Correction OfEnergy Deficiency Condition In Calves With Prenatal Hypotrophy

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ABSTRACT

The body of calves has high lability, the formation of its resistance and adaptive abilities are most expedient in the early stages of ontogenesis, but if the feeding, care, and maintenance conditions do not meet the requirements of the organism, animals are forced to adapt to these conditions, primarily due to increased energy costs. At the same time, the processes of all links of the metabolism are disturbed and the resistance to diseases decreases. The article presents the classification of antenatal hypotrophy of calves based on the criteria for assessing the state of clinical and zootechnical status and changes in the morphological and biochemical parameters of the blood of sick animals. A method for correcting the energy status of newborn calves with prenatal hypotrophy using carnitine chloride is described. Antenatal malnutrition is the pathology of the fetus, manifested by a violation of its development and arising as a pathophysiological reaction to an inadequate supply of the fetus with oxygen, nutritional and biologically active substances, or in violation of their digestibility.

A comparative study of the effectiveness of the correction of metabolic disorders in calves with postnatal hypotrophy with a 10% solution of the transmitochondrial fatty acid transporter carnitine chloride at a dose of 100 mg/kg/day was carried out.

The material for the study was the Holstein-Friesian calves from birth to 14 days. All calves were similar in age, body weight and were in the same conditions of housing, feeding, and care. Calves with signs of prenatal malnutrition were divided into 2 groups: experimental and control 6 animals each. The use of a 10% solution of carnitine chloride in hypotrophic calves restores the level of glucose, the main source of energy in the body, and inorganic phosphorus used for various phosphorylation processes to form adenosine triphosphate (ATP), stabilizes anabolic, transport, and catabolic processes, which together alleviate the condition of the newborn's body young with malnutrition. The recommended therapeutic approach leads to the stabilization of the energy-deficient state by optimizing the hemorrhological composition of the blood, the glucose content of the basic energy source in the body, and inorganic phosphorus used for various phosphorylation processes, reducing stress in the anaerobic metabolism system and forming reserve macroergic substrates. The implemented therapeutic measures allow, in the body of calves-hypotrophic, to restore nutritional status.

Keywords: malnutrition, hypotrophy, calf, metabolism, energy, carnitine, blood, erythrocytes, lipids, proteins, and carbs.

1. INTRODUCTION

The competitiveness of cattle breeding is based on the use of production potential in the period of receiving and raising calves. At the same time, the rearing of young stock should be organized in such a way that with the lowest labor costs and optimal feed consumption to ensure normal growth and development. In this regard, the understanding of all interdependent relationships occurring in a growing body will allow purposefully influence their development, the formation of animals of a certain direction of productivity, the high transformation of feed nutrients, their health, and adaptability to technological conditions. Currently, physiology and medicine pay great attention to the study of the early stages of development of various pathologies and their initial mechanisms. It is worth noting that the young organism has high plasticity, therefore, it is most appropriate to form its resistance and adaptive abilities in the early stages of ontogenesis.[2,4,27,28,30,35,39] This is especially characteristic of newborn calves, which are poorly adapted to protect from adverse environmental factors. Moreover, the development in the early stages of the life of an animal largely determines the further success of raising repair and fattening young animals. Therefore, the stimulation and strengthening of the body's natural defenses, their long-term maintenance at a high level is the most important task of livestock breeders. In recent decades, the number of calves with disturbed nutritional status has increased, which is clinically manifested by hypotrophy. Mortality with severe hypotrophy reaches up to 30%.[1,4,5,6,9,11,12,16,28,29] It should be noted that the metabolic basis of malnutrition is inadequate substrate support, low activity of the final stage of glycolysis, and inadequate reorganization of lipid metabolism. If the need for ATP is not satisfied, a state of energy deficiency occurs, leading to regular metabolic, functional, and morphological disturbances up to cell death.[7,8,10,18,21,22,23,25,26,28] The condition of newborn calves, their viability and physiological maturity, the subsequent development, the realization of the genetic possibilities of productivity are directly dependent on the conditions in which their embryonic and fetal (fetal) development proceeded, on the species and pedigree characteristics, on the hereditary characteristics of the parents. At all stages of fetal development, especially in its last months of intrauterine life, an important factor is the complete nutrition of the maternal organism. Under adverse conditions during pregnancy; the presence of structural changes in the uterus with postpartum endometritis transferred viral, bacterial, and parasitic diseases in history; when the intestinal microbiota changes (for example, as a consequence of yersiniosis) aggravated by insufficient and inadequate feeding of pregnant women, they give rise to full-length, but weak, small calves - hypotrophies. So, for example, liver amyloidosis, especially characteristic of highly productive animals such as dairy cattle, poorly viable offspring is born, there are economic losses.[29,31,32,38] Hypotrophy reflects the concept of "physiological immaturity" of newborns. This pathology causes significant economic damage to the farms, which is characterized by a reduction in terms of use, loss of body weight, death and forced culling of animals, death of young animals, growth retardation, loss of breeding qualities, deterioration of animal meat quality and reduced payback of feed.[1,4,5,6,9,11,12,13,16,30] Currently, the treatment of malnutrition presents a large number of drugs. Despite this, the search, development, and introduction of new drugs into veterinary practice continues to be relevant. This is due to the fact that when developing complex therapy aimed at normalizing metabolic processes, there remains an urgent need for drugs with effective pharmacological properties, low toxicity, and a slight side effect. Therefore, there is a particular interest in environmentally safe drugs that do not accumulate in animal tissues and do not lead to allergic diseases. At present, many methods and means of treatment have been proposed for newborn calves-hypotrophic, however, the therapeutic and preventive measures being carried out require further improvement in terms of increasing their effectiveness.

