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Experience of Fir Tree Extract Application for Prevention of Gastrointestinal Tract Diseases in Newborn Calves (Prevention of Calf Dispepsy)

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ABSTRACT

The aim of the research was to study the use of fir tree extract (Pikhteks) in calves from 14 to 28 days of age for prevention of gastrointestinal tract diseases. The studies were carried out for 14 days. The results showed that the introduction of Pichteks into the diet of calves did not negatively affect the physiological state of the animals. Appetite was preserved, body temperature, respiratory rate and heart rate remained within the physiological norm for the entire period of the experiment. Hematological studies showed no changes in the direction of pathology in the calves of the experimental group, so the number of erythrocytes ranged from 7.7±0.38 to 8.33±0.20 10^{12}/l; leukocytes from 9.31±0.12 to 8.17±0.38 10^{9}/l and hemoglobin from 110.33±4.97 to 111.3±1.88 g/l. A slight increase in these indicators corresponded to the age of the calves. In biochemical blood tests and in the leukocyte formula, there was no significant difference in the indicators. However, in the control group on the 3rd day of the study (age 17 days) two calves fell ill with dyspepsia. The disease was difficult and one calf died. In the experimental group, the survival rate of calves was 100%.

Key words : Calves, dyspepsia, Pikhteks, blood tests, safety

INTRODUCTION

Modern methods of raising cattle are largely dependent on organizational, economic, zootechnical and veterinary measures. Efficient use of high quality feed, balanced nutrition and use of mineral supplements makes it possible to increase the production of dairy and meat products (de Paris *et al.*, 2020; da Silva *et al.*, 2020). Knowledge of objective laws of cattle growth and development is of great importance. It should be borne in mind that with age, the growth energy decreases, but the consumption of feed per kilogram of gain increases significantly (Afanasyev and Elenschläger, 2017; Severino-Lendechy *et al.*, 2020). The main factor for the full growth and development of calves is a properly balanced diet in the first days of life. Only healthy calves can become highly productive in the future (Constable *et al.*, 2017). The practice of livestock farming and numerous scientific studies have established that a deficiency in the diet of even one nutrient can cause disruption in the development of tissues and organs that have a huge growth rate; thereby it reduces the viability and immunity of the calf. Calves during the preweaning period are more in need of a well-balanced and nutritious diet. During this period, dairy calves are very sensitive to the deficiency of vitamins, macronutrients, trace elements and other biologically active substances. Saturation of diets with complex biologically active substances is a simple and effective way to normalize metabolism (Jiang *et al.*, 2020).

In the first hours of life, calves are not adapted to self-preservation, and their adaptation to external conditions is extremely difficult. In a newborn animal, all the basic mechanisms of life support (water exchange, mineral metabolism, thermoregulation and the work of enzyme systems) are very poorly developed. In the postnatal period, the blood of calves shows a slightly acidic, neutral pH from 6.8 to 7. It contains a large amount of sugar, amide nitrogen, lactic acid, acetone bodies, while the protein content is low. The humoral protective factors of the blood are acquired gradually through the consumption of maternal

colostrum. All nervous regulation of physiological processes occurs with the help of inborn reflexes, such as motor, food (sucking), protective, thereby adapting the newborn to environmental conditions. All major digestive functions, which are influenced by the central nervous system, increase their performance over time (Pozov *et al.*, 2018). Saliva of newborn calves has a similar composition to that of an adult animal. Starting from the first minutes of life, all salivary glands (sublingual, submandibular, parotid) function normally, but they secrete very little saliva. Calves' saliva contains lipase, which begins to be activated during drinking, in the process of sucking colostrum (Andreevskikh, 2018).

The first ruminant periods occur in calves from 10 days of age, but they are very weak. From the 20th day of life, the rumen of the calves is reduced in a normal rhythm and the ruminants become stable. In comparison with adult animals, in which almost 85% of the feed consumed with the help of microflora is digested in the rumen, newborn calves use a set of their own enzymes that help to assimilate proteins better from colostrum and take part in assimilation of carbohydrates. In the postnatal period, the body of the calf digests lactose immediately, while sucrose is not absorbed at all due to the low activity of maltose and the high level of lactose (Poryvaeva *et al.*, 2019). Until 28 days of age, due to the low concentration of amylase and maltose in the juices of the gastrointestinal tract, starch and its decay products are not fully digested. Over time, the activity of lactose gradually decreases. The first release of meconium (original feces) from the intestines of calves occurs in the first hours of life. In the first week of life, calf feces consist of 72% of water and 28% of solids contained in colostrum (Tyapkova and Shusharin, 2019). At birth, calves have a poorly developed protective (barrier) function of the liver and all toxic substances are very poorly neutralized (Arfuso *et al.*, 2017). Newborn calves are prone to neonatal calf diarrhea, especially during the first 28 days of life. Neonatal diarrhea is a common disease in calves and continues to be a major cause of productivity and economic loss for breeders worldwide (Merhan *et al.*, 2016). A calf with diarrhea is dehydrated, depleted of electrolytes and acidosis. In addition to the effects on the gastrointestinal tract, other organ systems and functions are affected, such as the lungs, kidneys and liver (Zemlyanukhina, 2019). Timely drinking of high-quality colostrum allows increasing the immunity of calves; it populates the gastrointestinal tract with microflora useful for the animal's body. Untimely intake of colostrum or intake of poor quality colostrum violates the general and local protective function of the body, provoking diseases of the gastrointestinal tract (Asadi *et al.*, 2015).

