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The Application Of A Feed Additive In The Treatment And Prevention Of Cattle Diseases.

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ABSTRACT

Presently the issue of searching for the affordable and potent pharmaceuticals, which allow improving the efficiency of cattle breeding and the milk yield of cows in particular, is still relevant. No less important is the tackling of the problem of preventing the effects of poor animal nutrition and the infection of animal feed with hazardous mycoflora. Pathogenic fungi, when ingested by a cow, can provoke mycoses and mycotoxicoses. To prevent these and other diseases on livestock farms, experts recommend the application of special vaccines and veterinary medicines. However modern animal feed additives can be equally efficient, particularly the ones with enterosorbent properties and containing additional micronutrients. It must be borne in mind that there are many more anomalies or disorders in metabolism, with which diseases occur in a subclinical form and can only be identified by conducting laboratory biochemical, immunological, hormonal analyses. The more requirements one imposes on animals bred commercially on an industrial scale, the higher are their requirements to the living conditions. Increase in milk yield comes with increased metabolism, which requires higher quality feed, vitamins, minerals.

Keywords: prevention, therapy with animal feed, infectious diseases, enterosorbent, animal feed mineral additive, immunoglobulins

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INTRODUCTION

It is a known fact that the level of metabolism in cows and heifers is influenced by many factors: compliance with technological processes on dairy farms and units, housing and operating conditions of livestock, feed quality, balanced diets for all age and gender groups, as well as the level of individual resistance to infectious, parasitic and non-contagious diseases. Many cows are often exposed to diseases associated with liver - an organ, which plays a vital role in the body, including the detoxification. Furthermore, under nutrition and poor quality feed often lead to the development of ketosis, directly associated with the parenchymatious tissue damage. This disease poses threat to pregnant female animals, as toxins contained in their blood can enter the bloodstream of the fetus through the blood-brain and placental barriers. Pathogens penetrating the organism contribute to the destructive processes in the liver of a developing fetus, resulting in calves born to cows and heifers with ketosis, have congenital immunodeficiency, reduced liver detoxification function, toxic dyspepsia or susceptibility to its development. In this case both the newborn and the mothers are both in a state of chronic intoxication, amid which either secondary infections or other microbial or viral pathology begin to develop. Furthermore, congenital immune-deficiencies are often the cause of infectious diseases in cows. For these reasons, it is a common practice at livestock enterprises to apply specific disease prevention measures entailing the use of hyper-immune sera and different types of vaccines. However, this procedure can have both positive and side effects depending on the initial state of the immune system of animals. Therefore, the search for optimum protection of cattle from hazardous external environment is highly relevant.

RESTORING THE BALANCE

In order to prevent the occurrence of infectious diseases in cows one can efficiently use state-of-art feed additives with enterosorbent properties. With these supplements, toxins are neutralized owing to the ion-exchange mode of action of a solution, which contributes to the reduction of a negative impact of exo- and endotoxins on the functionality of all systems and organs. Due to reduction of intoxication the digestibility of the feed increases, resulting in increased intake of nutrients, vitamins and microelements. This effect has a positive impact on the maintenance and restoration of impaired functions, improves the balance of substances needed for both developing and growing fetus and an adult animal. Such feed additives should be included in the diet for pregnant cows, because when recovering their health one can get strong offspring with higher resistance ability. In addition, the application of said supplements contributes to increased milk yield of the livestock. Presently, several feed additives/solutions with enterosorbent properties are offered on the Russian market. Experts of several research facilities conducted studies of one such additive — 'BSH-VIT', created by a Russian company. This feed mineral additives, or FMA, contains a large amount of microelements: stable iodine, copper sulfate, cobalt chloride, calcium hydroxide, aluminogel and a ferrous hydrogarnet. The main purpose of the experiments was to determine the degree of influence of this supplement on the changes in the state of blood, biochemical and clinical statuses of the animals and their milk yield. Two series of studies were carried out at the farms in the Sverdlovsk region. At the time of the studies, these farms were free of infectious diseases, but it was noted that the quality of feed was low. At the farms, one selected animals for experimental and control groups based on the similarity. To mitigate the deficiencies in the diet the cows in the experimental group were given feed mineral additive. The housing conditions of animals in the experimental and control groups were identical.

