by 4.1^{0}T (7.7%; $p<0.001$), Bestuzhev – by 5.0^{0}T (8.3%; $p<0.001$), Holstein – by 5.5^{0}T (10.4%; $p<0.001$), Ayrshire – by 4.0^{0}T (6.8%; $p<0.001$). At the same time, below marginal norm (48^{0}T), the acidity of a colostrum decreased only in the group of cows of Holstein breed with milk yield more than 8000.0 kg of milk for a lactation.

In globulin fraction of colostrum proteins, the special part is assigned to immunoglobulins, which getting to an organism of calves, promote formation of colostral immunity, providing thereby a protective function, protecting newborns from a negative impact of a surrounding medium and the influence of a pathogenic microflora (table 5).

Table 5. Change in the content of immunoglobulins in a colostrums with cows age depending on the level of milk procuctivity, a g/l

Milk yield for lactation, kg	Breed			
	Black Pied breed	Bestuzhev	Holstein	Ayrshire
First lactation				
up to 4000	41.50±0.53	69.73±0.64	42.11±0.52	67.84±0.36
4001-5000	35.84±0.39	62.95±0.57	35.26±0.48	60.15±0.69
5001-6000	31.68±0.44	56.39±0.51	30.18±0.63	55.47±0.73

6001-7000	26.80±0.75	-	25,94±0,79	48.81±0.57
7001-8000	-	-	21,73±0,56	-
more than 8000	-	-	19.36±0.54	-
Third lactation				
up to 4000	79.06±0.42	103.35±0.53	74.52±0.63	99.03±0.75
4001-5000	70.57±0.64	99.24±0.69	64.74±0.59	93.78±0.81
5001-6000	65.21±0.59	92.27±0.83	55.76±0.64	86.88±0.73
6001-7000	60.38±0.68	81.38±0.71	52.65±0.72	78.45±0.64
7001-8000	53.06±0.76	-	47.66±0.69	65.35±0.52
more than 8000	-	-	42.29±0.38	-
Fifth lactation				
up to 4000	83.84±0.49	131.36±0.88	-	110.88±0.71
4001-5000	79.90±0.55	126.12±0.93	66.91±0.72	101.76±0.69
5001-6000	68.73±0.61	118.57±0.79	61.66±0.75	94.11±0.78
6001-7000	61.35±0.52	109.68±0.49	57.94±0.54	87.49±0.47
7001-8000	58.86±0.45	96.53±0.42	48.59±0.45	79.37±0.39
Sixth lactation				
up to 4000	64.31±0.67	108.57±0.54	-	-
4001-5000	58.64±0.54	100.39±0.62	-	98.17±0.46
5001-6000	-	94.76±0.59	-	83.95±0.55
6001-7000	-	88.48±0.55	-	-

It has been established that the content of immunoglobulins in a colostrum of the first milk yield of different breeds cows changes under the influence of the level of milk productivity and also with the animals' age. It was found the highest content of immunoglobulins for the first lactation was in the colostrum of Bestuzhev breed cows (63.4 g/l), and the lowest was in Holstein breed (29.8 g/l). The difference was 33.6 g/l (112.8%; $p < 0.001$), which is derived from the difference between these breeds on milk yield for a lactation, which was 2506.0 kg of milk (61.9%; $p < 0.001$). It should be pointed out, that a minimum threshold in the content of immunoglobulins in a qualitative colostrum is 60.0 g/l. After the first lactation the colostrum of Bestuzhev and Ayrshire breeds with milk yield of cows for a lactation up to 5000.0 kg conformed the requirements. It once again confirms, that the colostrum of cows after the first and second calving is not recommended to be given to calves because of the low content of immunoglobulins.