To a large extent, the use of modern energy protectors (vitamin-like substances), such as carnitine chloride, in the complex treatment of these issues can contribute to the solution of these problems.

Recently, a high level of various pathologies of newborns has been observed in humane medicine: intrauterine growth retardation, prenatal hypotrophy, which does not arise as a result of the alimentary factor - insufficient nutrition of a healthy child, but as a result of severe, often chronic, diseases leading to increased nutritional requirements or disruption of nutrient absorption, neonatal hyperbilirubinemia, transient myocardial ischemia, which requires a neonatologist to search for modern effective safety drugs. Taking into account the peculiarities of metabolism in newborns (lability of carbohydrate metabolism, physiological carnitine deficiency, low reserve capacity), the use of left carnitine is reasonable in this category of children with various pathologies. It is known that the body's need for left carnitine increases dramatically in situations of high consumption of energy resources. In newborns, the ability to synthesize carnitine is extremely limited, and the functional state of the internal organs affects the activity of the endogenous formation. Carnitine can exist in two forms - D- and L-stereoisomers. However, only L-carnitine is a physiologically active and biologically effective substance found in the body. L-carnitine is an indispensable component involved in the oxidation of fatty acids and energy production at the cellular level. Levocarnitine plays an important role in the process of energy supply of the body cells. Only with the participation of levocarnitine is it possible to transport long-chain fatty acids through mitochondrial membranes, where they are oxidized to form a large amount of adenosine triphosphate; it also binds and removes toxic organic compounds resulting from the oxidation of fatty acids, and includes an LC shunt whose activity is not limited by oxygen.[2, 3,7,8,10,14,15,17,18,19,20,23,24,25,26,27]

Objective: to correct energy metabolism in newborn calves with prenatal hypotrophy syndrome based on a test of energy protector-carnitine chloride.

2. METHODS (MATERIALSANDMETHODS).

Scientific production experiments were carried out in the conditions of EkoNivaAgro LLC, Voronezh Region.

The material for the study was the Holstein-Friesian calves from birth to 14 days. As a result of the experiment, 3 groups of calves were formed. Calves with signs of prenatal hypotrophy of the average degree were divided into 2 groups: the control (comparison group) and the experimental group of 6 animals each, all calves were similar in age, body weight and were under the same conditions of housing, feeding and care. And a group was formed - healthy calves (background). Newborn calves with acute infectious inflammatory diseases were excluded from the study group. After calving, all calves were placed in an individual box with an infrared illuminator.

Previously, experiments were carried out to identify the optimal doses of the drug for calves with antenatal hypotrophy. The dose was determined by clinical and biochemical parameters. It was found that the most optimal dose of carnitine chloride is 100 mg / kg.[13]

From the first day of life, the animals of the experimental group, mixed with Ringer-Locke solution, were injected intravenously with 10% carnitine chloride solution once a day in a dose of 100 mg / kg for 7 days. All animals of the control and experimental groups used a basic, farm-adopted treatment regimen: to enhance the AOD system (antioxidant protection), E-selenium was administered once at a dose of 0.5 ml per 10 kg of animal body weight; As a pathogenetic therapy, the vitamin complex Eleovit was used in a volume of 2 ml once every 7 days. For the prevention of gastrointestinal and respiratory infectious diseases, Immunoserum serum was used at a dose of 20 ml on the first and seventh days of life. To restore the volemic properties, a ringer-Locke solution was injected intravenously at a dose of 200 ml. The first portion of colostrum was drunk by coercion using a drencher. Given the small volume and underdevelopment of the gastrointestinal tract, colostrum was fed in a reduced volume of 3 liters. To achieve the optimal amount of immunoglobulin and the formation of passive immunity, they fed colostrum from cows 2-3 lactation periods with a relative density of 1.067-1.068 g / cm3, which was determined using a colostrometer.

In the newborn calves examined, blood was taken for morphological and biochemical analysis from the jugular vein (venae jugulares). In the morning before the first feeding of colostrum, in the following days of research in the morning before feeding the animals. Laboratory analyzes were carried out at the Department of Therapy and Pharmacology at the Voronezh State Agrarian University and All-Russian Research Veterinary Institute of Pathology, Pharmacology and Therapy.

In the first series of studies, clinical, zootechnical and hematological studies were carried out on healthy newborn and sick antenatal hypotrophy of calves. Clinical studies of newborn calves were carried out according to the plan generally accepted in veterinary medicine. Basic zootechnical measurements, such as body weight, height at withers, slanting body length, chest girth behind the shoulder blades - were determined according to the standard technique - using a measuring tape and a ruler.

Morphological blood analysis in experimental animals was carried out by standard methods, including the determination of the number of red blood cells, hemoglobin. Determination of hemoglobin, glucose, alkaline phosphatase, ACT, ALT, cholesterol, triglycerides, was carried out by a chemical method using Vital diagnostics kits on a PE-5300B spectrophotometer, according to Menshikov V.V. et al. (1993) and the pyruvate-enzymatic UV method. (reagent kit, Vita Ros), determination of inorganic phosphorus and iron was performed on a HumaStar 600 biochemical analyzer.

