Original Article

The use of technological measures in improving the body growth and morphofunctional properties of the udder of cows

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Abstract

The article presents information on the positive impact of the use of the "Imnamak" food additive in the cultivation of Holstein females in the "Karpat-ola Chashmasi" farm in the Yakkabog district of the Kashkadarya region, as well as the positive effect of active massage of the udder of heifers during the period of 7-8 months of pregnancy on their growth, development and morphofunctional characteristics of the udder of first-calf heifers.

Keywords: Holstein breed, food supplement, growth, development, indicators, udder, massage, lactation, udder index.

INTRODUCTION

Relevance of the topic.

Currently, in our republic and in foreign countries, a large research work is being carried out to create biologically active feed additives that are used instead of antibiotics. This situation is associated with the appearance of some unpleasant, negative, side effects of antibiotics, despite the fact that they are effective at a later date, as well as with the observation of adaptation of pathogenic organisms to antibiotics. Also, as a result of the accumulation of antibiotics in the body, a decrease in the quality of livestock products, leading to negative consequences when it is consumed by humans, is the reason for the ban on the use of antibiotics in many countries.

The use of new biologically active food additives as part of the diet of farm animals can increase the natural resistance of animals, prevent the development of pathogenic infections, increase adaptability and immunobiological resistance, as well as ensure high rates of growth and productivity.

In this regard, the study of the effectiveness of the use of the "Imnamak" feed additive produced in our republic in the cultivation of females intended to replenish the herd of cows in dairy cattle breeding has a certain practical significance.

Massaging the udder of heifers increases milk yield, improves the morphological and functional characteristics of the udder, increases the number of udder glands, and prevents mastitis. The milk productivity of cows is associated with the morphological and functional properties of their udders, and the study of the effectiveness of udder massage is of great practical importance.

The purpose of the study was to study the effect of the Imnamak food additive and the morphological and functional properties of the udder of cows, massage of the udder of heifers during the period of 7-8 months of pregnancy, on the growing organisms of females by the age of insemination, intended to replenish the herd of cows.

As an object of study, one-year-old females of the Holstein breed were taken, imported from Germany to the Kashkadarya region of the Republic of Uzbekistan.

The subject of the study is growth indicators, exterior, body dimensions, body structure indicators, udder shape, dimensions and functional features of the body of Holstein females.

Scientific novelty of the research.

The use of the drug "Imnamak" and massage of the udder of heifers on the morphological and functional properties of the udder in growing females of the Holstein breed was studied for the first time in the conditions of the Kashkadarya region of the Republic of Uzbekistan.

Materials and methods.

The research was carried out in 2020-2022 in the farm "Karpat-ola chashmasi" of the Yakkabog district of the Kashkadarya region. 12-month-old Holstein females brought to the farm from Germany were divided into 3 groups in the style of paired counterparts. The first group (15 heads) was made up of a diet prepared from the feed available on the farm, the females of the second group (n=15) were added to the main diet of 30 g of “Imnamak” per head per day in concentrated feed for 30 days.

In the third group, 30 g of "Imnamak" was added to the diet of each head per day, and during the 7-8th month of pregnancy, the udder was actively massaged.

The live weight of the experimental animals was determined by weighing on a scale, and the growth and replenishment rates of the herd were determined by the methods adopted in zootechnics.

Research results and analysis.

In the process of growth and development, animals are affected by various factors. These factors affect the organism of animals differently in different periods of individual development, in different natural and climatic conditions, and in different breeds [4,9].

Intensive breeding of heifer bodies to replenish the herd makes it possible to achieve economic benefits due to their earlier use, since the unproductive period of the animal is significantly reduced. The faster the bodies grow, the faster they mature sexually and physiologically, and this is inextricably linked with their live weight and body size [3,11].

The drug “Imnamak” is produced by the private company “Bibinor”, which is part of the state joint-stock concern “Uzfarmsanoat”. It consists of licks, a complex preparation immunofor, an antiseptic stimulant Dorogov (ASD-2 fraction), peppermint oil (menthol), bran and other fillers. This drug is currently used in veterinary practice, in particular against brucellosis, and scientific research data on its positive results are published. But the effect of this drug on the growth of young animals and the ability of livestock to replenish the herd has been studied very little.