It can be noted that, as in most diseases, in gastrointestinal pathology with a symptom complex of diarrhea, it is necessary to single out the factors predisposing to the disease, etiological and complicating the course of the pathological process. The success of preventive measures can be achieved by taking into account all these factors and, in accordance with them, organizational, sanitary and hygienic and other measures should be carried out on the farm (Kletikova *et al.*, 2020; Zwierzchowski *et al.*, 2020).

In Russia and abroad, various protocols for the prevention and treatment of gastrointestinal diseases in young cattle have been developed and they are being successfully implemented, however, most of the drugs used do not always give the desired effect. Therefore, at present, in veterinary practice, various extracts of medicinal plants that are harmless to the animal's body are increasingly used for the prevention of these diseases.

The topic of the gastrointestinal disease prevention in calves is also relevant for the farms of the Kemerovo region.

Objective of the research was to study the effect of fir tree extract for the prevention of gastrointestinal diseases in calves.

MATERIALS AND METHODS

The experiment was carried out in the conditions of the calf barn of the individual farm entrepreneur of the peasant farm enterprise "Baranov Alexander Yurievich". The groups of calves were formed according to the principle of analog pairs. Animals for the experiment were selected according to live weight, sex, age and physiological state. Calves of all groups were kept under the same conditions typical for the given farm.

To monitor the health status of the animals,

the following indicators were determined : daily heart rate and body temperature; respiratory rate on the 14th and 28th days of the study. Heart rate was determined by palpation on the left side in the 4th intercostal space on an area of 5-7 cm^2 and on the right side in the 3rd intercostal space. Respiratory rate was determined at rest period, by counting the number of breaths or exhalations in 1 min. The method of examination was used by fluctuations of the chest or by the lower outline of the abdomen. Body temperature was measured rectally with a medical thermometer. Blood was taken from the jugular vein into sterile tubes, observing the rules of asepsis and antiseptics. Blood tests were carried out in the research laboratory "Biochemical, molecular and genetic research and selection of farm animals" located at 9A Centralnaya st., village Novostroyka, Kemerovo region.

Research work was carried out in accordance with directives 2010/63/EU of the European Parliament and the Council of the European Union on the protection of animals used for scientific purposes, as well as with the Federal Law of the Russian Federation of November 21, 2011 N 323-FZ "On the basics of protecting the health of citizens in the Russian Federation". Experts with higher veterinary and biological education took part in the research.

For experimental animals, there was created an individual map, in which all manipulations during the experiment and until its completion were reflected daily. During the work with the animals, safety measures for the experimenters were observed.

To assess the preventive effect of the Pikhteks preparation, there were determined the incidence of dyspepsia in calves, the course of the disease and the safety of animals (Table 1).

Table 1. Scheme of the experiment

Group (n=10)	Preventive treatment
Control	Traditional feeding
Experimental	Traditional feeding+0.1 ml of fir tree extract/kg of live weight once a day for 14 days

The fir tree extract contained : vitamins A, B, C and E; trace elements, phytoncides, chlorophyllin, starch, proteins, bioflavonoids and sugars. The preparation was 100% natural. Practice showed (Constable *et al.,* 2017) that the use of the extract prevented animals from many diseases and complications. Vitamin A (retinol) contributed to the animal's growth and development, increasing the resistance of young animals, the body's resistance to gastrointestinal and respiratory diseases. Vitamin E (tocopherol) increased the productive capacity of females and males, reduced stillbirth. Vitamin C (ascorbic acid) increased the body's resistance, counteracted inflammatory processes, metabolic disorders, etc. Vitamin B2 (riboflavin) promoted the development of young animals.

RESULTS AND DISCUSSION

Before the introduction of Pikhteks into the diet of calves, the body temperature was within the physiological norm and amounted up to 38.6±0.30 and 38.6±0.18°C, which corresponded to the age of the animals. After 10 days of using the drug, these indicators changed slightly and also corresponded to the norm. The difference in heart rate (HR) indicators did not go beyond the physiological norm (70-100 beats/min) in all periods of the study. There were no pathological shifts in the respiratory rate (RR) in the calves of the experimental group compared to the control one; the respiration rate in all periods of the study ranged from 37.0±0.85 to 38.5±0.84 respiratory movements per min i.e. was within the physiological norm for young cattle (25-45 respiratory movements/min) (Table 2).