3. RESULTS, DISCUSSION.

Taking into account our clinical and laboratory studies and filmed zootechnical measurements, we have developed a classification of antenatal malnutrition of newborn calves according to signs revealing the degree of underdevelopment of offspring, which includes 3 degrees: light (I), medium (II) and heavy (III).

According to the obtained results, an attempt to self-standing in newborn hypothrophic calves of the first degree was observed 2-3 hours after birth, the sucking reflex manifested itself in 1.5-2 hours, the number of sucking movements per 1 minute was 96.0 ± 4.0. A number of signs of underdevelopment were characteristic of grade II antenatal hypotrophy in newborn calves. After birth, an attempt to self-standing manifested itself after 4-6 hours, the sucking reflex appeared after 3-4 hours, and the sucking movements per minute were 77.0 ± 3.0. When antenatal hypotrophy III degree attempts to self-standing in the first decade of the day after birth was not observed. The sucking reflex was not observed in the first 5-6 hours after birth. One minute sucking movements were less than in calves with hypotrophy II degree. The response to the pinch determined the reduction of pain and tactile sensitivity, noted the lability of the nervous system (sometimes apathetic, then excited). Milk teeth are in some cases underdeveloped. The mucous membranes are mostly pale.

The eyeball is often sunken. Auricles, tail more noticeably saggy.The bodyweight of the calf with congenital malnutrition 1 degree less than the accepted norm. The oblique length of the body at birth was 69.2 ± 0.6 cm, the height of the withers in calf hypotrophy I degree was 72.5 ± 1.1 cm, the chest girth behind the shoulder blades was 81.1 ± 1.6 cm. The bodyweight of the calve with II degree hypothrophy was 30.8 ± 0.4, height at withers - 67.9 ± 0.7 cm, chest girth behind the shoulder blades was 74.0 ± 1.3 cm, slanting body length (cm) in hypotrophic calves II degree was 63.5 ± 0.9. With III degree hypotrophy body weight was significantly lower than the previous degree. Height at withers was 53.8 ± 1.9 cm, slanting body length - 55.25 ± 1.8 cm, chest girth behind the shoulder blades was 60.5 ± 1.3 cm. The body temperature in newborn calves with antenatal malnutrition of the first degree was 38.4 ± 0.3 °, the number of heartbeats per 1 minute was 125.5 ± 4.1, and the number of respiratory movements per 1 minute was 59.0 ± 2.2. Temperature in newborn calves with II degree antenatal malnutrition was 38.1 ± 0.4. The number of heartbeats per 1 minute was 129.5 ± 2.6, the number of respiratory movements per 1 minute was 61.5 ± 1.8 (Table 1). The body temperature in newborn calves with a hypotrophy of III degree compared to the norm was below and was 37.4 ± 0.2, the number of heartbeats per 1 minute and the number of respiratory movements per 1 minute is reduced. In calves of hypotrophy I degree, skin turgor is lowered, hair is disheveled in places, dull, but tightly retained. In calves with hypotrophy II, there is a reduced skin turgor, hair is disheveled, dull, but tightly retained. Skin turgor in III degree hypotrophy was absent. The newborn calf hairline with this pathology was disheveled, dull and there were areas of alopecia. The subcutaneous fat layer is first thinned on the abdomen and on other parts of the body (Table 1) Meconium unformed, yellow in color with a greenish tinge. Established the presence of bilirubin in the feces, which was also confirmed by a sample of bile pigments. Microscopic examination of the feces of newborns was determined amylorea and steatorrhea, neutral fats were detected (++++).

The hematocrit value in neonatal calves (hypothrophy I) on the first day after birth was 43.8 ± 8.22%. Blood density was 1.046 ± 0.915; blood viscosity was 5.42 ± 0.11. The number of red blood cells (1012 / l) of blood in newborn hypothrophic calves of I degree averaged 7.18 ± 0.63, the presence of hemoglobin - 111.0 ± 6.5 g / l, the number of leukocytes (109 / l) - 9, 98 ± 0.3, the total protein content in serum was 60.7 ± 2.3 g / l, the sodium content - 145.3 ± 9.2 mm / l, the potassium content was 8.14 ± 0.04 mmM / l. The hematocrit number, specific gravity and blood viscosity at hypotrophy of the II degree were lower than those of the hypotrophy of the I degree.

Table 1. Clinical and zootechnical indicators in healthy newborn calves and with hypotrophy of varying degrees in the first days of life

Indicators	Physiologically mature calves	With hypotrophy (degree)		
		I	II	III
Attempttoget up	30-60 minutes	2-3 hours	4-6 hours	First 8-10 hours after birth was not observed
The manifestation of sucking reflex after birth	In the first 60 minutes	In the first 1.5-2 hours	In the first 3-4 hours	Not manifested after 5-6 hours of observation
Suckingmovements, movements / min.	114.0±3.0	96.0±4.0	77.0±3.0	37.0±3.0
Body weight, kg	37.0±0.8	32.4±0.6	30.8±0.4	24.7±2.6
Oblique length of the body (trunk height), cm.	71.0±1.2	69.2±0.6	63.5±0.9	55.2±1.8
Withersheight, cm.	75.0±0.9	72.5±1.1	67.9±0.7	53.8±1.9
Chest girt, cm.	83.5±1.8	81.1±1.6	74.0±1.3	60.5±1.3
Temperature^{o}C	38.7±0.5	38.4±0.3	38.1±0.4	37.4±0.2
Pulse rate in 1 min.	116.0±3.2	125.5±4.1	129.5±2.6	77.5±10.8
Respiratory rate in 1 min.	57.0±2.3	59.0±2.2	61.5±1.8	39.0±2.7