After the third calving when the cow becomes full-age, the quality of the colostrum considerably improves. The colostrum of the first milk yield in cows of Bestuzhev and Ayrshire breeds meets the requirements for the content of immunoglobulins completely[48]. At the same time it remains the tendency of decrease in content of immunoglobulins in process of increase in milk yields for a lactation[49]. The cows of Black and Pied breed with milk yield higher than 7000 kg had a content of immunoglobulins below a minimum threshold of requirements for quality. In group of Holstein breed only the cows with milk yield up to 5000.0 kg of milk conformed the requirements for the quality of a colostrum. The difference between the maximum and minimum indexes on the content of immunoglobulins in colostrum was among the cows of Black and Pied breed 26.0 g/l (49,0%; $p<0.001$), Bestuzhev – 21.97 g/l (27.0%; $p<0.001$), Holstein – 32.23 g/l (76.2%; $p < 0.001$), Ayrshire – 33.68 g/l (51.5%; $p<0.001$). The highest content of immunoglobulins was in a colostrum of Bestuzhev breed – 103.35-81.38 g/l, and the lowest was in Holstein breed – 74.52-42.29 g/l. The difference between an index of the maximum content of immunoglobulins was 28.83 g/l (38.7%; $p<0.001$), minimum – 39.09 g/l (92.4%; $p<0.001$). Thus, in process of increase in milk yields for a lactation not only the content of immunoglobulins in a colostrum

of cows decreases, but also the difference between breeds increases.

The researches showed that the increase in content of immunoglobulins in the colostrum of the first milk yield of cows, continues to the fifth lactation. It is necessary to emphasize that the livestock of cows in groups was reduced to the fifth lactation, respectively by 74.0, 46.0, 80.0, 62.0%. At the same time groups were left first of all by all high-yield animals which are characterized by the low content of immunoglobulins in a colostrum. In group of cows with milk yield up to 4000 kg the content of immunoglobulins increased in Black and Pied breed by 4.78 g/l (6.1%; $p<0.001$), Bestuzhev – by 28.01 g/l (27.1%; $p<0.001$), Holstein – all animals left, Ayrshire – by 11.85 g/l (12.0%); in group with a yield of milk up to 5000.0 kg, respectively by 9.33 g/l (13.2%; $p<0.001$), 26.88 g/l (27.1%; $p<0.001$), 2.17 g/l (3.4%), 7.98 g/l (8.5%; $p<0.001$), in group with milk yield up to 7000,0 kg – by 0.97 g/l (1.6%), 28.30 g/l (34.8%; $p<0.001$), 5.29 g/l (10.1%), 9.4 g/l (11.5%; $p<0.001$), in group with milk yield of 8000.0 kg – by 5.80 g/l (10.9%), in the group there was one cow which indicator increased by 15.15 g/l (18.6%), 0.9 g/l (2.0%), 14.02 g/l (21.5%). By the sixth lactation in the group of Black and Pied breed cows there were 5 heads (10.0%), Bestuzhev –15 heads (30.0%), Ayrshire –7 heads (14.0%), in the group of Holstein breed 100.0% of animals for various reasons had left. The content of immunoglobulins in the colostrum of cows began to decrease irrespective of the breed accessory and the level of milk productivity. Cows of all groups of Bestuzhev and Ayrshire breeds conformed to the minimum requirements on the content in colostrum of immunoglobulins and also the cows of Black and Pied breed with milk yield up to 4000.0 kg.

Immunoglobulins of a colostrum are divided into three main classes – IgG, IgA, IgM. It was established that about 81.0% of immunoglobulins (antibodies) of a colostrum are synthesized from a blood serum of cows (table 6).

Table 6. Content of immunoglobulins in a colostrum depending on the level of milk productivity of cows (the third lactation)