EXPERIMENT PARAMETERS

For the first series of experiments, one selected two groups of cows of black-multicolored Holstein breed at the training farm 'Uralets'. A control group of 20 animals, experimental group of 40 animals. Animals were picked out on the principle of similarity. Their average annual milk yield was 6500 kg of milk, and the average age was five years. Livestock at the farm was kept in the following housing conditions: indoors, tied up. Feeding type: silage, coarse concentrated feed. For 15 days, cows from the experimental group were fed 150 g of the dry FMA once a day along with the feed 30 days prior to calving. Prior to conducting the experiment, all cows were subjected to complete clinical examination; to evaluate the state of metabolism of the animals blood samples were taken to perform haematology and biochemical tests. State of mineral metabolism was evaluated according to the mineral profile of the blood plasma. All results were subjected to statistical analysis. When assessing the housing conditions one took into account the compliance of the microclimate with the regulations: on the temperature in livestock facilities, on the volume of harmful gases, on the air velocity, on the illumination intensity in livestock facilities, on the efficiency of ventilation and

sewage, and paid attention to the type of manure removal system and the regularity of its operation. In addition, one evaluated the water quality and the state of automatic livestock waterer. When analyzing the diet one evaluated the weight percent of the feed and its nutritive value by the concentration of essential substances, viz. vitamins, macro- and microelements, and the quality of these components. Animal feed was studied at the agrochemical laboratory. Information on the occurrence of infectious diseases in cows and the quality of disinfection at the farm livestock facilities and the maternity ward was established based on the results of tests in the regional veterinary laboratory. For the second series of experiments, two groups of newly calved cows were also selected based on the principle of similarity at OOO DSP 'Sovkhoz Bogoslovskiy' (State owned farm Bogoslovskiy LLC). A control group consisted of 21 animals, and the experimental group - of 24 animals. Average annual milk yield per forage-fed cow was 5038 kg of milk. Feeding type was silage, concentrated feed. 7-10 days after calving animals of the experimental group were given 150 grams a day of the studied FMA for 90 days, whereas cows in the control group received the basic feed. Dynamics pattern of changes in cows' milk yield was evaluated according to control milkings. Results were subjected to statistical analysis.

RESULTS

Results of the first part of the experiment indicated that the disinfection performed at the Uchkhoz 'Uralets' (training farm 'Uralets') met the veterinary hygiene requirements, the quality of the feed met the requirements for I and II class feed, potable water met the GOST national standard requirements. According to the full clinical examination conducted prior to commencing the experiment, one identified minor disorders on the part of the musculo-skeletal system, discovered initial signs of osteomalatia, problems with hoof sharp parts and some joint pathologies. 10 percent of the animals were diagnosed with hypotension of the first stomach - one contraction in 5 minutes. Examination of the liver revealed an increase in the organ boundaries and soreness during percussion. Results of haematological tests indicated the signs of chronic inflammatory processes. After the course of feed mineral additive use blood parameters in cows of the experimental group changed. For instance, it was noted that the number of erythrocytes increased by 18.5 %, leukocytes - increased by 12.8 %, hemoglobin - increased by 16.7 %, lymphocytes - increased by 28.1 %, monocytes — increased by 80 %. At the same time, ESR dropped by 33.6 %, the number of eosinophils decreased by 5.7 %. At the same time, in the animals of the control group ESR increased by 45.5 %, lymphocytes increased by 2.9 %, banded neutrophils increased by 1.5 times. Meanwhile, the number of erythrocytes decreased by 6.8 %, leukocytes — decreased by 19.7%, eosinophils — decreased twice, hemoglobin - decreased by 9.7 %, monocytes - decreased by 37.5 %. Therefore, feeding the dry pregnant cows with the feed mineral additive 15-30 days prior to calving improved blood values to the average values of the standard range. On top of that, one has observed positive changes in their biochemistry. At the same time, it was established in the animals of the control group, that there was a trend towards more pronounced fluctuations and the values pertinent to state and the functions of liver exceeded the upper standard deviations for alkaline phosphatase by 15 %, for gamma-glutamilaminotranspherase — by more than three times.