ISSN 2515-8260 Volume 08, Issue 02, 2021

Turgor (skin tightness)	Good	Acceptive	Decreased	Deficit
Pelageandskinstate	Smooth,tight-fitting	Locally disheveled, dull, tightly held	Partly disheveled, dull, tightly held	Disheveled, dull, there are areas of alopecia

In calves with moderate hypotrophy, the number of erythrocytes (10^{12}/l) in the blood was 5.66 ± 0.6, the presence of hemoglobin was 90.0 ± 5.1 g/l, the number of leukocytes (10^{9}/l) was - 8.9 ± 0.92. With III degree congenital hypotrophy, the hematocrit number in calves averaged 50.80 ± 13.10%, the specific gravity of the blood was 1.068 ± 0.023, the viscosity of the blood was 6.21 ± 0.11. When antenatal hypotrophy of the III degree in newborn calves, the number of erythrocytes, hemoglobin content, total hemoglobin amount, white blood cell count and total protein content are significantly reduced. The content of sodium and potassium in newborn calves of hypothrophy III grade was 120.6 ± 4.1 and 6.44 ± 0.06 mM / l, respectively. The content of total protein in serum was 55.8 ± 2.2 g / l. The sodium content on the first day after birth in serum with hypotrophy II degree in newborn calves was 136.8 ± 6.9 mM/L, the potassium content - 7.12 ± 0.03 mM / L.

The obtained clinical results allow us to diagnose this pathology in a timely manner, to prescribe a more effective therapy, taking into account all disorders occurring in all organs and tissues of the body.

As a result of testing the proposed treatment regimen in calves of the experimental group (Table 2), the number of erythrocytes increased by the seventh day by 13.3% ($P \leq 0.05$), and by the fifteenth day another 10.4% ($P \leq 0.05$), while in the calves of the control group, this indicator remained at the same level by the seventh day of the study, and by the fifteenth day it did not significantly increase by 2.9% ($P \leq 0.01$), without reaching the indicators of background animals.

The hemoglobin content in calves of the experimental group by the fifteenth day increased significantly by 26.4% ($P \leq 0.05$), and in calves of the control group, the index decreased by 4.7% ($P \leq 0.01$) by the seventh day and by the fifteenth day on the contrary, an increase, but only by 9.2% ($P \leq 0.05$), which in general, this value did not correspond to the reference limits (Table 2). The serum iron content in calves-hypotrophy of the experimental group increased by the seventh day by 9.8% ($P \leq 0.05$), by the fifteenth day - by 7.7% ($P \leq 0.05$).In general, this corresponded to the physiological state. In animals of the control group, this indicator remained below the values of calves of the background group.

Thus, the use of 10% solution of carnitine chloride, as part of complex therapy, leads to stabilization of the hemorrhological composition of the blood of calves with prenatal hypotrophy: it compensates iron deficiency, restores the functioning of the mitochondrial electron transport chain, and oxygenates the blood transport function, thus arresting hypoxia in the tissues. The amount of glucose in the blood of newborn calves of the experimental group by the fifteenth day increased by 43.8% ($P \leq 0.05$), but this value did not exceed the reference values of the background group of animals, and in calves of the control group this indicator increased by 7 days of life 7.3% ($P \leq 0.05$), and by the fifteenth day only 9.9% (Table 2). The content of inorganic phosphorus in animals of the experimental group increased by 15.1 ($P<0.01$) by the seventh day of the experiment and by the fifteenth day an increase of 25.9% ($P \leq 0.05$) was observed, reaching physiological limits. In the calves of the control group, the studied parameter increased by the seventh day by 2.7% ($P<0.05$), and by the fifteenth day increased by 2.2% ($P \leq 0.05$), but did not reach the background group values (Table 2).

Table 2-Effect of carnitine chloride on hematomorphological indicators and indicators of energy-plastic metabolism of newborn hypotrophic calves

Indicators	Before the start of the experience			14 days after		
	Test (n=6)	control (n=6)	background (n=6)	test (n=6)	control (n=6)	background (n=6)
RBC, 10^{12}/l	5.2±0.2	5.3±0.3	7.98±0.18	6.70±0.4	5.67±0.3	6.88±0.18
Hemoglobin, g / l	90.7±15.1	93.4±14.5	122.63±19.70*	123.2±23.6	102.9±17.9	120.5±22.7
Iron, μmol / l	18.70±1.90	17.97±1.87	20.9±1.40	22.48±2.44	17.84±1.74	22.77±2.75
Glucose, mmol / l	3.89±0.35	3.93±0.27	5.74±0.69	6.92±0.42	4.71±0.51	5.04±0.58
Phosphorus, mmol / l	1.79±0.11	1.80±0.13	2.78±0.14	2.85±0.15	1.89±0.14	2.94±0.12
Alkaline phosphatase, nmol / s * l	1189.58±124.6	1196.40±151.8	943.38±61.3	498.98±49.6	685.72±58.1	505.77 ±47.8
ACT, nmol / s * l	177.32±19.51	169.91±18.52	298.47±33.24	242.88±33.22	198.54±20.45	239.72±29.98
ALT, nmol / s * l	122.25±15.86	119.17±14.96	240.44±21.27	192.13±17.0	134.66±14.51	191.78±16.80
Cholesterol, mmol / l	0.97±0.05	0.90±0.06	1.34±0.61	3.43±0.65	2.95±0.74	3.75±0.99
Triglycerides, mmol / l	0.11±0.01	0.13±0.03	0.31±0.01	0.42±0.01	0.27±0.04	0.49±0.06
Lactate, mmol / l	3.41±0.21	3.39±0.19	1.97±0.24	1.16±0.10	2.24±0.33	1.13±0.18
Pyruvate, mol / l	79.55±7.81	81.24±8.92	128.0±11.7	129.90±11.0	90.40±6.55	127.75±10.22

* Differences in this indicator are statistically significant between the experimental groups of animals P≤0.01; P≤0,05.

