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Stimulation of Formation of Pre-stomach Type of Digestion in Young Ruminants

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Abstract

Early formation of the pre-stomach type of digestion in young ruminants is an urgent problem for dairy farms even today. This leads to saving milk for milking animals in early ontogeny and replacing it with cheaper feed typical for adult livestock. But the problem of an earlier transition to a common diet for dairy herds often leads to dysbiosis and consequently to diarrhea, dyspepsia, dehydration, and consequent death of the herd. This is explained by the lack of early colonization of pre-stomachs and the rennet itself with symbiont microorganisms characteristic of adult livestock, as well as the formation of toxic substances of the developing pathological microflora.

Disciplinary: Veterinary Science, Animal Science & Technology.

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1 Introduction

Stimulation of the formation of the pre-pancreatic type of digestion in young ruminants, the peculiarities of the structure of the digestion of calves of the dairy period consists in the absence of activity of the pancreatic preliminary preparation of vegetable feeds for further digestion in the main stomach – rennet [2]. The inadmissibility of penetration of food masses into the pre-ventricles is carried out due to the special anatomical structure of the calf's digestive system due to the presence of a special trough that does not allow food masses to penetrate the pre-ventricles (Figure 1).

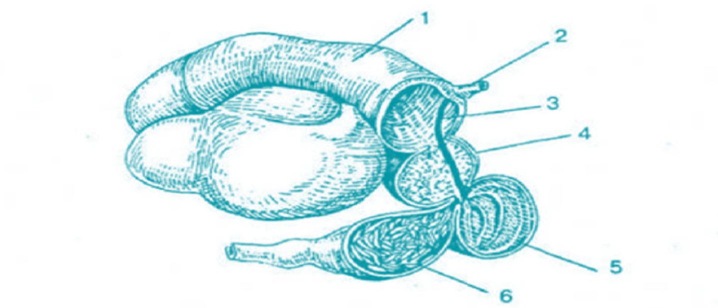

Figure 1: Diagram of the complex stomach of calves during the lactation period:
1 - scar; 2 - the end of the esophagus; 3 - esophageal trough; 4 - mesh; 5 - book; 6 - sychyug.

With proper feeding of the animal, the food masses bypass the pre-pancreas. (Figure 2) This does not allow them to remain undigested and not cause serious digestive disorders. In case of violation of the feeding technology, the esophageal trough ruptures and the milk enters the pre-ventricles that are not adapted for its digestion. Since dairy calves consume milk consisting of protein - casein. Casein - remaining undigested undergoes rotting with the release of such dangerous toxins as indole, skatole, paracresol, etc. This leads to toxicosis, colic and death of young calves [5].

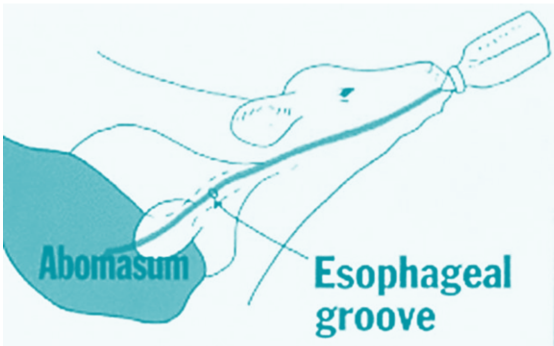

Figure 2: Calf Digestion.

To reduce the recovery time of pancreatic fermentation, the calves were added probiotic drugs and a sorbing additive to the general diet. Previous attempts to populate calf pre-stomachs with symbiont microflora did not have a sufficiently scientifically grounded, holistic and easily accessible technology for artificial faunization of calves this idea was not widely spread [4]. Previously, some of the methods of artificial faunization of calves were to give calves the rumen contents of adult animals obtained by screening with a probe or after slaughtering at the slaughterhouse, exposure of the animal to pharmacological agents that induce vomiting, gum extraction from the mouth and its subsequent feeding to the calf [1].

To reduce the toxic effects of pathogenic microflora during the period of settlement by symbiont microflora through sorption of poisons and xenobiotics entering with feed, sorption of substances involved in hepato- and hemoenteric circulation, substances formed in the intestine during feed hydrolysis, The decision was made to test the mineral additive montmorillonite which is not less than 60-70% of bentonite composition [9].

The goal was to solve the following tasks:

1. Study of the effect of probiotic drugs and their combinations on the digestibility of nutrients, formation of pre-stomach type of energy supply, nitrogen metabolism of the body of calves;
2. The possibility of increasing the non-specific resistance of the body of calves through the settlement of the gastrointestinal tract with lactic acid bacteria by means of probiotic preparations;
3. Effect of the studied preparations on vitamin supply and antioxidant status of dairy calves.
4. Studying the effect of sorbent montmorellenite in combination with the probiotic preparations under the study on the digestibility of nutrients, formation of pre-stomach energy supply, nitrogen metabolism, nonspecific resistance, vitamin supply and antioxidant status of dairy calves.