Table 1: Hematology profile of cows

Item No	Parameters, UOM	Standard range	Baseline values n=40	After feeding of the FMA	
				Experiment, n=20	Control, n=20
1	Erythrocytes, 10^{12}/l	5.0 – 7.5	5.73±0.35	6.28±0.3	5.34±0.4
2	Leukocytes, 10^{9}/l	6.1 – 9.1	7.66±0.45	8.64±0.4	6.15±0.3
3	Hemoglobin, g/l	90 - 140	113.8±0.15	132.8±0.3	102.75±0.5
4	ESR, mm/h	0.5-1.5	3.3±0.4	2.19±0.3	4.8±0.3
5	Basophils, %	0-2	0±0	0±0	0±0
6	Eosinophils, %	5-8	5.3±0.8	5.0±0.5	2.8±0.6
7	Immature, %	0-1	0±0	0±0	0±0
8	Rod nuclear cell, %	2-5	1±0.01	2.0±0.01	1.5±0.01
9	Segmented cell, %	20-35	50.8±1.0	35.2±2.6	49.5±2.6
10	Lymphocytes, %	40-65	44.5±2.5	57.0±5.1	45.8±2.6
11	Monocytes, %	2-7	2.0±0	3.6±0.01	1.25±0.01

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Experiments with feeding of the feed mineral additive to dry pregnant cows 30-15 days prior to calving indicated that the blood values tended to average values of the standard range, and the changes were observed in the biochemistry of cows.

Table 2: Biochemical profile of cows' blood serum

Item No	Parameters, UOM	Standard range	Baseline values n=40	After feeding of the FMA	
				Experimental group, n=20	Control group, n=20
1	Albumin, g/l	29.0 - 38.0	31.65±0.45	32.0±0.5	30.0±0.8
2	ASAT, u/l	45.0 - 110.0	60.5±2.3	82.4±5.1	72.3±5.4
3	Glucose, mmol/l	1.9-3.8	2.7±0.4	3.4±0.4	4.2±0.5
4	Creatinine, µmol/l	56.0 - 162.0	88.95±2.7	80.5±3.2	82.2±5.4
5	Urea, mmol/l	2.0 - 7.5	3.8±0.4	2.4±0.2	2.26±0.5
6	Total protein, g/l	62.0 - 82.0	68.5±1.0	68.0±2.3	65.0±3.6
7	Total bilirubin, µmol/l	0.0 – 8.5	2.05±0.01	6.4±0.5	6.54±0.4
8	Alkaline phosphatase, u/l	20.0 - 164.0	76.0±2.5	71.0±3.0	189.0±5.1
10	ɣ- gammaGT, u/l	4.9 - 26.0	12.5±0.3	9.92±0.5	44.7±2.2
18	LDH, u/l	309.0 - 1200.0	745.5±5.8	808.9±5.4	703.9±6.1
19	Cholinesterase, u/l	over 450.0	2519.5±21.0	1852.0±24.0	2380.3±23.0
20	Globulins, g/l	25.0 - 41.0	37.0±2.0	36.1±3.8	34.3±5.4
24	Albumin/Globulin, c.u.		0.88±0.02	0.9±0.01	0.9±0.1

Table 3: Mineral profile of cows' blood serum

Item No	Parameters, UOM	Standard range	Baseline values, n=40	After feeding of the FMA	
				Experimental group, n=20	Control group, n=20
1	Potassium, mmol/l	4.0 – 5.8	5.0±0.5	5.3±0.3	4.8±0.4
2	Calcium, mmol/l	2.4 – 3.1	2.05±0.05	2.6±0.2	2.1±0.1
3	Magnesium, mmol/l	0.8 – 1.5	1.4±0.2	1.08±0.1	0.96±0.1
4	Sodium, mmol/l	132.0-152.0	162.5±1.5	152.0±1.5	132.0±1.0
5	Phosphorus, mmol/l	1.1 – 2.8	2.0±0.01	1.7±0.3	1.6±0.1
6	Chlorine, mmol/l	96.0 – 109.0	103.5±0.5	98.3±0.3	91.3± 0.2
7	Zinc, µmol/l	10.0 – 24.0	20.0±0.2	19.0±0.4	18.0±0.5
8	Anion gap, mEq/l	12.0 – 27.0	25.0±0.2	12.0±0.5	8.4±0.5
9	Ca/P, c.u.	1.5-2.0	1.1±0.1	1.5±0.1	1.3±0.05
10	Na/K, c.u.	26.2-33.0	32.5±0.5	28.7±0.8	27.5±0.5