The results of the analysis of the dynamics of the increase in live weight of experimental cattle show that the absolute indicators of live weight and average daily growth rates in the corresponding periods of growth were higher in cattle in the experimental groups than in the control (Table 1). In particular, the body weight in the I experimental group increased by 9.1 kg or 3.2% at the age of 15 months compared to the body weight in the control group, by 16.5 kg (5.1%) at the age of 18 months; in the body weight of the experimental group II, it was higher by 6.6 kg or by 2.3 and 13.5 kg or by 4.2%, respectively ($P<0.95$).

It should be noted that the body weight of the experimental groups at 18 months of age exceeded the standard requirements for the Holstein breed. This indicator exceeded the requirements of the breed standard by 7.2 kg or 2.2% in the 1st experimental group, where “Imnamak” was added to the diet, and by 4.2 kg or 1.3% in the 2nd experimental group.

The absolute increase in live weight was higher in the experimental groups receiving the food supplement "Imnamak" compared to the control group. In the first experimental group, the absolute increase from 12 months to 15 months compared with the

control group was 9.4 kg (19.1%), from 15 months to 18 months - 7.4 or 22%, from 12 months to 18 months - 16.8 (up to 20.3%; In the II experimental group, it was higher by 8.9 (18.0%), 6.9 (20.7%) and 15.8 kg (19.1%), respectively. The significance level of intergroup differences is high (P<0.01).

Table 1 Dynamics of live weight gain in females in the experiment (n = 15)

Age, months	Groups					
	Control		I experienced		II experienced	
	$\overline{X} \pm S\overline{x}$	*Cv*	$\overline{X} \pm S\overline{x}$	*Cv*	$\overline{X} \pm S\overline{x}$	*Cv*
Live weight, kg						
12	238,2 ± 3,39	5,52	237,9 ± 3,48	5,65	235,9 ± 2,99	4,90
15	287,4 ± 4,12	6,34	296,5 ± 3,87*	6,28	294,0 ± 4,06*	6,12
18	320,7 ± 2,35	3,82	337,2 ± 3,64*	4,18	334,2 ± 3,36*	3,90
Absolute increase in live weight, kg						
12 -15	49,2 ± 0,3	5,04	58,6 ± 0,4**	5,72	58,1 ± 0,3**	5,02
15 -18	33,3 ± 0,4	6,72	40,7 ± 0,5**	6,23	40,2 ± 0,4**	6,07
12 -18	82,5 ± 0,7	6,28	99,3 ± 0,9**	4,78	98,3 ± 0,8**	4,10
Average daily live weight gain, g						
12 -15	547 ± 4,1	5,17	651 ± 5,7**	5,44	646 ± 6,3**	5,24
15 -18	370 ± 3,4	6,64	452 ± 6,2**	6,12	447 ± 5,2**	5,79
12 -18	458 ± 3,8	6,23	552 ± 5,8**	4,82	546 ± 5,8**	5,48

Note: *P< 0,05 **P< 0,01

The coefficient of variation in live weight gain indicates that all cattle in the groups grew evenly (Cv = 1.2 - 3.8%).

An analysis of the average daily rate of increase in the live weight of the experimental bodies showed that this indicator was higher in the bodies of the experimental groups compared to the control group in all periods of cultivation, and in the period from 12 months to 18 months - the average daily increase in the body of the experimental group I compared with peers in the control group was 94 g or 20.5% (P<0.01); In the organs of the experimental group II, it was higher by 88 g or by 19.2% (P<0.01).

For a clearer expression of the growth rate and an objective assessment, the relative growth rates of the live weight of cattle in the experiment were calculated (Table 2).

As can be seen from the data in the table, the power of growth in certain periods of growth and in the period from 12 months to the age of the first birth was higher in the experimental groups. In particular, the relative increase in live weight in the bodies of the experimental group I compared with the control group was 3.2% during the growing period up to 12-15 months, 1.8% during the period from 15-18 months, 5.0% during the nursery period. for a period of 12 months to 18 months; in the organs of the II experimental group, respectively, by 2.9; 1.7 and 4.9% higher.

The relative index of live weight growth decreased with increasing age of animals in all the studied groups, which is consistent with the general patterns of animal growth.

Table 2 Relative rate of live weight gain in the experiment, %

Growing time, months	Groups		
	Control	I experienced	II experienced
12 -15	18,7	21,9	21,6
15 -18	11,0	12,8	12,7
12 -18	29,5	34,5	34,4

Signs of adaptation of cattle imported from abroad to new conditions are, first of all, high productivity, normal reproductive functions, fast industrial technology and good adaptation to local climatic conditions, rational use of feed. An animal organism,

getting into a new ecological and food environment, in the process of adapting to the conditions, undergoes certain changes in a number of exterior, internal and economically useful features [5].