2 Materials and research methods

The study proves the advantage of early colonization of young cattle gastrointestinal tract not by individual representatives of symbiont microorganisms, and their complex, joint, use with sorbent additives to achieve a maximum, positive effect. A series of experiments were set up to implement these objectives [11].

Research and production experiments were carried out in the Salashansky section of the Frunze collective farm in the Belgorod region [3]. Technological processes mainly meet modern zoo veterinary requirements, but according to the adopted technology calving cows are carried out in the maternity department and then calves are raised in typical rooms, isolated from the breeding stock by feeding the mother's milk to 20 days old twice a day [17].

Experimental and control groups of 10 calves were formed of newborn calves. Calves were fed according to the norms for calves with an average daily live weight gain of 750-850 g. Calves of all groups in all the experiments were on suckling and then received the same ration consisting of milk [15]. Calves of the control group received for a day the named ration, and the experimental groups were added to the portion of milk in the morning and evening with the used preparations. Control of the clinical and physiological condition of the calves was carried out on a daily basis [12].

They were kept on a leash in a separate room on a wooden floor without bedding. The intensity of growth was recorded by individual weighing at birth at the beginning and at the end of the balanced experiment, which coincided with the end of the experiment, namely at 21 days of age, coinciding with the end of the dairy period, and at 45 days of age to determine the effect of the drug [8].

The introduction of the test preparations into the diet was started from the first days from birth and continued until 21 days of age [10].

The first group served as a control and received the basic ration, the second group received in addition to the basic ration the lactobacillus in an amount of 1 a billion microbial bodies per day of live weight, the third group received in addition to lactobacillus the montmorillonite containing bentonite clay, 100 mg per kg bodyweight of the animal [7].

Over the period of the experiment, the average daily live weight gain increased by 4.2% when lactobacillus and montmorelenite were used together by 5.8%. The use of the preparations increased feed efficiency and achieved a decrease in feed consumption per unit live weight gain by 6.89 and 7.24%, respectively.

The weak gain in live weight in the control is probably due to lower digestion, metabolism and absorption of nutrients and the resulting growth rate, which probably led to the illness and death of one calf from dyspepsia [6].

At the age of 45 days in transition to vegetable feed, growth of live weight of experimental, artificially faunalized calves still remained higher, apparently, it is connected to the better assimilation of a diet and consequently the greater provision of nutrients and energy [2].

The health status of the calves was satisfactory. No pronounced differences between the groups were found. The animals actively consumed feed, were mobile, and reacted adequately to various stimuli. In the early period of life, there were cases of diarrhea in calves of this farm, with appetite and feed intake decreased in animals, they became weak and little mobile, body temperature was within normal limits, sometimes nasal effusion was observed [1]. However, animals of the group that consumed probiotic and sorbent had practically no diarrhea, and in those who had it, it was of mild form [16]. The animals actively consumed fodder, and during the whole experiment the calves receiving the preparation had higher consumption of vegetable feed: hay and concentrates. Consumption of concentrates was higher in the first three weeks by 5% ($p>0,95$) in calves treated with probiotic and by 8% (probability (p) > 0.95) in calves fed with probiotic and sorbent containing montmorellinite. Compared to the control group, hay consumption increased by 22% ($p > 0.999$) in the third group. This indicates that faunization of lactobacilli stimulates the appetite of calves towards the consumption of plant feed and consequently activates the polligastric type of digestion [13].

The study of rumen content revealed that the index of hydrogen ions level in it in calves was optimal for the given age. Intergroup differences were practically absent. Concentration of ammonia nitrogen in rumen content in calves of experimental groups at three weeks of age was reliably higher by 15.2% ($P>0.99$) in lactobacillus-treated calves and by 56,7% ($P>0,95$) in calves given a complex preparation in comparison with the control. Reliably higher amount of total nitrogen in the rumen fluid of the experimental groups' calves was kept at a significantly higher level than that of the control, which was higher by 15% ($P>0.999$) in the second group and 22.2% ($P>0.99$) in the third group, respectively [14].

Higher content of higher fatty acids in scar content of experimental groups by 21.4% ($p>0.999$) in the second group and by 51.4% ($p>0.95$) in the third one, apparently, is caused by activating action of the complex of substances resulting from the activity of microflora, including that splitting protein compounds, which is proved by higher content of ammonia by 56.7% in the second 15.2% in the third group as compared with the control group, and of total nitrogen by 22.2% and 15.3%, respectively (Table 1).

