

Artículo de investigación

Blood biochemical parameters of calves when using herbal preparations based on biopolymers

Биохимические Показатели Крови Телят при Применении Галеновых Препаратов на Основе Биополимеров

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Abstract

The article discusses the issues about the effect of the energy coniferous flax stimulator on the blood chemistry values of calves. Every day for 14 days, bulls of two experimental groups (second and third groups) received the drug at the doses of 150 ml and 200 ml, respectively. The animals in the reference group did not receive the drug. When analyzing biochemical parameters, it has been established that the concentration of phosphorus in the blood of the experimental calves prior to the experiment was significantly below the normal level. The use of the drug has significantly increased the phosphorus level in the blood of the experimental calves. The AST/ALT ratio in the animals before the experiment exceeded the normal levels, whereas the use of the galenic preparation normalized this indicator. It has also been established that the drug provides the normalization of the calcium-phosphorus ratio.

Аннотация

рассматриваются вопросы о влиянии препарата «Энергетический хвойно-льняной стимулятор» на биохимические показатели крови телят. Ежедневно на протяжении 14 суток бычки 2-х опытных групп (2-я и 3-я группы) получали препарат в дозах 150 мл и 200 мл соответственно. Животные контрольной группы препарат не получали. При анализе биохимических показателей установлено, что концентрация фосфора в крови подопытных телят до опыта была существенно ниже уровня нормы. Применение препарата достоверно повысило уровень фосфора в крови опытных телят. Коэффициент де Ритиса у животных до опыта превышал уровни нормы, применение галенового препарата нормализует этот показатель. Установлено также, что препарат приводит к нормализации кальций фосфорного соотношения.

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Keywords: Calves, galenical preparation, blood chemistry values, calcium and phosphorus metabolism.

Ключевые слова: телята, галеновый препарат, биохимические показатели крови, кальций фосфорный обмен.

Introduction

When growing young cattle, two tasks are set: to grow healthy productive cows from the heifers grown to replace the animals that had left the herd, and to grow and feed the bulls in order to produce high-quality beef.

The survival rate of the newborn calves, their subsequent development and growth, physiological development, and realization of their genetic potential for productivity directly depend on conditions of keeping and feeding pregnant cows (Petterson, Svensson, Liberg, 2001).

When organizing the feeding of young cattle, it is necessary to consider the specifics of their development terms. A high growth rate is observed in the first six months of their lives. At the same time, during this period calves adapt to the environment, especially in the very first days of their life and during the formation of the digestive function of the rumen. At this age, the requirements for calves, and for the adequacy of their feeding are the highest ones. Calves should be provided with the necessary amount of energy, minerals, high-grade protein, and vitamins. Both their resistance to various diseases and growth and development depend on this. In order to treat and prevent metabolic pathologies in the calves, it is necessary to make adjustments to their diets by introducing protein-vitamin supplements, premixes, medicines, etc. (Shlyakhtunov, 2005).

Recently, in order to normalize all metabolic processes in the body of calves, great attention has been paid to supplementary feeds and medicines of natural origin, having high biological bioavailability and digestibility thereof (Bogatova, 2000; Karpuz, 2014; Korotky et al., 2013; Kirilov et al., 1998; Polivanov et al., 2016; Ryzhov et al., 2014; Yudenko, 2010). It is

also important that they have no side effects and are environmentally friendly.

Thus, the purpose of this scientific work was to study the effect of the original galenical preparation on the blood serum chemistry values, reflecting the state of the basic metabolism.

Materials and Methods

The studies were conducted on the basis of the Lukhovskoye farm of the Oktyabrsky District of the Republic of Mordovia. The administrative center is in Lukhovka village. Saransk is the nearest point of sale of agricultural products.

At the time of the survey, there were 1,630 units of black-and-white breed cattle of different age groups in the farm. They included 710 cows, 243 bred heifers and heifers over one year old, 145 calves of the current year of birth, and 522 young animals over one year old. Before weaning (3 months), the calves were kept in groups of 20 – 25 animal units. Dairy-period calves were fed automatically using a Westfalia automatic calf feeder. Young cattle were vaccinated according to the vaccination schedule. To perform the experiment according to the principle of analogues, three experimental groups were formed, of which one was the reference group (Yudenko, 2010). Throughout the experiment, the calves of all groups received a balanced diet. They had free access to feed (Council Directive on the Approximation of Laws, Regulations and Administrative Provisions of the Member States Regarding the Protection of Animal Used for Experimental and Other Scientific Purposes, 1986; European Convention for the Protection of Vertebrate Animals for Experimental and Other Scientific Purposes, 1986). Studies were performed according to the scheme presented in Table 1.

