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Efficiency of probiotics use in treatment of calves

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ABSTRACT

The comprehensive approach to solving the issue of the animal raising intensification, the integrated part of which is herd breeding, animal yield preservation and its development provision, conditioned the enhancement of the research works aimed at further investigation of young stock diseases, features of their digestion development, search of efficient preventive and treatment measures, feeds and feed additives for simulating animal growth and development. The main objective of this study was the exploration of comparative therapeutic efficiency of the use of Lactusan probiotic in treatment of calves, in acute digestive disturbances in the complex of conventional treatments. The experiment was carried out in the conditions of Danilovsky Complex of Semenovsky Stud Farm CJSC of Medvedev District in Mari El Republic in calves aged 2-4 days with clinical signs of digestive organs dysfunction. 3 experimental groups of calves were formed observing the principles of analogues. Calves of the first and the second experimental groups, in addition to the treatment regimen adopted at the farm, were given Lactusan probiotic with colostral milk or milk at the rate of 6 grams and 4 grams, respectively per one calf once a day. Haemotological and biochemical analysis was carried out in all experimental calves at the beginning of the experiment and 5, 10 and 15 days after the treatment start. The experience demonstrated that Lactusan has a normalizing effect on protein, carbohydrate, mineral metabolisms, and pH balance. The positive effect of this drug on animals is conditioned by the probiotic effect of lactulose - it selectively stimulates the growth of useful intestinal normal flora by inhibiting pathogenic flora of colon.

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INTRODUCTION

A crucial and yet unsolved task in modern cattle breeding is the challenge of providing high young stock preservation during the early postnatal period (Khristoforovich *et al.*, 2016; Smolentsev *et al.*, 2018). Among young stock non-contagious diseases, gastrointestinal diseases are registered most often, equaling 60-90% in newborn calves younger than 10 days, and mortality is from 14 to 60 % in the first days of life. One of the most common gastrointestinal diseases of newborn calves is acute indigestions (dyspepsia) (Semenov *et al.*, 2018).

Conventional drugs for treating gastroenteritis and

dyspeptic disorder not always have high therapeutic efficiency and long-term use of antibiotics causes dysbacteriosis as a rule. Protecting normal intestinal flora by feeding probiotics is an efficient method to restore the broken balance between the ratio of main groups of intestinal microorganisms (Anatolievna *et al.*, 2016; Ilyasovich *et al.*, 2016; Egorov *et al.*, 2018). However, useful properties of most probiotics can stay unrevealed because strains included in their composition are not able to actively colonize the intestinal wall. In connection with this, the interest in searching ways to normalize the intestinal flora due to the use of prebiotics contributing to animal health improvement with selective growth stimulating and or metabolic activity of one or several groups of bacteria in the intestine increased considerably in the recent decades. Among all bifidogenic food materials, lactulose is one of the most studied and widespread (Matveeva *et al.*, 2015; Dmitriyevich *et al.*, 2016).

The main objective of this study was the exploration of comparative therapeutic efficiency of the use of Lactusan probiotic in the treatment of calves, in acute digestive disturbances (dyspeptic disorder) in the complex of conventional treatments.

MATERIALS AND METHODS

The basic laboratory and clinical studies were carried out in the Republic Veterinary Laboratory of Mari El Republic, and scientific and economic experiments were carried out in Semenovsky CJSC in Danilovsky Cattle Complex of Medvedev District in the Mari El Republic on calves aged 2-4 days with clinical signs of digestive organs dysfunction.

3 experimental groups of calves (the control one and two experimental) were formed using the pair comparison method.

Lactusan (TC 9229 -005-53757476-09) manufactured by Felitsata Holding LLC with a mass fraction of lactulose 75.2 %. Lactulose is a white crystalline substance, odorless, very soluble in water. It is a product of advanced milk processing: is manufactured from sugar - lactose of milk.

Calves of the first and the second experimental groups, in addition to the treatment regimen adopted at the farm, were given Lactusan probiotic with colostral milk or milk at the rate of 6 grams and 4 grams, respectively per one calf once a day. Hematological and biochemical analysis was carried out in all experimental calves at the beginning of the experiment and 5, 10 and 15 days after the treatment start.