Undoubtedly, the live weight of animals is the most objective indicator of the overall growth of the organism, but it does not allow one to get a complete picture of the changes in the structure of the animal's body in different age periods. To do this, it is advisable to study other indicators of the animal, in particular, external characteristics.

The development of the animal organism is a process that includes qualitative changes in the composition of cells, specialization and complication of organs and tissues, occurring from the period of the zygote to old age. An increase in the linear dimensions of animals is one of the main indicators of their physiological and economic development.

The appearance of animals, the type of body structure, the development of certain parts of the body, and so on are indicators characterizing its growth characteristics. These indicators are expressed in a change in the linear dimensions of the animals. The linear dimensions of cattle vary depending on their age, feeding conditions, care and other factors [6].

The data obtained in our studies on changes in the main body dimensions at different ages are presented in Table. 3.

Table 3. Change in body size of experimental animals depending on age, cm ($\overline{X} \pm S\overline{x}$), n= 15

Dimensions	Groups		
	Control	I experienced	II experienced
at 12 months			
Body height	113,9 ± 0,78	113,7 ± 0,74	113,8 ± 0,71
Tail height	118,4 ± 0,71	118,3 ± 0,67	118,5 ± 0,69
Slanted body length	127,4 ± 0,56	126,9 ± 0,60	127,3 ± 0,58
Chest circumference	163,0 ± 0,64	162,8 ± 0,57	162,9 ± 0,61
Chest depth	60,8 ± 0,51	60,6 ± 0,48	60,7 ± 0,49
Chest Width	38,5 ± 0,37	38,4 ± 0,41	38,5 ± 0,38
Iliac flank width	38,4 ± 0,34	38,5 ± 0,32	38,4 ± 0,33
Iliac warehouse width	18,6 ± 0,27	18,5 ± 0,36	18,6 ± 0,29
Palm circumference	16,1 ± 0,31	16,0 ± 0,28	16,1 ± 0,30
at 18 months			
Body height	129,4 ± 0,67	130,7 ± 0,67	129,9 ± 0,64
Tail height	132,8 ± 0,61	135,3 ± 0,72	135,4 ± 0,70
Slanted body length	147,2 ± 0,71	148,9 ± 0,74	149,1 ± 0,72
Chest circumference	178,6 ± 1,12	179,5 ± 1,16	179,4 ± 1,08
Chest depth	65,4 ± 0,73	65,9 ± 0,78	65,8 ± 0,76
Chest Width	44,8 ± 0,41	45,2 ± 0,43	45,1 ± 0,41
Iliac flank width	46,0 ± 0,51	46,3 ± 0,53	46,2 ± 0,50
Iliac warehouse width	25,9 ± 0,62	26,1 ± 0,64	26,1 ± 0,61
Palm circumference	19,3 ± 0,48	19,4 ± 0,47	19,4 ± 0,49
At the age of 1 birth			
Body height	133,9 ± 0,52	134,7 ± 0,51	134,6 ± 0,53
Tail height	138,4 ± 0,64	139,0 ± 0,62	138,9 ± 0,59
Slanted body length	159,7 ± 0,93	161,2 ± 0,86	161,1 ± 0,83
Chest circumference	188,3 ± 0,68	189,3 ± 0,71	189,2 ± 0,72
Chest depth	74,6 ± 0,47	74,9 ± 0,48	74,8 ± 0,49
Chest Width	47,2 ± 0,54	47,8 ± 0,42	47,7 ± 0,43
Iliac flank width	57,7 ± 0,48	52,3 ± 0,38	52,2 ± 0,41
Iliac warehouse width	26,4 ± 0,36	26,6 ± 0,28	26,7 ± 0,29
Palm circumference	19,9 ± 0,21	20,0 ± 0,22	20,0 ±0,24

Note: *P< 0,05 **P< 0,01

There were practically no intergroup differences in the main body dimensions of 12-month-old females weaned at the beginning of the experiment. As a result of the introduction of the drug "Imnamak" into the diet of the organs of the experimental groups in subsequent periods of breeding, the corresponding differences in their body sizes were also determined. In particular, at the age of 18 months, the height of the first experimental group was 1.3 cm lower than the control one, the height of the buttocks was 2.5 cm higher; oblique body length - 1.7 cm; chest circumference - 0.9 cm, chest depth - 0.5 cm, chest width - 0.4 cm, hip circumference - 0.3 cm, groin circumference - 0.2 cm, palm circumference - 0.1 cm higher; and at the age of first birth, respectively, it increased by 0.8; 0.6; 0.5; 1.0; 0.3; 0.6; 0.6; 0.2 and 0.1 cm. The level of significance of differences between groups is relatively low ($P<0.05$).