Milk yield for lactation, kg	Breed			
	Black Pied breed	Bestuzhev	Holstein	Ayrshire
Immunoglobulins of class G, g/l				
up to 4000	66.72±0.38	88.53±0.73	62.85±0.48	85.76±0.58
4001-5000	59.46±0.47	85.39±0.69	54.62±0.52	80.37±0.56
5001-6000	54.81±0.63	79.61±0.78	46.94±0.68	74.59±0.64
6001-7000	51.10±0.59	70.12±0.62	44.36±0.63	67.84±0.70
7001-8000	45.34±0.44	-	40.22±0.47	56.44±0.53
more than 8000	-	-	35.49±0.52	-
Immunoglobulins of class A, g/l				
up to 4000	8.24±0.31	9.33±0.22	7.69±0.24	9.04±0.26
4001-5000	7.58±0.27	8.79±0.30	6.75±0.28	8.53±0.32
5001-6000	7.11±0.36	8.24±0.27	5.93±0.33	7.95±0.27
6001-7000	6.40±0.33	7.56±0.31	5.64±0.29	7.10±0.38
7001-8000	5.36±0.24	-	5.13±0.25	6.22±0.26
more than 8000	-	-	4.68±0.42	-
Immunoglobulins of class M, g/l				
up to 4000	4.10±0.25	5.49±0.34	3.98±0.31	4.23±0.28
4001-5000	3.53±0.29	5.06±0.31	3.37±0.34	4.88±0.43
5001-6000	3.29±0.33	4.42±0.25	2.89±0.27	4.34±0.35
6001-7000	2.88±0.27	3.70±0.29	2.65±0.36	3.51±0.42
7001-8000	2.36±0.21	-	2.31±0.33	2.69±0.29
more than 8000	-	-	2.12±0.24	-

The main part of immunoglobulins of a colostrum are presented by class G immunoglobulin. It was established that in a colostrum of the first milk yield of Black and Pied breed cows IgG share, from the common content of immunoglobulins, makes 84.1-85.5%, Bestuzhev breed – 85.7-86.3%, Holstein – 83.9-84.4%, Ayrshire – 85.7-86.6%. At the same time there is a tendency of increase in a share of IgG in process of increase in milk yields of cows for a lactation. It is a kind of protective reaction of an organism to increase in level of milk productivity of cows. The higher a size of milk yields of cows, the weak calves are born with low level of natural resistance of an organism which are more subject to influence of a surrounding medium and pathogenic microflora. Many scientists established that IgG is the major protective factor which neutralizes up to 98.0% of the infectious activators getting to an animal organism[50].

On the other hand, the received results showed that breed accessory of cows and the level of their milk productivity influence considerably on the content of immunoglobulins. The highest content in a colostrum of IgG is noted in Bestuzhev breed cows, and the lowest is in Holstein breed. At the same time it was established that all breeds have a decrease in maintenance of IgG in process of increase in milk yields for a lactation. The difference between the maximum and minimum maintenance of IgG is in Black and Pied breed 21.38 g/l (47.2%; $p<0.001$), Bestuzhev – 18.41 g/l (26.3%; $p<0.001$), Holstein –27.36 g/l (77.1%; $p<0.001$), Ayrshire – 29.32 g/l (51.9%; $p<0.001$).

Immunoglobulins of class A are considered as a factor of primary answer, as they are contained in composition of mucous secretion of eyes, an oral and nasal cavity, airways, digestive tract, urinary system, connecting microbes and viruses on these sites of an organism and without allowing them to get into internals (lungs, heart, a liver, kidneys).

The highest content of IgA was noted in a colostrum of Bestuzhev breed cows, and the lowest – in Holstein breed. The difference was 1.64-2.88 g/l (21.3-61.5%; $p<0.001$). In the process of increase of milk yield of cows for a lactation there is a decrease in maintenance of IgA in Black and Pied breed by 2.88 g/l (35.0%; $p<0.001$), Bestuzhev – by 1.77 g/l (19.0%; $p<0.001$), Holstein – by 3.01 g/l (39.1%; $p<0.001$), Ayrshire – by 2.82 g/l (31.2%; $p<0.001$). At the same time the share of maintenance of IgA from all immunoglobulins, on the contrary, increases a little, in Black and Pied breed from 10.4 to 10.9%, Bestuzhev from 8.9 to 9.3%, Holstein – from 10.3 to 11.1%, Ayrshire – from 9.1 to 9.5%.