REDUCTION IN PATHOLOGIES

During the first experiment, one observed the change in the animals' mineral profile of blood plasma in the prenatal period. For instance, the calcium content in the control group was at times below the minimum standard values by 12.5 %. In addition, the amount of chlorine was smaller in this group of animals as opposed to the reference values by 4.9 %, the anion gap — 30 % less than the reference values, calcium-phosphorus ratio - 13.4 % below reference and the content of bicarbonate surpassed the upper value of the reference range almost twice. Despite the general downward trend, the values of the cows in the experimental group tended to stay within the limits of the average values of the standard range. For one, in terms of calcium-phosphorus ratio values were approaching the optimal numbers. At the same time, in the animals of this group the calcium content in the serum increased by 26.8 %, which reflected the positive impact of the feed additive on the cows' organisms.

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One observed the differences in groups in the kinds of obstetrical and gynecological pathologies in the post-natal period, although the labour process in both groups went physiologically. In cows fed with feed mineral additive, the retention of placenta was reported in three percent of cases, the number of animals with ovarian hypofunction decreased almost two times and did not exceed 15 % and other pathologies reduced to 2.5 %. The number of cows diagnosed with postpartum endometritis had decreased by 20 % experimental group, and the recovery occurred earlier. Almost all the cows were bulling in the experimental group on average after 61.25 days after calving. In addition, the calves born to the cows of the experimental group were healthy 10 days after labour.

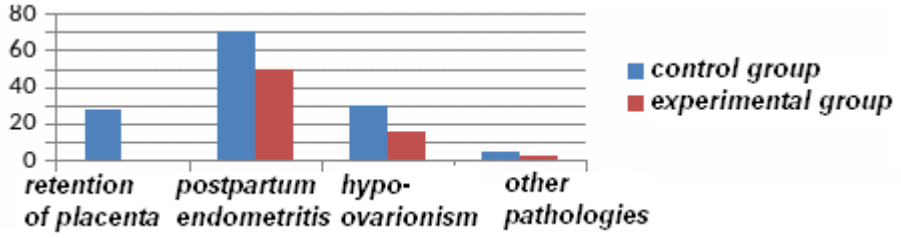

Fig 1: Kinds of obstetrical and gynecological pathology in cows

DAILY MILK YIELD

During the second part of the experiment and evaluation of the feed mineral additive impact on cows' milk yield, one monitored the yield values not only within 90 days when the additive was fed, but also in the following 90 days. At the beginning of the experiment, the average milk yield was at 2.6 liters less in the experimental group than in the control one. Housing and feeding conditions were identical throughout the monitoring period.

In the control group, results of the experiment indicated that the daily milk yield after 60 days of increasing the milk yield grew by 3.7 l or by 116.9 %. However, after 65 days after calving this value fell by an average of 0.08 l per day. In the experimental group over the same period, viz. 45 days from the start of the feed mineral additive feeding, daily milk yield of one cow rose by 7.4 l, which amounted to 138.3% as opposed to the initial value. The maximum value for this group was achieved 60 days after the feeding of the feed mineral additive, and notably this value remained at the same level within a month — 28.5-28.7 l of milk per day. When the feeding of the feed mineral additive was stopped, the reduction in the amount produced milk decreased by an average of 0.06 l per day. After 180 days of lactation, milk yield exceeded the initial values by 3.7 l in the experimental group, while it was five liters below the initial value in the control group. The minimum economic effect by 180 day of lactation measured in prices at the end of 2016, when the cost of feed mineral additive was 50 roubles/kg and the price of milk was 20 rubles/l amounted to no less than 15 Roubles per each Rouble of additional costs. This calculation entails the inclusion of the additive to the animal diet for 90 days, after which the prolonged action of the additive was reported for at least 90 days.