For the entire growing season, the height of growth in the control and experimental groups was 117.5-118.4%; buttock height - 116.8-117.5%; oblique body length - 125.3-127.0%; chest circumference - 115.5 - 116.2%; chest depth - 122.6 - 123.6%; chest width - 122.6 - 124.4%; width of the lateral iliac bones - 134.6-135.8%; groin circumference width - 141.9-143.8%; palm circumference - increased by 123.6 - 125.0%, that is, the growth rate of these sizes was higher in the bodies of the experimental groups compared to the control group.

Table 4. Indicators of body structure of experimental cattle, % ($\overline{X} \pm S\overline{x}$)

Indices	Groups		
	Control	I experienced	II experienced
at 12 months			
Leggy	46,62 ± 0,31	46,7 ± 0,34	46,66 ± 0,32
Elongation	111,8 ± 0,13	111,6 ± 0,42	111,,9 ± 0,43
Pelvis - chest	100,5 ± 0,20	99,7 ± 0,26	100,3 ± 0,28
Busty	63,5 ± 0,74	63,4 ± 0,68	63,4 ± 0,66
Compactness	128,2 ± 0,41	128,3 ± 0,43	127,96 ± 0,42
Altitude	103,9 ± 0,11	104,0 ± 0,36	104,1 ± 0,32
Bony	14,1 ± 0,14	14,1 ± 0,16	14,1 ± 0,15
at 18 months			
Leggy	49,45 ± 0,26	49,4 ± 0,29	49,3 ± 0,28
Elongation	113,75 ± 0,22	113,9 ± 0,17	114,8 ± 0,20
Pelvis - chest	97,4 ± 0,28	97,3 ± 0,23	97,6 ± 0,19
Busty	68,4 ± 0,72	68,5 ± 0,79	68,5 ± 0,76
Compactness	121,3 ± 0,19	120,5 ± 0,16	120,3 ± 0,22
Altitude	102,6 ± 0,31	103,0 ± 0,14	104,2 ± 0,19
Bony	14,8 ± 0,14	14,8 ± 0,18	14,9 ± 0,21
At the age of 1 birth			
Leggy	44,28 ± 0,25	44,4 ± 0,23	44,4 ± 0,27
Elongation	119,3 ± 0,32	119,6 ± 0,25	119,7 ± 0,34
Pelvis - chest	91,29 ± 0,27	91,3 ± 0,33	91,4 ± 0,31
Busty	63,3 ± 0,68	63,8 ± 0,74	63,8 ± 0,70
Compactness	117,9 ± 0,21	117,4 ± 0,17	117,44 ± 0,23
Altitude	103,4 ± 0,17	103,1 ± 0,19	103,2 ± 0,19
Bony	14,8 ± 0,16	14,8 ± 0,18	14,8 ± 0,17

It was noted that with increasing age of cattle, the growth rate of the axial section and peripheral sections of the skeleton was uneven, as well as the development of the muscles of the body was different, and the animals in the experiment showed their influence on the degree of change in body structure indicators (Table 4). There were no significant intergroup differences in body mass index. Cows of the 1st calving of all groups have indicators of the body structure characteristic of the dairy type, and are characterized by high growth, an elongated body, relatively thin skin, many skin folds in the neck, a relatively long, dry, light head and neck.

In the organisms of females, the formation of the mammary glands begins much earlier, and this process is carried out under the influence of genetic factors. In calves up to 6 months of age, the mammary glands grow mainly due to fat and connective

tissue, and glandular tissue does not develop. During puberty, the mammary glands begin to develop rapidly. After fertilization of the bodies, especially in the second period of estrus, the development of the mammary glands is accelerated, alveoli and milk ducts are formed. During this period, that is, in the last three months of pregnancy, a heifer udder massage gives a good effect [1,7,10]. During massage, massage has a good effect on the receptors of the mammary gland, blood circulation and metabolism in the udder are accelerated, the peristalsis of the digestive organs is accelerated, as a result, favorable conditions are created for the rapid development and uniform formation of the udder glands. At the same time, the process of nourishing the skin of the udder is activated, it is cleansed of dead cells of the epidermis, the activity of the skin glands improves, the skin of the udder becomes elastic and dense, possibly for the glandular tissue of the udder, the contractile muscular system and the uniform development of individual parts [2,8].