Immunoglobulins of a class M are the protection against primary meeting with bacteria and viruses, without allowing an infection to develop, i.e. blocking it at early stages of development[51]. The feature of IgM is that they have immunologic memory and at repeated meetings with the same infection of an antibody of a class M are capable to learn a microbe and to give it potent repulse. The mechanism of vaccinating reactions is based on this property[52].

Immunoglobulins of class M are the least numerous. IgM share in the common structure of immunoglobulins in a colostrum of Black and Pied breed cows is 5.2-4.5%, Bestuzhev – 5.3-4.6%, Holstein – 5.3-4.8%, Ayrshire – 5.2-4.1%. The highest content of IgM has been established in a colostrum of Bestuzhev breed cows, and the lowest –in Holstein breed. The maintenance of IgM decreases in process of increase in milk yields for a lactation, but, in difference from IgG and IgA, the share in the common content of immunoglobulins also decreases. The difference between the maximum and minimum maintenance of IgM in Black and Pied breed is 1.74 g/l (73.7%; $p<0.01$), Bestuzhev –1.79g/l (48.4%; $p<0.05$), Holstein –1.86 g/l (87.7%; $p<0.01$), Ayrshire – 1.54 g/l (57.2%; $p<0.05$).

The different quality of a colostrum of the studied breeds cows, caused by the size of milk yield for a lactation, variously affected on formation of colostral immunity on newborn calves and, as a result, on a condition of their health during the colostral period (table 7).

Table 7. Quantity of the calves from the cows with different milk yield, diseased during the colostral period

Milk yield for lactation, kg	Breed							
	Black Pied breed		Bestuzhev		Holstein		Ayrshire	
	heads	%	heads	%	heads	%	heads	%
First lactation								
up to 4000	3	21.4	1	6.7		0		0
4001-5000	9	40.9	5	16.7	4	57.1	4	26.7
5001-6000	7	63.6	3	60.0	6	60.0	6	27.3
6001-7000	3	100.0	-	-	14	60.9	6	60.0
7001-8000	-	-	-	-	5	62.5	-	-
more than 8000	-	-	-	-	1	100.0	-	-
total in group	22	44.0	9	18.0	30	60.0	16	32.0
Third lactation								
up to 4000		0		0		0		0
4001-5000		0		0		0		0
5001-6000	4	28.6	2	28.6		0	1	16.7
6001-7000	4	80.0	3	100.0	2	100.0	4	20.0
7001-8000	3	100.0	-	-	8	66.7	3	50.0
more than 8000	-	-	-	-	4	100,0	-	-
total in group	11	32.4	5	12.2	14	66.7	8	22.2

The poor quality of a colostrum of the first milk yield of first-calf heifers, did not provide necessary protection of an organism of newborns of calves against negative influence of a surrounding medium and a pathogenic microflora. From 50 received calves in group of Black and Pied breed cows 44,0% of animals, in group of Bestuzhev – 18.0 %, Holstein – 60.0%, Ayrshire – 32.0 % got sick. At the same time the quantity of sick calves in subgroups increased in process of increase in level of milk productivity of cows, respectively in breeds from 21.4 to 100.0%; from 6.7 to 60.0%; from 57.1 to 100.0%; from 36.7 to 60.0%.

As it was noted above, with age the quality of cows colostrum improves, but at the same time also there are breeds distinctions depending on the size of milk yield for a lactation. On the other hand, for various reasons the majority of high-yield cows in experienced group had left the group by the third calving, which colostrum quality was below physiological norm. It has been established that from the cows with milk yield up to 5000 kg of milk for a lactation, more robust young growth is born. Besides, high quality of a colostrum provides to newborns one hundred percentage protection against negative impact of a surrounding medium and a pathogenic microflora[53].

Increase of milk yields more than 6000.0 kg of milk for a lactation is followed by essential decline in quality of a colostrum and the birth of weaker young growth, that leads to increase in incidence of calves in experienced groups. Even among the calves of Bestuzhev and Ayrshire breeds in which colostrum of mothers the content of immunoglobulins does not decrease less than 60.0 g/l, the number of the diseased reaches 50.0-100.0%. It means that the increase in yields of milk up to the maximum level caused by the genetic potential of cows is reached by use of internal reserves and hard work of all bodies and the systems of an organism[54]. As a result, there is weakening of immune system of cows, weakening of antibodies in blood and, as a result, decrease in their content in colostrum where they enter some days before calving[55].