Alkaline phosphatase in newborn calves of the experimental group by the seventh day of the experience decreased by 50.5% (P≤0.05), and on the fifteenth day, a further decrease by 58.6% (P≤0.05) was noted, to the standard values. Animals of the control group also noted a significant decrease in alkaline phosphatase at the height of the experiment and by the end of completion by 64.5% (P≤0.05), however, the level was above the background values (Table 2).

Thus, the use of the test drug calves hypotrophic, restores the level of glucose, the main source of energy in the body and inorganic phosphorus used for various processes of phosphorylation and the formation of adenosine triphosphate (ATP).

With the introduction of carnitine chloride solution to calf hypotrophy II degree, during the first seven days (Table 2), an increase in ACT and ALT was observed by 16.11% (P≤0.01) and 20.7% (P≤0.01). In animals of the control group, on the seventh day of research, ACT tended to increase by 2.9%, ALT increased by 1.7% (P≤0.01). And only by the fifteenth day of the study, the normalization of the studied parameters of cytolysis enzymes in the blood to the physiological boundaries of the experienced newborn calves was noted. At the same time, ACT and ALT increased compared to the seventh day of the study, respectively, by 12.8% (P≤0.05) and 19.8% (P≤0.05). In the calves of the control group, these indicators also increased, respectively, by 12.1% (P≤0.05) and 9.7% (P≤0.05), but the norm, like in physiologically mature calves, was not achieved (Table.2). Optimization of liver indicator enzymes in the experimental group indicates the rehabilitation of functional properties.

In the study of cholesterol content, the experimental calves observed an increase by the seventh day by 45.8% ($P \leq 0.05$) and by the fourteenth day by 47.8% ($P \leq 0.05$), reaching physiological indices. In the hypotrophic calves of the control group, the indicator studied by the fourteenth day of the study increased by 69.4% ($P \leq 0.05$),but did not reach the values of physiologically mature calves (Table 2). Optimization of cholesterol levels in hypotrophic calves of the experimental group indicates the restoration of the role of plastic processes, structure formation at the cellular level - membrane construction, rigidity and protection against free radicals.

The content of triglycerides (TG) in calves of the experimental group by the seventh day increased by 56.0% ($P \leq 0.05$), and by the fifteenth day of the study, it was higher by 40.5% ($P \leq 0.05$) and reached the reference values. By the seventh day of the study, this indicator in control animals increased by 31.6% ($P \leq 0.05$) and increased by the fifteenth day by 29.6% ($P \leq 0.05$), but without reaching physiological parameters (Table 2).

The recovery of TG in the blood indicates that the body is sufficiently supplied with such energy-intensive substrates as neutral fats.

When analyzing the lactate index in the experimental calves, an insignificant decrease by 46.3% ($P \leq 0.01$) was noted, and by the fifteenth day this indicator decreased by 2 times (100.8%), thus reaching the background values of clinically healthy calves. In the calves of the control group, the same trend of this indicator was noted, in particular, on the seventh day the lactate decreased by 14.9% ($P \leq 0.01$), and by the fifteenth day it decreased by 31.7% ($P \leq 0.01$), but the achievement of reference values was not observed (Table 2).

The decrease in lactate accumulation in hypotrophic calves of the experimental group indicates a decrease in stress in the anaerobic metabolism system and the formation of reserve macroergic substrates.

When studying pyruvate in calves of the experimental group, an increase of 7.9% ($P \leq 0.01$) by the seventh day and by the fourteenth day by 31.2% ($P<0.01$) was noted, thereby achieving the standard indicators. In animals of the control group, the index by the seventh day increased by 19.4% ($P \leq 0.01$), and by the fourteenth day of the study it decreased by 10.3% ($P \leq 0.01$), but the norms of the calves of the background group did not reach. Optimization of pyruvate indicates a weakening of the processes of protein catabolism and the restoration of the activity of the initial stage of glycolysis.

4. CONCLUSION.

Thus, under the action of 10% carnitine chloride solution, energy accumulation in ATP is restored, which provides structure-forming, anabolic, transport and catabolic processes, which together alleviate the body condition of the newborn young cattle with hypotrophy.

5. ACKNOLOGMENTS

This paper has been supported by the RUDN University StrategicAcademic Leadership Program.

6. COMPETING INTERESTS

The authors declare that they have no competing interests.

7. REFERENCES:

[1] Vatnikov Y. et al. Immune-inflammatory concept of the pathogenesis of chronic heart failure in dogs with dilated cardiomyopathy. Veterinary World. 2020; 12(9): 1491-1498.