Table 2. Clinical and physiological parameters of calves

Indicator	Group	
	Control	Experimental
At the beginning of the research		
Body temperature (°C)	38.6±0.30	38.6±0.18
HR/min	80.7±0.97	79.8±1.43
RR/min	34.3±2.71	32.7±2.48
At the end of the research		
Body temperature (°C)	38.2±0.20	39.0±0.26
HR/min	80.8±1.32	78.9±1.47
RR/min	38.5±0.84	37.0±0.85

HR–Heart rate and RR–Respiratory rate.

When studying the morphological and physiological parameters of blood, the number of erythrocytes (RBC), leukocytes (WBC) and the concentration of hemoglobin (HGB) were within the physiological norm (Table 3).

Table 3. Morphological parameters of the calves' blood (M±m; n=6)

Indicator	Group	
	Control	Experimental
At the beginning of the research		
RBC (10^{12}/l)	7.11±0.32	7.7±0.38
WBC (10^9/l)	8.79±0.31	9.31±0.12
HGB (g/l)	110.81±5.73	110.33±4.97
On the 14th day of the research		
RBC (10^{12}/l)	8.2±0.28	8.33±0.20
WBC (10^9/l)	8.3±0.22	8.17±0.38
HGB (g/l)	112.0±0.63	111.3±1.88

Quantitative indicators of erythrocytes slightly increased on the 14th day of research from 7.11±0.32 to 8.2±0.28 in calves of the control group and from 7.7±0.38 to 8.33±0.20 10^{12}/l in the experimental group. There was a slight increase in the amount of hemoglobin from 110.81±5.73 to 112.0±0.63 in the control group and from 110.33±4.97 to 111.3±1.88 g/l in the experimental one. There was no significant difference in the indicators.

The quantitative indicators of total protein on the 14th day of the experiment in the control group increased from 62.7±0.35 to 66.3±1.33, and in the experimental group from 62.3±0.27 to 64.3±0.98 g/l. There was a slight increase in serum calcium in calves of the control group from 2.42±0.15 to 2.67±0.02 mmol/l, in the experimental group from 2.63±0.02 to 2.65±0.01 mmol/l. The phosphorus indicator in the control group increased from 1.84±0.18 to 2.02±0.19 mmol/l; in the experimental group this indicator remained unchanged. The alkali reserve in the control group slightly increased from 52.50±0.59 to 53.00±0.57% CO_2 and decreased in the experimental group from 54.07±0.61 to 52.92±0.56% CO_2. There was no significant difference in the indicators (Table 4).

The percentage of basophils in calves at the age of 14 days was from 0.37±0.04 to 0.47±0.04, at the age of 28 days it decreased and ranged from 0.08±0.01 to 0.07±0, 01%, which corresponded to the norm. The number of neutrophils decreased from 40.67±1.38 to 26.53±0.72%, which also coincided with the physiological norm for calves of these age groups. The indices of eosinophils and lymphocytes increased from 0.12±0.09 to 0.50±0.01 and 51.90±0.67 to 66.83±0.44%, respectively. Normally, these indicators should increase by the 28th day of calves' life (Table 5).

In the control group on the 3rd day of research, two calves (17 days old) fell ill with dyspepsia. The disease was hard and one calf died. In the experimental group, the safety of calves was 100%.

CONCLUSION

The use of fir tree extract (Pikhteks) did not

Table 4. Biochemical parameters of blood serum of animals under research (M±m; n=6)

Group	Indicator			
	Total protein (g/l)	Calcium (Ca) (mmol/l)	Phosphorus (P) (mmol/l)	Alkali reserve (% CO_2)
At the beginning of the research				
Control	62.7±0.35	2.42±0.15	1.84±0.18	52.50±0.59
Experimental	62.3±0.27	2.63±0.02	1.98±0.2	54.07±0.61
On the 14th day of the research				
Control	66.3±1.33	2.67±0.02	2.02±0.19	53.00±0.57
Experimental	64.3±0.98	2.65±0.01	1.98±0.2	52.92±0.56

Table 5. Leukocyte formula (%) for the research period (n=6)

Group	Blood cells				
	Basophils	Eosinophils	Neutrophils	Lymphocytes	Monocytes
At the beginning of the research					
Control	0.37±0.04	0.12±0.09	42.33±0.78	50.86±0.77	6.32±0.19
Experimental	0.47±0.04	0.13±0.04	40.67±1.38	51.90±0.67	6.83±0.46
On the 14th day of the research					
Control	0.08±0.01	0.50±0.01	27.17±0.18	66.20±0.18	6.05±0.07
Experimental	0.07±0.01	0.49±0.01	26.53±0.72	66.83±0.44	6.08±0.06

have a negative effect on the calves' physiological parameters (appetite, temperature, pulse and respiration). There was also no significant difference in hematological and biochemical studies. The safety of calves in the experimental group was 100%.