Table 4: Average daily milk yield changes in the experimental and control group

Days after calving	Control group (n=21)			Experimental group (n = 24)		
	Milk yield, l	Deviation from the baseline values		Milk yield, l	Deviation from the baseline values	
		liters	%		liters	%
15	21.9	-	100.0	19.3	-	100.0
30	23.6	1.7	107.8	23.2	3.9	120.4
45	25.4	3.5	116.0	26.7	7.4	138.3
60	25.6	3.7	116.9	28.7	9.4	148.6
90	24.5	2.6	111.9	28.5	9.2	147.8

POSITIVE EFFECT

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Conducted experiments have shown that the application of the feed mineral additive allows increasing the cows' natural resistance and normalizes the exchange of macro-and micronutrients. This effect is crucial in the period of active growth of the fetus in terms of prevention of the development of postnatal pathologies, increasing natural resistance and facilitation of active bone formation. Furthermore, the application of the FMA allows increasing the cow milk yield by 1.27 times, and this increased productivity maintains over a long period. In addition, it becomes possible to begin to yield more milk from the cows considerably faster. The labour process in all experimental animals over this period went physiologically, and because of feeding the feed mineral additive the number of obstetrical and gynecological pathologies reduced and the reported postpartum endometritis ran without complications. At the same time, the recovery of the reproductive function occurred quicker. Besides, another advantage of the feed mineral additive was that the calves born to the cows of the experimental group were healthier — they had no signs of postnatal pathologies. Thus, the feed mineral additive with enterosorbent properties has a positive effect on both the health of cows and their offspring.

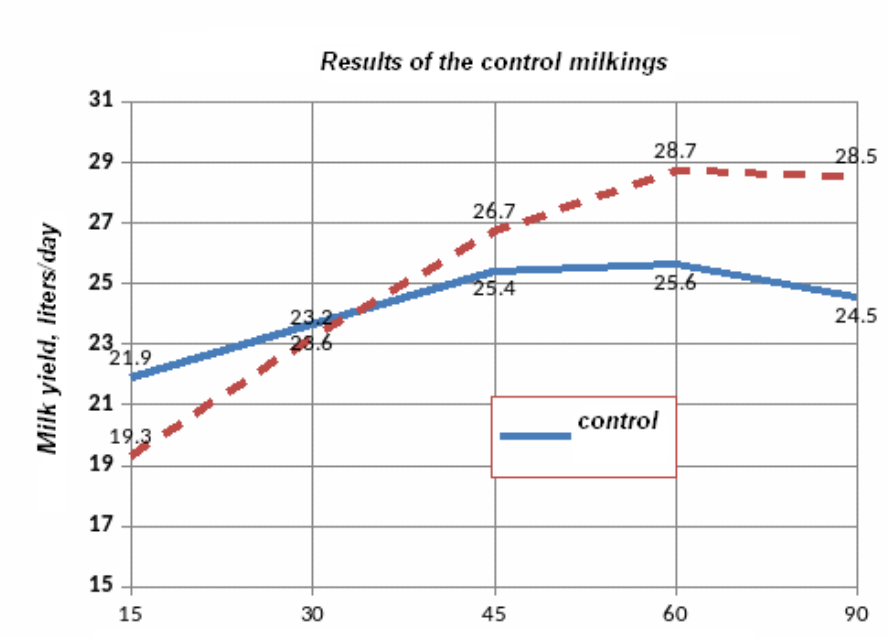

Fig 2: Dynamics of growth of average daily milk yield in freshly calved cows

A FEED MINERAL ADDITIVE AS A WAY TO INCREASE THE RESISTANCE OF THE CATTLE ORGANISM DURING ACUTE RESPIRATORY DISEASES

We conducted laboratory tests before and after the feeding of the feed mineral additive BSH at the agricultural company OOO 'Sovkhoz Beregovoi' (State-funded farm Beregovoi LLC) of Kaslinskiy district of the Chelyabinsk region, with high incidence of infectious rhinotracheitis (IRT), virus diarrhea (VD)-mucous disorder (MD), parainfluenza type 3 (PI-3), respiratory syncytial (RS) infection and eimeriosis.

Authors examined 20 calves born to cows immunized with the Kombovak vaccine at the age of 30 days prior to the application of the BSH additive and after its application, considering the control group. Livestock breeding takes place in the harsh environmental conditions in the region of Middle Urals. Considering the environmental aspects, one specified the task of evaluating the level of animals' natural resistance.