[2] SmolentsevS.Yu, Volkov A.H, Papunidi E.K, Yakupova L.F, Fayzrakhmanov R.N, Bouadila I., Rudenko A.A, Rudenko P.A. Influence of para-aminobenzoic acid on young cattle. International Journal of Research in Pharmaceutical Sciences. 2020; 11(2): 1481-1485.

[3] Rudenko P., Vatnikov Yu., Kulikov E., Sachivkina N., Karamyan A., Rudenko A., Rudenko V., Gadzhikurbanov A., Murylev V., Elizarov P., Mansur T., Vyalov S., Troshina N. Experimental and clinical justification of the use of probiotic-sorption drugs in veterinary surgery. Systematic Reviews in Pharmacy. 2020; 11(4): 275-287.

[4] Vatnikov Y., Shabunin S., Kulikov E., Karamyan A., Lenchenko E., Sachivkina N., Bobkova N., Bobkov D., Zhilkina V., Tokar A., Shopinskaya M., Rudenko P. Effectiveness of biologically active substances from HypericumPerforatum L. in the complex treatment of purulent wounds. International Journal of Pharmaceutical Research. 2020; 12(4): 1108-1117.

[5] Shaykhutdinova E.R., Palikov V.A., Palikova Y.A., Borozdina N.A., Kravchenko I.N., Sadovnikova E.S., Pakhomova I.A., Rudenko P.A., Kazakov V.A., Zharmukhamedova T.Y., Khokhlova O.N., Dyachenko I.A. Effect of standard and high-fat diets on the development of complications in a streptozotocin-induced diabetes model in rats. Bulletin of Experimental Biology and Medicine. 2020; 170(12): 720-724.

[6] Palikov V.A., Palikova Y.A., Borozdina N.A., Nesmeyanova E.N., Rudenko P.A., Kazakov V.A., Kalabina E.A., Bukatin M.V., Zharmukhamedova T.Y., Khokhlova O.N., Dyachenko I.A.A novel view of the problem of Osteoarthritis in experimental rat model.Research Results in Pharmacology. 2020; 6(2): 19–25.

[7] Rudenko A.A., Pozyabin S.V., Rimihanov N.I., Boev V.I., AnanevL.Yu., Kazakov V.A., Rudenko P.A. Concentration of proinflammatory cytokines in blood serum of dogs with myxomatous degeneration of mitral valve. J. of Pharmaceutical Sciences and Research. 2018; 10(12): 3442-3446.

[8] Vatnikov Yu.,Shabunin S., Kulikov E., Karamyan A., Murylev V., Elizarov P., Kuznetsova O., Vasilieva E., Petukhov N., Shopinskaya M., Rudenko A., Rudenko P. The efficiency of therapy the piglets gastroenteritis with combination of Enrofloxacin and phytosorbentHypericumPerforatum L. International Journal of Pharmaceutical Research. 2020; 12(Suppl. Issue 2): 3064-3073.

[9] Rudenko P.A., Murashev A.N. Technological process of integrated probiotics sorption drugs «Dilaksil» and «Sorbelact». Russian Journal of Biopharmaceuticals. 2017; 9(3): 49-54.

[10] Vatnikov Y., Shabunin S., Karamyan A., Kulikov E., Sachivkina N., Stepanishin V., Vasilieva E., Bobkova N., Lucay V., Avdotin V., Zenchenkova A., Rudenko P., Rudenko A. Antimicrobial activity of HypericumPerforatum L. International Journal of Pharmaceutical Research. 2020; 12(Suppl. Issue 1): 723-730.

[11] Rudenko P.A., Rudenko V.B., Rudenko A.A., Khokhlova O.N., Kazakov V.A., Rzhevskiy D.I., Dyachenko I.A. The effectiveness of probiotic-sorption compounds in the complex treatment of sepsis in cats. Research J. of Pharmaceutical, Biological and Chemical Sciences. 2019; 10(1): 1734-1739.