REFERENCES

Afanasyev, V. A. and Elenschläger, A. A. (2017). Comparative assessment of the clinical, biochemical and morphological status of calves at different stages of the pathological process in dyspepsia. *Bull. Altai State Agrarian Univ.* **4** : 116-122.

Andreevskikh, M. S. (2018). Modern feed additives used in the treatment of simple dyspepsia in calves. *Youth and Sci.* **2** : 1-5.

Arfuso, F., Fazio, F., Panzera, M., Giannetto, C., di Pietro, S., Giudice, E. and Piccione, G. (2017). Changes in the lipid and lipoprotein profile in newborn calves in response to the perinatal period. *Acta Vet. Belgrade* **67** : 25-32.

Asadi, A. H., Baginejad, M. and Asadi, H. (2015). Diarrhoea of newborn calves caused by rotavirus and coronavirus : Review. *Int. J. Biosci.* **6** : 230-236.

Constable, P. D., Hinchcliffe, K. V., Donet, S. H. and Grunberg, V. (2017). Infectious disease of newborns. Veterinary medicine : Textbook of diseases of cattle, horses, sheep, pigs and goats. China : Elzevir.

da Silva, A. P., de Toledo, A. F., Moelemberg Cezar, A., Gavanski Coelho, M., Virginio Júnior, G. F., Poczynek, M., Donizete Silva, M., Haines, D. M., Campos, M. and Machado Bittar, C. M. (2020). Passive transfer and neonatal health in dairy calves receiving maternal colostrum and/or a colostrum replacer. *Livestock Sci.* **240**. *https://doi.org/10.1016/j.livsci.2020.104158.*

de Paris, M., Stivanin, S. C. B., Klein, C. P., Vizzotto, E. F., Passos, L. T., Angelo, I. D. V., Zanela, M. B., Stone, V., Matté, C., Heisler, G. and Fischer, V. (2020). Calves fed with milk from cows receiving plant extracts improved redox status. *Livestock Sci.* **242**. *https://doi.org/10.1016/j.livsci.2020.104272.*

Jiang, X., Xu, H. J., Cui, Z. Q. and Zhang, Y. G. (2020). Effects of supplementation with *Lactobacillus plantarum* 299v on the performance, blood metabolites, rumen fermentation and bacterial communities of preweaning calves. *Livestock Sci.* **239**. *https://doi.org/10.1016/j.livsci.2020.104120.*

Kletikova, L. V., Martynov, A. N., Shishkina, N. P. and Sinelshchikova, D. I. (2020). The state of calves' health and the strategy for the prevention of early postnatal pathology. *Bull. Agrarian Sci.* **1** : 73-80.

Merhan, O., Bozukluhan, K., Gokce, G. and Yilmaz, O. (2016). Investigation of the levels of haptoglobin, ceruloplasmin and some biochemical parameters in calves with diarrhea. *Firat Univ. Vet. J. Health Sci.* **30** : 195-198.

Poryvaeva, A. P., Krasnoperov, A. S., Tomskikh, O. G. and Lysova, Ya. Yu. (2019). Model for assessing the risk of dyspepsia complications in calves. *Agrarian Bull. Urals* **1** : 31-37.

Pozov, S. A., Porublyov, V. A. and Orlova, N. E. (2018). Influence of colostrum quality on the development of dyspepsia in calves. *Veterinarian* **1** : 34-37.

Severino-Lendechy, V. H., Montiel-Palacios, F., Ahuja-Aguirre, C., Peralta-Torres, J. A. and Segura-Correa, J. C. (2020). Feed supplementation affects age and weight at puberty in Girolando (*Bos taurus* x *Bos indicus*) heifers in the tropics. *Livestock Sci.* **240**. *https://doi.org/10.1016/j.livsci.2020.104154.*

Tyapkova, E.Yu. and Shusharin, A. D. (2019). Dyspepsia in calves. *Youth and Sci.* **81** : 7-8.

Zemlyanukhina, T. N. (2019). Feeding young cattle with fermented milk. *Bull. Altai State Agrarian Uni.* **1** : 143-147.

Zwierzchowski, G., Micinski, J., Wójcik, R. and Nowakowski, J. (2020). Colostrum-supplemented transition milk positively affects serum biochemical parameters, humoral immunity indicators and the growth performance of calves. *Livestock Sci.* **234**. *https://doi.org/10.1016/j.livsci.2020.103976.*