Hematological and biochemical analysis was carried out in all experimental calves at the beginning of the experiment and 5, 10 and 15 days after the treatment start. At this, quantitation of red blood cells and white blood cells according to the established procedure by count in Gorjaev's chamber, differential leukocyte count (WBC differential) were carried out according to the procedure described by I.P. Kondrakhin. Hemoglobin level was determined by Hemoglobin-Cyanide Method with the use of the Bio cont Gem diagnostic kit. Total blood serum protein was determined by refractometric methods, and its fractions - by turbidimetric (nephelometric) method, total calcium - by trigonometric method, inorganic phosphorus in protein-free blood filtrate with vanadiate molybdenum reagent (according to Pools in modification of W.F. Koromyslov and L.A. Kudryavtseva), blood alkalinity reserve - by diffuse method with duplicate flasks according to I.P. Kondrakhin, blood serum carotene according to Carr-Price (in modification of Yudkin) (Valiullin *et al.*, 2017; Popov *et al.*, 2018). Biochemical studies were conducted on the basis of the Republican Veterinary Laboratory. Calves were weighed to control the young stock growth and development. The study results were statistically processed in accordance with the use of Microsoft Excel.

RESULTS AND DISCUSSION

We have established for the period of studies that the incidence of various forms of dyspeptic disorder in the Danilovsky Dairy Farm of Medvedev District in the Mari El Republic is 35-42% and has seasonal dynamics. In the summer and autumn season, the disease incidence is lower, and in spring, the disease incidence and the degree of manifestation in calves increase.

The therapeutic drug efficiency was established with regard to the number of recovered calves from those treated and the disease severity and duration.

In the process of treatment, general health condition increased considerably, sucking reflex and appetite restored, fecal formation occurred, movements became active. In the first group, recovery occurred on the 6th day, and in the second, on the 5th one. Temperature, pulse rate and respiration rate were within normal limits. The therapeutic effect was 100% in the fist and the second groups. In the control group, recovery occurred on the 8th day of treatment.

According to the analysis of hematological parameters, before the start of therapy, the level of formed elements in the blood of sick animals was characterized by the relative increase vs. the reference values, typical for dehydration. In ill calves of all groups,

Table 1: Haematological blood values of experimental animals, with dyspeptic disorder

Parameters	Days of study	Experimental groups		
		First	Second	Control
RBC, 10^{12}/l	background	9.65±0.12	9.95±0.34	9.12±0.23
	7-days	7.46±0.13	7.82±0.14	8.88±0.18
	15-days	6.53±0.30	6.44±0.52	7.48±1.12
WBC, 10/l	background	11.1±0.03	10.2±0.01	11.8±0.02
	7-days	9.5±0.04	9.4±0.03	11.2±0.02
	15-days	9.6±0.01	9.5±0.03	10.7±0.05
Hb, g/l	background	110.6 ±6.0	103.6±5.0	120.4±4.3
	7-days	108.6±4.5	95.7±2.8	113.6±5.1
	15-days	98.6±3.2	97.5±3.1	90.6±2.7
ESR, mm/h	background	1.7±0.001	1.16±0.001	1.14±0.001
	7-days	1.0±0.002	1.0±0.001	1.3±0.001
	15-days	0.5±0.001	0.5±0.001	0.8±0.001

Table 2: Biochemical blood values of experimental animals with a dyspeptic disorder

Parameters	Days of study	Experimental groups		
		First	Second	Control
Glucose, mmol/l	background	3.65±0.02	3.8±0.04	3.7±0.01
	7 days	4.46±2.9	4.2±0.02	3.8±0.03
	15 days	4.84.6±2.9	4.2±0.03	3.8±0.02
Calcium, mmol	Background	2.51±0.22	2.67±0.31	2.72±0.45
	7 days	2.68±0.31	2.72±0.56	2.67±0.39
	15 days	2.84±0.65	2.89±0.56	2.81±0.64
Inorganic	Background	1.31± 0.02	1.24± 0.01	1.27± 0.004
phosphorus, mmol/l	7 days	1.66± 0.03	1.72± 0.02	1.65± 0.002
	15 days	1.74±0.12	1.78±0.74	1.55±0.87
Total protein, g/l	Background	51.1±1.2	56.6±3.5	50.5±2.9
	7 days	51.8±2.7	55.8±2.5	54.3±4.0
	15 days	59.2±3.0	57.1±3.1	54.2±2.7
Albumins, %	Background	51.5±4.6	54.1±4.1	50.3±2.5
	7 days	54.2±7.7	51.7±3.2	49.7±1.9
	15 days	52.4±2.6	53.1±4.3	47.2±5.6
α-globulins,%	Background	6.25±0.8	7.5±0.6	7.0±0.7
	7 days	4.4±0.9	4.8±0.3	5.3±0.8
	15 days	5.2±0.4	5.9±0.7	6.1±0.7
β-globulins,%	Background	13.2±1.5	14.5±1.1	14.5±0.6
	7 days	15.1±0.7	13.6±0.8	16.7±0.6
	15 days	15.1±0.7	18.1±0.4	16.3±0.7
γ-globulins,%	Background	39.1± 3.2	23.9±3.1	28.2±3.8
	7 days	26.3 ±4.4	29.9±4.6	28.3±4.1
	15 days	26.3±1.2	22.9±2.8	30.4±2.9