[12] Vatnikov Yu., Donnik I., Kulikov E., Karamyan A., Notina E., Bykova I., Lenchenko E., Bannoud G., Bondareva I., Shlindova E., Sotnikova E., Rudenko V., Rudenko A., Rudenko P. Effectiveness of HypericumPerforatum L. phytosorbent as a part of complex therapy for acute non-specific bronchopneumonia. International Journal of Pharmaceutical Research. 2020; 12(Suppl. Issue 1): 1108-1116.
[13] Rudenko P., Rudenko V., Vatnikov Y., Rudenko A., Kulikov E., Sachivkina N., Sotnikova E., Sturov N., Rusanova E., Mansur T., Vyalov S., Sakhno N., Drukovsky S. Biocoenotic Diagnostics of Unfavorable Factors in the Cows Infection of Farms in the Moscow Region. Systematic Reviews in Pharmacy. 2020; 11(5): 347-357.
[14] Vatnikov Yu., Yousefi M., Engashev S., Rudenko P., Lutsay V., Kulikov E., Karamyan A., Dremova T., Tadzhieva A., Strizhakov A., Kuznetsov V. Yagnikov S., Shlindova E. Clinical and hematological parameters for selecting the optimal dose of the phytopreparation "Deprim", containing an extract of the herb Hypericumperforatum L., in husbandry. International Journal of Pharmaceutical Research. 2020; 12(Suppl. Issue 1): 2731-2742.
[15] Rudenko A., Rudenko P., Glamazdin I., Vatnikov Y., Kulikov E., Sachivkina N., Rudenko V., Sturov N., Babichev N., Romanova E., Rusanova E., Lukina D. Assessment of Respiratory Rate in Dogs during the Sleep with Mitral Valve Endocardiosis, Complicated by Congestive Heart Failure Syndrome: the Degree of Adherence for this Test by Animal Owners and its Impact on Patient Survival. Systematic Reviews in Pharmacy. 2020; 11(5): 358-367.
[16] Smirnova IP, Kuznetsova OM, Shek D, Ivanova-Radkevich VI, Sachivkina NP, Gushchina YS. Investigation of the immunogenic properties of antitumor enzyme l-lysine-alpha-oxidase. FEBS Journal. 2018; 8(S1): 234.
[17] Vatnikov Yu., Donnik I., Kulikov E., Karamyan A., Sachivkina N., Rudenko P., Tumanyan A., Khairova N., Romanova E., Gurina R., Sotnikova E., Bondareva I. Research on the antibacterial and antimycotic effect of the phytopreparation Farnesol on biofilm-forming microorganisms in veterinary medicine. International Journal of Pharmaceutical Research. 2020; 12(Suppl. Issue 2): 1481-1492.
[18] Binienda Z., Przybyla-Zawislak B., Virmani A., Schmued L. L-carnitine and neuroprotection in the animal model of mitochondrial dysfunction. Ann N Y Acad Sci. 2005; 1053: 174-182.
[19] Bremer J. "Carnitine--metabolism and functions". Physiological Reviews. 1983; 63 (4): 1420–80.
[20] Rudenko P., Sachivkina N., Vatnikov Y., Shabunin S., Engashev S., Kontsevaya S., Karamyan A., Bokov D., Kuznetsova O., Vasilieva E. Role of microorganisms isolated from cows with mastitis in Moscow region in biofilm formation. Veterinary World. 2021; 14(1): 40-48.
[21] Godfrey K., Barker D. Fetal nutrition and adult disease. Am.J.Clin. Nutr. 2000; - Vol. 71. - №5. - P. 1344-1352.
[22] Grover, Zubin; Ee, Looi C. "Protein Energy Malnutrition". Pediatric Clinics of North America. 2009; 56 (5): 1055–68.
[23] Hoppel Ch. The role of carnitine in normal and alterd fatty acid metabolism. Am J Kidney Dis. 2003; 41:S4-S12.
[24] Jahoor F., Badaloo A., Reid M. et al. Protein metabolism in severe childhood malnutrition // Ann Trop Paediatr. 2008; 28 (2). - P. 87–101.
[25] Joosten K. F., Hulst J. M. Prevalence of malnutrition in pediatric hospital patients Curr. Opin. Pediatr.2008; Vol. 20 (5). - P. 590 – 596.
[26] Krasnikov AV, Annikov VV, Vatnikov YA, Sotnikova ED, Kulikov EV, and Parshina VI. Analysis of Dental Implants' Biointegration in Animals. Biol Med (Aligarh). 2016; 8(3): BM-178-16, 5 pages.

[27] Kulikov EV, Seleznev SB, Sotnikova ED, VatnikovYuA, Kharlitskaya EV, Parshina VI, Rystsova EO, and Troshina NI. The Morphological Aspects of Bone Marrow of Guinea Fowl of the Volga White Breed in Postembryonic Ontogenesis / Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2016;. №7(5). Page 1148-1153.
[28] KulikovE.V., VatnikovY.A., ParshinaV.I., SotnikovaE.D., VilkovyskiyI.F., PopovaI.A., KochnevaM.V., KaramyanA.S.Special aspects of the pathohistological diagnostics of familial shar-pei amyloidosis. Asian Journal of Pharmaceutics. 2017; 11 (1) , pp. S152-S157.
[29] Kulikov E.V., Vatnikov Y.A., Sotnikova E.D., Seleznev S.B., Troshina N.I., and Rystsova E.O. "Morphometric characteristics of the bone tissue structure in white Volga guineafowls," Biol Med (Aligarh). 2015; 7(3): BM-111-15, 4 pages.
[30] Lenchenko E, Lozovoy D, Strizhakov A, Vatnikov Y, Byakhova V, Kulikov E, Sturov N, Kuznetsov V, Avdotin V, Grishin V Features of formation of Yersinia enterocolitica biofilms, Veterinary World. 2019; 12(1): 136-140.
[31] LenchenkoE.M., VatnikovY.A., SotnikovaE.D., KulikovE.V., GnezdilovaL.A., SeleznevS.B., StrizhakovA.A., KuznetsovV.I.Experimental toxemia of chickens contaminated with yersinia enterocolitica bacteria, Asian Journal of Pharmaceutics. 2017; 11 (1) , pp. S91-S96.
[32] Sawaya A. L. Martins P. A., Martins V. J. B. et al. Malnutrition, long term health and the effect of nutritional recovery // Nestle Nutrition Institute. 2009; - P. 95–108.
[33] Sermet-Gauelus I., Poisson-Salomon A. S., Colomb V. et al. Simple pediatric nutritional risk score to identify children ar risk of malnutrition / / AJCN. 2000;. 72. - P. 64–70.
[34] SeleznevS.B., KulikovE.V., VetoshkinaG.A., VatnikovY.A., SotnikovaE.D., KrotovaE.A., YagnikovS.A., YakuninaM.N.The evolution and structural organization of the organs of vertebrate immune system, Asian Journal of Pharmaceutics. 2017; 11 (1) , pp. S84-S90.
[35] Shakhov A. G. Feed additive for increase of productivity and natural resistance of young agricultural animals / A. G. Shakhov, I. V. Cheremushkina, A. E. Chernitskiy / / International Journal of Pharmacy and Technology. 2016; - T. 8. № 4. - P. 26876-26881.
[36] Schoonderwoerd Matt Protein Energy Malnutrition and Fat Mobilization in Neonatal Calves / Schoonderwoerd Matt, Doige Cecil E., Wobeser Gary A. and Naylor Jonathan M / / The Canadian veterinary journal. La revue veterinaireCanadienne.1986; Oct, 27(10):P. 365-371.
[37] Suleymanov SM, Usha BV, Vatnikov YA, Sotnikova ED, Kulikov EV, Parshina VI, Bolshakova MV, Lyshko MU, Romanova EV. Structural uterine changes in postpartum endometritis in cows, Veterinary World. 2018; 11(10): 1473-1478.
[38] ZavalishinaSYu, Kutafina NV, VatnikovYuA, Makurina ON, Kulikov EV, Rystsova EO, Gurina RR, and Sotnikova ED. Platelet-Activity Dependence on the Age of Rats with Experimental Dyslipidemia. Biol Med (Aligarh). 2014; 8: 326. doi: 10.4172/0974-8369.1000326.
[39] ZavalishinaS.Yu., VatnikovYu.A., Makurina O.N., Kulikov E.V., Sotnikova E.D., Parshina V.I., Rystsova E.O., Kochneva M.V., Sturov N.V. Diagnostical Appreciation of Physiological Reaction of Intravascular Thrombocytes' Activity of Two-Years-Old Mice to Regular Physical Loads. Biomedical & Pharmacology Journal. 2017; Vol. 10(1). pp. 129 – 136.
[40] Sachivkina NP, Karamyan AS, Kuznetsova OM, Byakhova VM. Development of therapeutic transdermal systems for microbial biofilm destruction. FEBS Open Bio. 2019; 9(S1): 386.
[41] Kravtsov E.G., Anokhina I.V., RybasYa.A., Sachivkina N.P., Ermolaev A.V., Brodskaya S.B. Effects of female sex hormones on adhesion of candida albicans yeast-like fungi to the buccal epithelium. Bulletin of Experimental Biology and Medicine. 2014; 157(2): 246-248.