Table 1. Scheme of the experiment

Research terms, days	Animal groups	Number of animals in the group	Preparation dose, ml	Age of animals, months	Research name	Feeding duration, days	Notes
Result	Reference	5					General clinical examination of the calves, the characteristics of feeding and management conditions, blood sampling for biochemical research
	1	10			Study of the clinical status of animals, the individual weighing		
	2	10		3 – 4		–	
After 14 days	Reference	5	–		Study of the animals' clinical status, weighing, blood sampling		Determination of clinical status, growth per month, and blood serum chemistry values
	1	10	150				
	2	10	200	3 – 4		14	
In a month	Reference	5	–				Determination of growth per month, and blood serum chemistry values
	1	5	150	4 – 5	Weighing, blood sampling		
	2	5	200			–	

Before the experiment (initial data), a set of measures for the study of the calves was performed:

1. Clinical examination of the experimental calves, collection of anamnesis, which included the study of feeding and management conditions. The calves of approximately the same age (3 – 4 months), clinically healthy, with no visible signs of disorders, kept in the same conditions and on a similar diet, were selected for the experiment;
2. Individual weighing of the calves at the beginning of the experiment; and
3. Biochemical studies of blood serum of the calves.

For 14 days every day, the calves of the second and third groups received the original preparation at the doses of 150 ml and 200 ml, respectively.

The experimental calves of the reference group did not receive the supplementary feed. At the end of the feeding, they were individually weighed, the clinical status was assessed, and blood samples were taken for chemistry and hematological studies.

The original galenical supplement was developed on the basis of conifer-glycerol dietary supplement at the Khiminvest Scientific-Technical Center, LLC. The supplement is composed of glycerin-based coniferous energy supplement, linseed extract, fodder yeast, activated charcoal, and sugar.

Chemistry values were studied on the basis of the Mordovian Republican Veterinary Laboratory on the TORUS analyzer, TORUS 1200 model, manufactured by DIXON, LLC, Russia (Organization, equipment and maintenance of experimental biological clinics (vivariums), 2006).

A total of six biochemical parameters were studied as follows: aspartate aminotransferase (AST) U/l; alanine aminotransferase (ALT) – U/l; total protein – g/l; glucose – Mmol/l; phosphorus – Mmol/l; and calcium – Mmol/l (Rebrova, 2002).

The AST/ALT (De-Ritis) ratio as well as the calcium-phosphorus ratio (Ca/P) were calculated.

Throughout the experiment, all calves were monitored, and clinical indicators, such as

appetite, signs of indigestion, etc. were taken into account.

The obtained material was statistically processed using conventional parametric methods, the degree of reliability was determined by the Student's t-test using the Microsoft Excel (2000) application package and the STAT 3 software.

Results

The results of the biochemical studies of the experimental calves' blood serum are summarized and presented in Table 2.

Table 2. The results of biochemical studies of the calves' blood serum when using the energy coniferous flax stimulator

Item No.	Blood values	Group of animals	The time frame for the study			
			reference values	initial data	after 14 days	after one month
1	ALT, (U/ml)	1	25 – 50	16.2 ± 1.0	16.2 ± 1.3	13.8 ± 2.1
		2			21.1 ± 4.4	25.2 ± 1.9*
		3			18.4 ± 2.1	20.5 ± 3.5
2	AST, (U/ml)	1	30 – 90	29.1 ± 8.8	86.2 ± 25.6	59.2 ± 8.8
		2			12.1 ± 3.0	55.0 ± 18.2
		3			60.4 ± 2.3	62.5 ± 22.2
3	Glucose, GLU, (mmol/l)	1	2.22 – 3.88	3.6 ± 0.2	2.3 ± 0.3	2.7 ± 0.4
		2			3.6 ± 0.3*	2.7 ± 0.2
		3			3.0 ± 0.3	3.1 ± 0.5
4	Total protein, TP (g/l)	1	72.0 – 86.0	49.6 ± 2.0	60.7 ± 1.5	50.8 ± 7.4
		2			57.3 ± 4.9	47.3 ± 3.9
		3			49.0 ± 6.6	55.8 ± 3.9
5	Calcium, Ca, (mmol/l)	1	2.5 – 3.13	1.11 ± 0.04	2.00 ± 0.14	2.10 ± 0.12
		2			1.46 ± 0.17	2.45 ± 0.09
		3			2.60 ± 0.11	2.16 ± 0.15
6	Phosphorus, P, (mmol/l)	1	1.45 – 1.94	0.69 ± 0.03	0.94 ± 0.20	0.96 ± 0.13
		2			0.88 ± 0.12	1.48 ± 0.04*
		3			1.71 ± 0.16*	1.19 ± 0.17
7	AST/ALT ratio, (U/l)	1	1.3 – 1.8	2.33 ± 0.79	5.69 ± 1.68	4.68 ± 0.85
		2			0.67 ± 0.19	2.29 ± 0.74
		3			3.55 ± 0.60	3.71 ± 1.48
8	Calcium Phosphorus Ratio Ca/P	1	1.5 – 2.0	1.65 ± 0.08	2.34 ± 0.25	2.28 ± 0.17
		2			1.75 ± 0.14	1.66 ± 0.03
		3			1.56 ± 0.12	1.89 ± 0.17