Table 1: Rumen fermentation indices in calves under probiotic inoculation at 21 days of age.

	Groups			Comparisons	
	I	II	III	II : I	III : I
RN	6.1 ±0.1	6.00 ±0.14	6.35 ±0.04	98.4	104.1
FLC mMol/100ml	3.93 ±0.17	5.95 ±0.14	4.77 ±0.1	151.4	121.4
Ammon. nitrogen mg/100ml.	14.98 ±0.8	23.8 ±0.74	17.5 ±1.43	156.7	115.2
Total nitrogen mg/100ml.	111.00±2.24	135.67±1.1	128.00±1.7	122.2	115.3

In turn, the increase in total nitrogen concentration by 32.4% (P>0.999) and 44.1% (P>0.99) in groups II and III compared to controls, and the decrease in ammonia by 28.1% (P>0.99) and 30.9% (P>0.95), respectively, are associated with intensive use of ammonia nitrogen for synthetic purposes by microflora inhabiting the gastrointestinal tract of dairy calves via the probiotic microorganisms used in this experiment 0.95), respectively, is obviously associated with intensive use of ammonia nitrogen for synthetic purposes by microflora colonized in the gut of dairy calves through probiotic products based on lactic acid bacilli and associations of flora and fauna cultures that appeared and multiplied in pre-stomachs in response to consumption of roughage, and the increase in the group with the addition of montmorellenite, apparently associated with the adhesion of lactobacilli on the surface of the sorbent and binding the latter of toxic substances entering with feed and formed by pathogenic microflora [4].

Study of morphological and biochemical blood parameters of animals revealed a tendency to increase under the action of preparations in blood of erythrocytes, hemoglobin, total protein, glucose and lipids. It should be also noted that obtained data are within the norm (Table 2).

Table 2: Non-specific resistance indicators at 21 days of age from birth

	Groups		
	I	II	III
Erythrocytes, million/µl.	5.07 ±0.12	7.07 ±0.05	7.99 ±0.02
Leukocytes thousand/µl.	4707 ±177	7350 ±1077	5459 ±79
Hemoglobin g/l.	117.5 ±2.77	111.00±1.17	109.2 ±0.47
Hematocrit	30.25 ±0.57	33.17 ±0.23	32.24 ±0.05
Oxygen capacity	17.07 ±0.42	15.07 ±0.20	14.77 ±0.07
COE	59.77 ±2.2	54.20 ±0.79	45.90 ±0.11
Average diameter	7.11 ±0.54	7.17 ±0.14	5.73 ±0.004
Average hemoglobin concentration	37.75 ±0.91	33.75 ±0.50	33.97 ±0.13
Average content (SSE)	22.73 ±0.54	17.27 ±0.05	15.50 ±0.07

3 Research Results

Increased erythrocyte content in blood of calves of experimental groups had a corresponding effect on hematocrit value, which also significantly increased. Significant changes in oxygen capacity were found in Group III calves receiving the complex supplement. It is important to note that against the background of using the complex of preparations, oxygen capacity was the highest. But the average red cell count (RBC) of this group was reliably the lowest (P>0,999). There was a significant decrease in the SOE also in the calves of groups II, III in comparison with the control group. The average concentration (SCE) and the average content (SSE) of hemoglobin in erythrocytes decreased, which had such a marked effect on the content of hemoglobin in general.

In calves of experimental groups not only the number of erythrocytes but also the haemoglobin amount, hematocrit value, oxygen capacity, sedimentation rate, mean thickness and mean diameter of erythrocytes significantly increased (P>0.95 - 0.99).

Erythrocytes of calves of control and experimental groups are functionally unequal. Larger erythrocytes in calves against the background of probiotics and montmorollenite were more saturated with hemoglobin.

4 Conclusion

This study finds positive effects of probiotics in combination with the sorbent montmorillonite. Infestation of the gastrointestinal tract of calves with lactic acid bacilli, with the addition of sorbent montmorollenite from the first days of existence helps to improve appetite, greater consumption of plant feed, increase live weight and reduce feed costs per kilogram of growth. The complex application of probiotics and bentonite clay based on montmorollenite had a positive effect on calves than their use separately, and the combined use of probiotics with adsorbent, can already be called eubiotic preparation. To accelerate the colonization of the gastrointestinal tract of dairy calves with symbiont microorganisms it is advisable to use lactobacilli in doses of 1 a billion microbial bodies per day per calf.

In case of unsatisfactory environmental conditions, which is reflected in feed, milk and colostrum, it is recommended to add to the above described complex an adsorbent, in this case montmorollenite base of bentonite clay.

5 Availability of Data and Material

Data can be made available by contacting the corresponding author.