Being born, the calf gets to aggressive surrounding medium conditions for it. Being almost sterile, the organism of newborns begins to adapt to these conditions intensively. Therefore, how intensively the

tentative immunity will be formed in an organism, so the further body weight, development and resistance to diseases of a calf will depend (table 8).

Table 8. Intensity of calves body weight during the colostral period depending on the level of mothers' milk productivity (the third lactation)

Milk yield for lactation, kg	Breed			
	Black Pied breed	Bestuzhev	Holstein	Ayrshire
Average daily growth in body weight, g				
up to 4000	186.3±4.38	253.8±5.67	169.5±5.35	238.1±.5.29
4001-5000	188.1±5.64	236.0±6.45	164.6±5.78	217.4±5.47
5001-6000	164.5±5.93	199.4±4.79	155.8±5.88	181.3±5.93
6001-7000	137.2±3.21	187.5±5.88	121.7±5.26	166.8±4.80
7001-8000	101.4±4.39	-	99.8±4.26	139.9±5.34
more than 8000	-	-	87.9±5.61	-

Newborn calves of the studied breeds, owing to the breed features, level of milk productivity of mothers and quality of the received colostrum, considerably differed on adaptation abilities[56]. The most robust and viable calves were born from the cows of Bestuzhev and Ayrshire breed. During the colostrum period from the calves of Bestuzhev breed after the first calving 18.0% of animals fell sick, after the third – 12.2% of animals, Ayrshire breed, respectively 32.0 and 22.2%. The calves of Holstein breed were born weaker and melancholic, the sickness rate after the first calving was 60.0%, after the third – 66.7%. The situation with Black and Pied breed is slightly better, the sickness rate of calves, respectively is 44.0 and 32.4%.

The sickness rate of calves in subgroups, depending on milk yield of mothers, considerably affected their body weight and development[57]. It has been established that with the increase in level of milk productivity of cows, the quality of a colostrum decreases and the number of sickness rate of calves increases[58,59].

As a result, the size of average daily growth of youth alive mass in proportion decreases[60]. It was observed the decrease in alive weight among sick calves, especially with digestive tract disease, because of body dehydration[61].

CONCLUSIONS

The results' analysis of the researches showed that along with the breed features, the level of milk productivity caused by the genetic potential of animals, influence on the colostrum quality of the first milk yield dairy cows[62,63].

The best colostrum quality, with the high content of immunoglobulins, is noted in cows of Bestuzhev breed. The lowest content of immunoglobulins was in a colostrum of Holstein breed cows. Irrespective of the animals breed accessory, the colostrum quality had decreased in the process of increase in the level of their milk productivity[64].

It has been established that between the indexes characterizing a colostrum quality, and the size of milk yield there is the inverse correlative dependence[65,66]. The decrease of colostrum quality, especially the reduction of immunoglobulins content, leads to increase of sickness rate among newborn calves that finally affects the body weight and the development of young growth[67,68].

Therefore, for quality upgrading of herd replacements, we recommend to estimate the quality of the first milk yield colostrum by means of an optical or digital refractometer[69]. It is necessary to conduct goal-oriented selection work with breeds in the direction of colostrum upgrading.