Table 3: Calf treatment results

Groups	Treatment duration, (days)	Recovered (%)	Bodyweight, (kg)		
			Before treatment	After recovery	Gain
Control	7.81±1.13	80	20.9±1.2	23.6± 1.5	0.35
1^{st} experimental	5.65±1.36	100	21.9±0.9	24.9± 1.1	0.43
2^{nd} experimental	4.72±0.68	100	23.1± 1.0	25.8±1.4	0.45

RBC blood level was higher by 25-30% by the start of therapy, than in normal healthy calves of the same age, WBC - by 10-12.0%, Hb– by 5-8%, along with ESR slowdown, that can be explained by liquid loss at diarrhea and body dehydration. No significant differences were observed in the parameters of different animal groups (Table 1).

In the process of treatment, hematological parameters were normalized in animals of all groups, which was connected with the treatment dynamics and age features. But in the first and the second groups, that were receiving Lactusan with colostral milk, this trend is revealed in earlier terms, which was confirmed by clinical studies. On both the 5th and the 15th day of the research, the level of RBC, WBC, Hb in the experimental group is already within the age limits for healthy animals, while normalization in the control group occurs later.

Concerning biochemical parameters, normalization of some of them in healthy animals occurs in shorter terms and exceeds those of control animals (Table 2).

E.g., total calcium level in animals of all groups was within the age reference values, but by the 15th day of the study, it exceeds these values in experimental groups by 11.5 % compared to the control group.

The level of inorganic phosphorus in the blood of animals of all three groups exceeded the age reference values, and it does not become normal throughout the observation period. However, in the second group, which was receiving 6 g /animal of Lactusan with colostral milk, it decreases more intensively by 7.9%.

Against this background, pH balance is shifted towards acidosis: Before treatment start, all animals had alkalinity reserve lower than reference values by 6-10 volume % CO_2. In the experimental groups, this parameter normalizes evenly by the 15th day, and in the control group, it remains below reference values.

The same trend is observed in glucose concentration change that is below age reference values by17.6% on average. In animals from the first two groups, it increases by 10 and 9% respectively and stays on the same level in the control group at the moment of the study start.

Alkalinity reserve, glucose, total protein parameters were below reference values in all animals before treatment, which is in accordance with the level of these parameters in the blood serum of mother cows. Total protein content was lower by 5-6 g/l (10%). By the end of the experiment, it is normalized and reaches normal parameters in the calves which received Lactusan, and in the control group, the increased intensity is lower.

In the first group of calves, animals recovered on the 5.65±1.36 day, and on the 4.72±0.68 day in the second group (Table 3).

The use of Lactusan also demonstrates the stimulating action on growth energy in ill calves. E.g., the average daily gain in those calves that received Lactusan probiotic with colostral milk in doses of 4 and 6 g /animal was 430 and 450 gr, respectively, which is higher by 22.8 and 28.6 % in comparison with the control group. For the experimental period, it was established that the use of Lactusan against the background of the conventional treatment method appeared to be more efficient. E.g., the average clinical recovery term in calves of the experimental groups was 5- 6 days, compared to 8 days in the control group; at this, the growth energy (average daily gain) in experimental animals was also higher, equaling 0.43 and 0.45 kg, respectively, compared to 0.35 kg in the control group which is lower by 20-22%.

CONCLUSION

With the purpose of increasing the therapeutic efficiency of dyspeptic disorder treatment in calves, it is recommended to add Lactusan in the dose of 4 g per one calf daily, with colostral milk or milk to the complex of therapeutic measures. Lactusan has a normalizing effect on protein, carbohydrate,

mineral metabolisms, and pH balance. The positive effect of this drug on animals is conditioned by the probiotic effect of lactulose - it selectively stimulates the growth of healthy intestinal normal flora, inhibiting pathogenic flora of the colon. The intestinal pathogenic flora inhibition caused by lactulose results in the considerable reduction of its toxic metabolites admission (ammonia, amines, nitrosamines, phenols, cresols, indole, etc.) into the bloodstream.

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