* – P ≤ 0.05

From the data in the table it is clear that the ALT level in all calves at all periods of the study was reduced. When using the energy coniferous flax stimulator, there was a tendency to the normalization of this indicator.

The AST level in the calves before the experiment was at the lower limit of the norm. On the 14th day of the experiment, in the calves of the second group (that received 150 ml of the preparation each), the index dropped sharply. In other cases, the AST level was within the normal range. The pronounced effect of the preparation was not established.

It was established that the glucose level in all experimental animals had been within the normal range. On the 14th day of the experiment, this indicator significantly increased in the calves receiving the preparation at a dose of 150 ml.

Studies of total protein in the blood of the experimental calves showed that it had a pronounced tendency to lower levels, which was most likely due to errors in protein feeding. The use of the preparation did not lead to a significant change in this indicator.

These studies found that the calcium level in the blood of the experimental calves most often had been below the lower limits of the norm. The significant effect of the preparation was not found.

The studies established that the concentration of phosphorus in the blood of the experimental calves prior to the experiment had been significantly below the normal level. The use of the energy coniferous flax stimulator significantly (with significant differences) increased the level of phosphorus in the blood of the experimental calves within the normal range. The AST/ALT ratio often exceeded the normal levels. Its values above two might indicate liver intoxication with feeds or drugs. The use of the preparation led to a certain normalization of the AST/ALT ratio.

In the calves, the calcium-phosphorus ratio before the use of the preparation, as well as during observations of the reference calves was above the normal values. The use of galenical stimulator led to the modification of this indicator within the range of normal values.

Discussion

Observation of the calves during the feeding period for 30 days revealed that the drug had not

caused violation of the clinical status of experimental animals, increased the appetite, and improved the digestibility of feeds.

When analyzing biochemical parameters, it was established that the concentration of phosphorus in the blood of the experimental calves prior to the experiment had been significantly below the normal level. It is known that the largest amount of phosphorus is concentrated in the bone tissues, representing 85 % of the total amount of the element present in the body. The remaining 15 % of phosphorus in different proportions are distributed in liquids and other tissues. Concentration in the body allows to include phosphorus in a group of macroelements. The use of the original preparation significantly (with significant differences) increased the level of phosphorus in the blood of the experimental calves within the normal range.

The AST/ALT ratio in the experimental calves often exceeded the normal levels. The AST/ALT ratio is the indicator, which was described in the literature, namely aspartate aminotransferase to alanine aminotransferase. The AST/ALT ratio may be informative in cases of suspected pathology: hepatitis (acute, chronic, toxic, viral, autoimmune, etc.); cholestasis, cholangitis; myositis; autoimmune diseases; hyperthyroidism, etc. Its values above two may indicate poisoning with substances or drugs that are toxic to the liver. It was found that the use of the energy coniferous flax stimulator led to the normalization of this value.

To ensure the complete calcium absorption, it is necessary to take into account the optimum ratio of this element to other components, such as magnesium, potassium, and phosphorus in the diet (Kamyshnikov, 2009). Maintaining the ratio of calcium and phosphorus within the required limits is especially important (Higgins, 2008; Rosliy, 2010). For the optimum calcium absorption, it should be approximately 1:1. Changes in the calcium-phosphorus ratio in the experimental animals were ambiguous in nature. In the reference group, this indicator was at an elevated level, compared with the calves receiving the galenical preparation, in which it was within the normal range.

Conclusion

1. The violation of the calcium-phosphorus ratio in the blood serum of the experimental calves has been shown, which is most likely due to the

imbalance of these elements in the diet on the farm.

2. It has been established that the use of the energy coniferous flax stimulator modifies the phosphorus level in the blood of the experimental calves, the AST/ALT ratio and the calcium-phosphorus ratio within the normal range.
3. In general, it has been found that the use of the drug leads to the normalization of metabolic processes in the body of fattening calves and improves the liver functioning.

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