ACKNOWLEDGEMENTS

There were no source of funding for this study.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

REFERENCES

1. Amelina IV, Medvedev IN. Relationship between the chromosome nucleoli-forming regions and somatometric parameters in humans. Bulletin of Experimental Biology and Medicine. 2009; 147(1):77-80.
2. Amelina IV, Medvedev IN. Transcriptional activity of chromosome nucleolar organizing regions in population of Kursk region. Bulletin of Experimental Biology and Medicine. 2009;147(6):730-732.
3. Zavalishina SYu. The Functional State Of Vascular Hemostasis In Calves During The Neonatal Phase. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):1507-1512.
4. Glagoleva TI, Medvedev IN. Physiological Features Of Anti-aggregational Control Of Blood Vessels Over The Shaped Elements Of Blood In Calves At The Onset Of Ontogenesis. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(5):440-447.
5. Zavalishina SYu. Physiology Of Antiaggregatory Manifestations Of The Vascular Wall In Newborn Calves With Iron Deficiency, Receiving Metabolic Significant Effects. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):1530-1536.
6. Medvedev IN, Kumova TA. Valsartan effects on platelet activity in patients with arterial hypertension and metabolic syndrome. Russian Journal of Cardiology. 2007;3:66-69.
7. Zavalishina SYu. The Functional State Of Primary Hemostasis In Newborns Calves With Dyspepsia. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):1543-1549.
8. Medvedev IN, Kumova TA. Angiotensin II receptor inhibitors: role and place in arterial hypertension and metabolic syndrome treatment. Russian Journal of Cardiology. 2007;5:97-99.
9. Zavalishina SYu. Dynamics Of The Functional State Of Platelet Functions In Newborn Calves Receiving Correction For Dyspepsia. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):1566-1572.
10. Medvedev IN. Correction of the image of the physical "I" in people with disabilities with hemiparesis who underwent a hemorrhagic stroke. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(2):697-704.
11. Zavalishina SYu. Physiological Control Of The Vascular Wall Over Platelet-Induced Aggregation In Newborn Calves With Iron Deficiency. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):1601-1606.
12. Medvedev IN. Weakening Of Disaggregation Control Of Blood Vessels Over Platelets In Patients With Hyperuricemia. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(4):711-717.
13. Zavalishina SYu. Functional Features Of Primary Hemostasis In Newborns Calves With Functional Disorders Of The Digestive System. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):1630-1636.
14. Medvedev IN. Features Of Disaggregation Effects Of Blood Vessels On Neutrophils In Patients With Hyperuricemia. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(4):740-745.
15. Kruse V. Yield of colostrum and immunoglobulin in cattle at the first milking after parturition. Anim. Prod. 1970;12:619-626.
16. Morin DE, McCoy GC, Hurley WL. Effects of quality, quantity, and timing of colostrums feeding and addition of a dried colostrums supplement on immunoglobulin Gi absorption in Holstein bull calves. J. Dairy Sci. 1997;80(4):747-753.
17. Coulon J.-B, Hurtaud C, Remond B, Verite R. Factors contributing to variation in the

proportion of casein in cows' milk true protein: a review of recent INRA experiments. J. Dairy Res. 1998; 65(3):375-387.