In our experiments, udder massage in heifers of the second experimental group was carried out twice a day (during milking) from the 7th month of pregnancy. They were brought to the parlour, and used the milking machines in a "free" mode, the purpose of which is to develop their skills regarding the noise of the machines and the milking environment.

During the first week, heifers were taught to massage the udder. At the same time, the udder was washed with warm water, wiped and massaged for 2 minutes, gently stroking the udder.

From the second week, each section of the udder of the heifers was lightly massaged separately from top to bottom, in the opposite direction, with horizontal movements. More attention was paid to the front parts.

From the third week, the heifers were transferred to a deep udder massage for 4-5 minutes. The udder and nipples were massaged separately in a circular motion with fingers, and the udder was massaged from top to bottom, bottom to top, and horizontal hand movements. At the end of the massage, the udder was lifted 4-5 times from the bottom up.

The duration of the massage was carried out for 2 months and stopped a month before the birth.

The morphofunctional features of the udder of heifers were studied at the 2nd month of lactation after childbirth and the results obtained were compared with those of the control group.

The udder of the cows of all experimental groups had a tub-shaped and cup-shaped (round) shape, there were no hanging and “goat udders” of the cows. In terms of udder size, the cows of the II experimental group had an advantage over other groups (Table 5).

The table shows that the circumference of the udder was higher (more than 110 cm) in all cows, and in the cows of the II experimental group, which were massaged, the udder was larger by 7.2 cm, or 6.5%, compared with the control group and by 5.5 cm, or 4.9%, compared with the first experimental group ($P<0.01$). In addition, the length of the udder in cows of the II experimental group is 1.2 cm, the width of the udder is 0.5 cm, the depth of the anterior sections of the udder is 0.4 cm, the depth of the rear sections is 0.4 cm, the depth of the following sections is 0.8 cm ; 1.7, respectively, compared with the control group; 0.7; 0.5 and 1.0 cm were larger ($P<0.01$).

Table 5. Dimensions of the udder of experimental cows, cm ($\overline{X} \pm S\overline{x}$)

Indicators	Groups		
	Control	I experienced	II experienced
Udder circumference	110,7 ± 1,38	112,4 ± 1,41*	117,9 ± 1,45**
Udder length	35,2 ± 1,22	35,7 ± 1,18	36,9 ± 1,23*
Udder width	29,7 ± 1,19	29,9 ± 1,21	30,4 ± 1,24*
Front udder depth	26,4 ± 0,52	26,5 ± 0,58	26,9 ± 0,71*
Back udder depth	28,7 ± 0,64	28,9 ± 0,72	29,7 ± 0,82*
Conditional udder volume, cm^3	2922,5	2978,6	3171,5
Front teat length	7,14 ± 0,08	7,15 ± 0,09	7,18 ± 0,11
Rear teat length	7,32 ± 0,09	7,34 ± 0,12	7,41 ± 0,13
Udder height from the ground	50,0 ± 1,6	50,2 ± 1,7	50,4 ± 1,8
Teat diameter	2,01 ± 0,04	2,01 ± 0,04	2,02 ± 0,05

Nipple circumference: front the following	7,4 ± 0,07	7,5 ± 0,08	7,6 ± 0,06
	7,1 ± 0,06	7,2 ± 0,07	7,4 ± 0,08
Distance between front nipples	12,3 ± 0,2	12,6 ± 0,2	13,1 ± 0,3
Distance between rear nipples	9,0 ± 0,1	9,2 ± 0,1	9,5 ± 0,1
Distance between anterior and posterior nipples	9,1 ± 0,1	9,3 ± 0,1	9,5 ± 0,1

Note: *P< 0,05 **P< 0,01

The conditional volume of the udder in cows of the II experimental group, which actively massaged the udder, compared with the I experimental group was 192.9 cm3 or 6.5%; compared with the cows of the control group, it was higher by 249.0 cm3 or by 8.6%, respectively.

The cows of the second experimental group were superior in other sizes of the udder, but the level of significance of these differences was low. Cows of all groups meet the requirements for udder size, which indicates that they are suitable for machine milking.

Data on the functional characteristics of the udder of cows in the experiment are presented in table 6.

As can be seen from the data in the table, the amount of milk per day in cows of the second experimental group with active udder massage is 1.1 kg compared to the first experimental group; 1.9 kg compared to control group (P<0.01); and in terms of the speed of dispensing milk, they had an advantage of 0.08 kg/min (P<0.05) and 0.19 kg/min (P<0.01), respectively.