We noted the low content of total protein in serum of calves (4.67 $\pm$ 0.10) prior to applying the BSH-VIT. The decline in the number of erythrocytes and hemoglobin concentration in the blood of calves (5.67 $\pm$ 0.71; 9.67$\pm$ 0.12) causes overall animal organism intoxication regardless of age. Among the calves, the drop in

the number of erythrocytes and hemoglobin concentration in the blood increases the incidence cattle ARVI. The inflammatory processes in animals can cause increase in the number of leukocytes in the blood of calves (7.75 +1.15) during the cattle ARVI. Pronounced leukocytopenia is typical of acute septic processes during viral and bacterial infections in calves (6.50±0.50) and is a consequence of acute intoxications and infectious processes in the acute phase.

After application, BSH-VIT additive stimulated the verified significant increase in the amount of hemoglobin in calves (11.58±0.34) as opposed to the amount prior to its application (P< 0.05), stimulated the increase of erythrocytes in calves (5.93±0.14).

The amount of total protein in calves' blood serum became higher after the application of the BSH-VIT additive (7.37 ± 0.42).

The incidence of ARVI in calves dropped from 32-26.2% to 2.9-1.7%. The livability increased by 17.6%, and daily gains of body weight increased by 17.3%, respectively as opposed to the control group (P< 0.05) (table 5).

Table 5: Specification of the calf performance

Parameters	Calf weight (control group)(n=10)	Weight of calves after the additive application (experimental group) (n = 10)
Calves born alive, %	100	100
Body weight of animals at birth, kg	41.20±0.75	41.80±0.67
Body weight of calves at 30 days of age, kg	55.67±1.57	66.95±1.17
Daily gains of body weight, g	434.1	754.00
The incidence of ARVI, %.	26.2	1.7

BSH-VIT additive has pronounced effect on the stimulation of specific immune response against cattle ARVI. When the anti-ARVI vaccine 'Kombovak' and the additive were applied jointly, the antiviral titer in the blood serum was 1.2-2 $\log_2$ (P<0.05) higher than in the case in which the animals were vaccinated only (table 6).

Table 6: Titers of antibodies to viruses RSI, IRT, VD-MD, PI-3 in the serum of calves

Titers of antibodies	Before	after
RSI, lg_2	1.700±0.125	2.340±0.167
IRT, lg_2	2.450±0.184	3.275±0.1786
WD-MD, lg_2	1.790±0.164	2.567±0.189
PI-3, lg_2	4.270±0.163	5.345±0.297

Mentioned agricultural company has high incidence of eimeriosis, which was reported in the immunoglobulin test results and data of the OGU Oblastnaya veterinarnaya laboratoria (Regional state-funded institution 'Regional veterinary laboratory' of the city of Chelyabinsk) (table 7).

Table 7: Immunoglobulins of the calves blood serum

Item No	Parameter	Prior to introduction of BSH	After 14 days
1.	IgG, g/l	15.588±0.428	16.433±0.321
2.	IgM, g/l	1.632±0.124	2.747±0.132
3.	IgA, g/l	1.982±0.045	3.145±0.064
4.	IgE, g/l (µg/l)	0.000000196±0.000000065(0.196±0.065)	0

IgE is responsible for immediate allergy, takes part in the antihelminth immunity. As can be seen from table 3 IgE was determined prior to the application of BSH-VIT additive, after the application of the additive immunoglobulin was not determined. One observed the increase in IgG, IgM, IgA by 1.2-1.7 times.

CONCLUSIONS

1. Application of the FMA BSH-VIT stimulates growth and development, the humoral and cellular immune response, and in a joint application increases the protective activity of vaccines, decreases allergic reaction eimeriosis (coccidiosis) in calves.
2. The application of the FMA BSH-VIT increases cow milk yield by 12.1%.
4. As for the obstetrical and gynecological pathologies, after the application of the FMA BSH-VIT, the amount of animals with disorders decreased.
5. Labour of all cows in the experiment ran physiologically.
6. Postnatal pathology ran without complications and recovery of reproductive function occurred in a shorter time.
7. Calves from cows in the experimental group had no signs of postnatal pathology.

SUMMARY

In summary, the application of the FMA BSH-VIT increases natural resistance of cows normalizes exchange of macro-and micronutrients, which is important in the period of active growth of the fetus, prevents the development of postnatal pathologies, and promotes natural resistance of the fetus and active bone formation.

CONFLICT OF INTEREST: The authors confirm that the data presented in the article do not contain conflict of interest

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