18. Shtankhefel I. The first days – solve everything. New agriculture. 2007;2:75-78.
19. Fayzrakhmanov DI, Nurtdinov MG, Khayrullin AN. The Organization of lactic cattle breeding on the basis of technological innovations. Kazan: Publishing house of the Kazan state university, 2007:352.
20. Zlobin S. Quality of a colostrum and safety of calfs. Livestock production of Russia. 2008;3:57-58.
21. Medvedev IN, Kumova TA. Angiotensin II receptor inhibitors: role and place in arterial hypertension and metabolic syndrome treatment. Russian Journal of Cardiology. 2007;5:97-99.
22. Hesecke D. Matabolische Litungagrenzen bei kuhen. Berlin: Medizin, 1991:531-535.
23. Quigley JD, Martin KR, Dowlen HH, Wallis LB, Lamar K. Immunoglobulin concentration, specific gravity, and nitrogen fractions of colostrum from Jersey cattle. J. Dairy Sci.1994;77(1):264-269.
24. Quigley JD, Drewry JJ. Nutrient and immunity transfer from cow to calf pre- and postcalving. J. Dairy Sci. 1998;81(10):2779-2790.
25. Zavalishina SYu. Functional Activity Of Plasma Hemostasis In Neonatal Calves With Iron Deficiency, Who Received Ferroglucin And Glycopin. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(5):1186-1191.
26. Georgiev IP. Differences in chemical composition between cow colostrums and milk. Bulg. J. Veter. Med. 2008;11(1):3-12.
27. Kreider RB. The colostrums edge? Muscular development. 2000;37(10). http://www.docstoc.com/docs/102506069/rbkreider
28. Scammell AW. Production and uses of colostrum. Austr. J. Dairy Techn. 2001;56(2):74-82.
29. Fox A, Kleinsmith A. Scientific and medical research related to bovine colostrums. Its relationship and use in the treatment of disease in humans. Selected publishers abstracts. 2010. http://www.immunetree.com
30. Hartmann PE. Changes in the composition and yield of the mammary secretion of cows during the initiation of lactation. J. Endocrin. 1973;59:231-247.
31. Akers RM. Lactation and the mammary gland. Iowa State Press, Blackwell Publishing Company. 2002:278.
32. Akers RM. Major advances associated with hormone and growth factor regulation of mammary growth and lactation in dairy cows. J. Dairy Sci. 2006;89(4):1222-1234.
33. Pritchett LC, Gay CC, Besser TE, Hancock DD. Management and production factors influencing immunoglobulin Giconcentration in colostrums from Holstein cows. J. Dairy Sci. 1991;74:2336.
34. Zarcula S, Cemescu H, Mircu C, Tulcan C, Morvay A, Baul S, Popovici D. Influence of breed, parity and food intake on chemical composition of first colostrum in cow. Anim. Sci. Biotechn. 2010;43(1):154-157.
35. Singleton W. Housing the caloes at Ioodwood. *Big Farm Management*.1973;4:41-42.
36. Kune D. Zdrovoth: problem atika odehovu telat v pod- minkach continualniho a Tumusoveho provsu VKT. Oeterunarstvi.1980;30(4):150-152.
37. Trielk J, Wilke A, Schifler R, Ebertus C. Qariation von Merkmalen in der Kalberaufsucht des SMR variation bei konzertrieren Haltung. Tiersucht.1985;39(4):163-165.
38. Zavalishina SYu. Elimination of platelet dysfunctions in newborn calves with functional
digestive disorders. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):1650-1656.
39. Mamayev AV, Samusenko LD. Lactic business. St. Petersburg: Lan publishing house,2013:348.

40. Glagoleva TI, Medvedev IN. Physiological Features Of Anti-aggregational Control Of Blood Vessels Over The Shaped Elements Of Blood In Calves At The Onset Of Ontogenesis. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(5):440-447.
41. Medvedev IN. Correction of the image of the physical "I" in people with disabilities with hemiparesis who underwent a hemorrhagic stroke. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(2):697-704.
42. Zavalishina SYu. Functional Features Of Platelets In Newborn Calves With Iron Deficiency. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(5):1153-1158.
43. Medvedev IN. The Level Of Disaggregation Control Of Blood Vessels Over Erythrocytes In Patients With Type 2 Diabetes Mellitus. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(4):760-765.
44. Zavalishina S.Yu. Physiological Features Of Vascular Hemostasis In Calves Of Dairy-Vegetative Food. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(5):1137-1143.
45. Medvedev IN. Disaggregation Control Of Blood Vessels Over The Activity Of Platelets In Patients With Type 2 Diabetes Mellitus. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(4):792-797.
46. Zavalishina SYu. Prevention Of Violations Of The Functional Status Of Platelet Hemostasis In Newborn Calves With Functional Disorders Of The Digestive System. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):1672-1678.
47. Medvedev IN. Severity Of Depression Of Vascular Disaggregation Effects On Neutrophils In Patients With Type 2 Diabetes Mellitus. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(4):837-842.
48. Zavalishina SYu. Physiological Properties Of Platelets In Newborn Calves With Functional Disorders Of The Digestive System, Treated With The Sorbent "Ecos". Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):1697-1702.
49. Medvedev IN. Influence Of Disaggregation Effects Of Blood Vessels On Erythrocytes In Patients With Impaired Glucose Tolerance And Abdominal Obesity. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(4):906-911.
50. Zavalishina SYu. The Dynamics Of The Physiological Properties Of Hemostasis In Newborn Calves With Functional Disorders Of The Digestion Against The Background Of Their Consumption Of Needles Extract. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):1726-1731.
51. Makhov AS, Medvedev IN. Assessment Of The Level Of Preparedness Of Athletes With Infantile Cerebral Palsy For Adaptive Sports. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(4):926-930.
52. Zavalishina SYu. Functional Features Of Vascular Hemostasis In Calves Of Dairy Nutrition. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):1754-1759.
53. Makhov AS, Medvedev IN. Functional State Of Muscles In Sports And Physical Training. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(4):965-968.
54. Zavalishina SYu. Functional Activity Of Vascular Hemostasis In Newborn Calves With Iron Deficiency. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):1490-1496.
55. Medvedev IN. The Degree Of Weakening Of Disaggregation Control Of Blood Vessels Over Platelets In Abdominal