Table 6. Functional characteristics of the udder of cows in the experiment $\overline{X} \pm S\overline{x}$

Indicators	**Groups**		
	Control	**I experienced**	**II experienced**
Daily milk yield, kg	15,8 ± 0,3	16,9 ± 0,4*	17,7 ± 0,4**
Duration of milking, min.	11,2 ± 0,1	11,3 ± 0,1	11,0 ± 0,1
Milking speed, kg/min.	1,41 ± 0,02	1,49 ± 0,2*	1,60 ± 0,3**
Udder index, %	42,2 ± 0,3	42,3 ± 0,3*	43,8 ± 0,5**

Note: *P< 0,05 **P< 0,01

The most important of the factors affecting the duration of milking and the speed of milking is the uniformity of the development of the udder sections, this indicator is calculated by expressing the ratio of the amount of milk received from the previous sections to the total amount of milk extracted from the udder in percent and is called the udder index. This indicator has an important selection value.

The udder index was higher in cows of the second experimental group by 1.5% (P<0.05) compared to the first experimental group and by 1.6% (P<0.01) compared to the control group.

Conclusion.

The use of the "Imnamak" preparation in breeding the bodies of females intended for filling the herd is an important factor in ensuring their high rates of growth and development, allows you to get cows with the appropriate body structure, height-latitudinal dimensions, structural features, allows you to breed cows typical of the dairy type according to the exterior-constitutional characteristics.

The use of the biologically active food additive "Imnamak" in the cultivation of females and massaging the udder of heifers at the 7-8th month of pregnancy has a positive effect on the morphological and functional characteristics of their udders, ensures their suitability for machine milking in industrial technology.

REFERENCES

1. Agafonov N.I. Vliyanie sposoba massaja vymeni neteley na produktivnost pervotelok. // «Zootexniya». 2005. №1. p. 17-18.
2. Andrianov A.M. Andrianov A.A. Sovershenstvovanie texnologii massaja vymeni neteley v period podgotovki k laktatsii. // collection of scientific works of VSAU. Voronezh. 1996. - p. 61.
3. Axtamova M.T., Amirov Sh.K., Gapparov Sh.T. Golshtin zotli urg'ochi tanalarni urug'lantirish yoshigacha o'stirish natijalari. // "Animal and breeding work". No. 1. 2022 - p. 13-14. ISSN-2181-9459.
4. Akhtamova M.T., Amirov Sh.K., Kurbonova Sh.E., Gapparov Sh.T., Sherkulova F.E. The use of feed additives in the diet of cattle.// European Journal of Agricultural and Rural Education (EJARE). Vol. 2 No. 6, June 2021. ISSN: 2660-5643. P. 37-39.
5. Bolotov N.A., Zarьitovskiy A.I. Vliyanie belkovoprobioticheskoy dobavki na dinamiku prirosta korov i jivuyu massu telyat pri rojdenii. Collection of scientific papers "Livestock and fodder production". Stavropol. Stavropol Scientific Research Institute of Animal Husbandry and Feed Production. 2012. Issue 5. p. 107-110.
6. Bukina Yu.V. Rost, razvitie i biologicheskie osobennosti molodnyaka cherno-pyestroy porody i ix pomesey s golshtinofrizami v usloviyax Chitinskoy oblasti. The dissertation of the candidate of agricultural sciences. Chita, 2007. - 170 p.
7. Ivanov V., Lamonov S., Tadjiev K. Morfofunktsionalnye svoystva vymeni i molochnaya produktivnost pomestnyx simmental-golshtinskix korov. // Molochnoe i myasnoe skotovodstvo. 2013. № 8. p. 12-15.
8. Kudrin M.R. Razvitie remontnyx telok chyorno-pyestroy porody po periodam rosta// Successes of temporary natural science. 2008. No. 12, p. 30-32.
9. Kurbanova Sh. E., Akhtamova M.T., Ismailova D. U., Dekhkanov B. B. State of Animal Husbandry and Prospects for the Development of Livestock Breeding in Uzbekistan. // Journal of Ethics and Diversity in International Communication. Vol. 2 No. 5, May 2022. e-ISSN: 2792-4017. P. 83-87.
10. Naumov M.K. Effektivnost massaja vymeni neteley. // Vestnik Oryol SAU. 2012. № 1 (34). p. 146- 148.
11. Tarakanov B.V. Mexanizmy deystviya probiotikov na mikrofloru pishevaritelnogo trakta i organizm jivotnyx. // Veterinariya. 2000. № 1. p.47-54.