[42] Sachivkina N.P., Kravtsov E.G., Vasilyeva E.A., Anokhina I.V., Dalin M.V. Study of antimycotic activity of Lyticase. Bulletin of Experimental Biology and Medicine. 2009; 148(2): 214-216.

[43] Lenchenko E, Blumenkrants D, Sachivkina N, Shadrova N, Ibragimova A. Morphological and adhesive properties of Klebsiella pneumoniae biofilms. Veterinary World. 2020; 13(1): 197-200.

[44] Stanishevskiy YM, Sachivkina NP, Tarasov YV, Philippov YI, Sokolov SA, Shestakova MV. Evaluation of biocompatibility of an experimental membrane for glucose sensors: the results of a prospective experimental controlled preclinical study involving laboratory animals. Problems of Endocrinology. 2017; 63(4), 219-226.

[45] Zhilkina, N. P. Sachivkina, A. N. Ibragimova, T. Y. Kovaleva, M. A. Molchanova, D. V. Radeva. Methods for the identification and quantitative analysis of biologically active substances from vitamin plants raw material. FEBS Open Bio. 2019; 9(S1): 285-286.

[46] Morozov I.A., Sachivkina N.P., Kravtsov E.G., Vasilyeva E.A., Anokhina I.V., Yashina N.V., Dalin M.V. Damaging effects of lyticase on Candida albicans and changes in the response of rat alveolar macrophages to the contact with yeast-like fungi. Bulletin of Experimental Biology and Medicine. 2011; 151(6): 705-708.

[47] Sachivkina N.P., Kravtsov E.G., Wasileva E.A., Anokchina I.V., Dalin M.V. Efficiency of lyticase (bacterial enzyme) in experimental candidal vaginitis in mice. Bulletin of Experimental Biology and Medicine. 2010; 149(6): 727-730.

[48] Sachivkina N, Lenchenko E, Blumenkrants D, Ibragimova A, Bazarkina O. Effects of farnesol and lyticase on the formation of Candida albicans biofilm, Veterinary World. 2020; 13(6): 1030-1036.

[49] Sachivkina N.P., Podoprigora I.V., Marakhova A.I. Farnesol: properties, role, and prospects for use in the regulation of film formation in fungi of the genus Candida Farmatsiya. 2020; 69 (6): 8–12. https://doi.org/10/29296/25419218-2020-06-02

[50] Khan I.I., Parfait K., Sachivkina N.P. Comparison of different methods for determining the critical micell concentration. Farmatsiya (Pharmacy). 2018; 67 (6): 35–38. https://doi.org/10.29296/25419218-2018-06-07

[51] Sachivkina N.P., Lenchenko E.M., Marakhova A.I. Study of the formation of Candida albicans and Escherichia coli biofilms. Farmatsiya (Pharmacy). 2019; 68 (7): 26–30. https://doi.org/10/29296/25419218-2019-07-05

[52] Sachivkina N.P., Lenchenko E.M., Mannapova R.T., Strizhakov A.A., Romanova E.V., Lukina D.M. Candida biofilm modeling: past and present. Farmatsiya (Pharmacy). 2019; 68 (3): 18–22. https://doi.org/10/29296/25419218-2019-03-03