Obesity And Dyslipidemia. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(4):1022-1028.

56. Zavalishina SYu. Physiological Features Of Primary Hemostasis In Newborns Calves With Functional Digestive Disorders. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):1514-1520.
57. Medvedev IN. The Level Of Disaggregation Control Of Blood Vessels Over Neutrophils In Patients With Abdominal Obesity And Dyslipidemia. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(4):1082-1087.
58. Zavalishina SYu. Functional Features Of Hemostasis In Calves Of Dairy And Vegetable Nutrition. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):1544-1550.
59. Medvedev IN. Possibilities Of Combined Therapy In Relation To Disaggregation Parameters Of Blood Vessels In Patients With Metabolic Syndrome With A High Degree Of Arterial Hypertension. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(4):1122-1134.
60. Zavalishina SYu. Functional Activity Of Primary Hemostasis In Calves During The First Year Of Life. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):1575-1581.
61. Medvedev IN. Antiaggregatory Characteristics Of Blood Vessels In Relation To Platelets In Patients With Impaired Glucose Tolerance And Abdominal Obesity. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(4):1163-1169.
62. Vorobyeva NV, Mal GS, Zavalishina SYu, Glagoleva TI, Fayzullina II. Influence Of Physical Exercise On The Activity Of Brain Processes. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):240-244.
63. Medvedev IN. Severity Of Vascular Disaggregation Control Over Neutrophils In Patients With Impaired Glucose Tolerance And Abdominal Obesity. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(4):1215-1220.
64. Medvedev IN, Kharitonov EL, Zavalishina SYu. Physiological response of the hemostatic system in newborn calves with iron deficiency to the use of ferroglucin and glycopin. International Journal of Advanced Biotechnology and Research. 2019;10(2):99-107.
65. Bikbulatova AA. Functional Features Of Microcirculatory Processes In Obese Women Against A Background Of Long Daily Wearing Of Corrective Clothing. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018;9(6):785-793.
66. Medvedev IN. Physiological features of antiaggregatory vascular control of platelets in calves of dairy nutrition. International Journal of Advanced Biotechnology and Research. 2019;10(2): 108-112.
67. Lenchenko E, Lozovoy D, Strizhakov A, Vatnikov Y, Byakhova V, Kulikov E, Sturov N, Kuznetsov V, Avdotin V, Grishin V. Features of formation of Yersinia enterocolitica biofilms. Veterinary World. 2019;12(1):136-140.
68. Suleymanov SM, Usha BV, Vatnikov YA, Sotnikova ED, Kulikov EV, Parshina VI, Bolshakova MV, Lyshko MU, Romanova EV. Structural uterine changes in postpartum endometritis in cows. Veterinary World. 2018;11(10):1473-1478.
69. Yousefi M, Hoseini SM, Vatnikov YA, Nikishov AA, Kulikov EV. Thymol as a new anesthetic in common carp (Cyprinus carpio): Efficacy and physiological effects in comparison with eugenol. Aquaculture. 2018;495:376-383.