6 References

[1] Antipov, V.A. (1981). Biological preparations of symbiont microorganisms and their use in veterinary medicine. *Agriculture abroad*, 2, 43-47.

[2] Antipov, V.A. (2007). Prospects of use of natural aluminosilicate minerals in veterinary medicine. *Veterinary*, Krasnodar NIVI; VNIVIPFiT, pp. 54-57.

[3] Boyko I.A., Vodyanitsky G.A., Likholetov Y.P. (1992). Method of growing calves: A.C.. 1715283. Bull. 8.

[4] Ivanov A.V. (2010). Mycotoxicosis of animals (biological and veterinary aspects), (M.: Kolos) pp. 392.

[5] Intizarov M.M. (1986). Possibilities of gnotobiological experiment in studying the mechanisms of bacterial antagonism and symbiosis. *Theoretical and practical problems of gnotobiology*. M., pp. 22-29.

[6] Kuznetsov A.F. (1988). Enterosorption as a method of efferent therapy in veterinary medicine. *Veterinary practice*, 3(6), 10-16. http://bentonite.narod.rLi/prod2_ru.htm

[7] Tkachev A.V., Tkacheva O.L., Rossokha V.I. (2018). Cytogenetic status of mares (Equus caballus) of Ukrainian riding breed influences their fertility, Sel'skokhozyaistvennaya Biologiya (Agricultural Biology), 53(2), 302-308. DOI: 10.15389/agrobiology.2018.2.302eng

[8] Tkachev A.V., Tkacheva O.L., Rossokha V.I. (2018). Associated connection of erythrocitary antigens with characteristics of stallion semen after cryoconservation. Sel'skokhozyaistvennaya Biologiya (Agricultural Biology), 53(4), 735-742. DOI: 10.15389/agrobiology.2018.4.735eng

[9] Tkachev A.V., Sheremeta V.I., Tkacheva O.L., Rossokha V. I. (2017). Physiological relationship of erythrocyne antigens with indicators of horse spermogram. *Fiziol. Zh.,* 63(1), 84-90. DOI: 10.15407/fz63.01.084

[10] Tkachev A.V., Tkacheva O.L., Zubova T.V., Pleshkov V.A., Smolovskaya O.V. (2020). Effect of Mycotoxins on the Spermatozoa and Embryos of Animals. *Advances in Animal and Veterinary Sciences*, 8(s3), 47-55. DOI: 10.17582/journal.aavs/2020/8.s3.47.55

[11] Tkachev A.V., Tkacheva O.L., Gazzavi-Rogozina L.V., Zubova T.V., Smolovskaya O.V., Pleshkov V.A., Modern Technology of Poultry Semen Cryopreservation. *IV International Scientific and Practical Conference Modern S&T Equipments and Problems in Agriculture*, pp. 235-244. DOI:10.32743/kuz.mepa.2020

[12] Kovalenko Anatoly M., Tkachev Alexander V., Tkacheva Olga L., Izhmulkina Ekaterina A., Zubova Tatyana V., Pleshkov Vladimir A., Smolovskaya Oksana V. (2020). Distal extremities diseases in dairy cattle related to qualitative and quantitative indicators of embryos obtained from donor cows. *International Journal of Advanced Science and Technology*, 29(9s), 1271-1282.

[13] Tkachev A.V., Tkacheva O.L., Gutyj B.V. (2019). The modern methods of reproduction physiology of horses. *Ukrainian Journal of Veterinary and Agricultural Sciences*, 2(1), 18–23. DOI: 10.32718/ujvas2-1.04

[14] Kovalenko A. M., Tkachev A. V., Tkacheva O. L., Gutyj B. V., Prystupa O. I., Kukhtyn M. D., Dutka V. R., Veres Ye. M., Dashkovskyy O. O., Senechyn V. V., Riy M. B., Kotelevych V. A. (2020). Analgesic effectiveness of new nanosilver drug. *Ukrainian Journal of Ecology*, 10(1), 300-306. DOI: 10.15421/2020_47

[15] Boyko N., Tkachev A., Kovalenko A., Pisarev D., Kuznietsova V., Sushchuk N., Bondarev A. (2019). Phytochemical, microbiological, and technological studies in the field of obtaining a hydroalcoholic extract with antimicrobial activity from the liquorice root. *Asian Journal of Pharmaceutical and Clinical Research*, 12(1), 403-407.

[16] Pokhodnya G.S., Malakhova T.A., Korobov D.V. (2018). Increasing the efficiency of fattening pigs. Zootehnia, 5, 14-17.

[17] Pokhodnya G.S., Malakhova T.A. (2018). Influence of feeding the preparation "HydroLactiB" to repair pigs in the period of growth on their growth and reproductive function. *Agrarnaya nauka*, 7-8, 32-34.

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