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Antenatal prophylaxis of acute digestive disorders in calves

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Abstract. Among the diseases of young cattle of non-contagious aetiology, an important place is occupied by the pathology of the digestive system. In particular, dyspepsia, casein-bezoar disease, colostrum toxicosis, and diarrhoea are characteristic of the above pathologies. A familiar name, acute digestive disorders, unites these diseases. That is why it is essential to correct the metabolism of calves. The aim of the study is to investigate the effectiveness of antenatal prophylaxis for acute digestive disorders in calves of the neonatal period with the addition of propylene glycol to the diet of cows during the transient period, which increases the amount of propionic acid in the rumen and chlorophyll, which affects lipid metabolism and prevents fatty liver infiltration and ketosis. It was determined that the addition of propylene glycol and Cholin-Chloridum to the diet of cows during the transient period influenced the change in the content of β-hydroxybutyrate (HTA) and the amount of ketone bodies in the blood of animals in the experimental group of animals. In the experimental group of animals, these indicators were lower in the control group, by 35% of β-hydroxybutyrate and 44% by the sum of ketone bodies. During the transient period, especially in the first months after calving, cows experience an energy deficit, so ketone bodies are formed to compensate for glucose deficiency. Since propylene glycol and Cholin-Chloridum increased the glucose concentration in the blood, the need for synthesising ketone bodies decreased.

1 Introduction

Among the diseases of young cattle of non-contagious etiology, an important place is occupied by pathologies of the digestive organs, which are characterized by dyspepsia, casein-bezoar disease, colostrum toxicosis, and diarrhea. Therefore, they are united by a common name: acute digestive disorders. The causes of dyspepsia are different. These are factors that disrupt the normal development of the embryo and fetus; adverse effects of the external environment on newborns, and non-compliance with the rules of rearing young animals. Among the factors associated with the maternal body, the most significant impact on the occurrence of the disease is exerted by metabolic disorders in pregnant queens due to their unbalanced diet in terms of energy, protein, vitamins, and minerals, feeding low-quality feed, hypokinesia, and diseases suffered during pregnancy [1–5].

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Nearly all cows experience negative energy balance throughout the changeover phase. Being in a negative energy balance, the cow mobilizes body fat, but cannot convert it into energy in the usual ways. Instead, ketone bodies are formed, which in small quantities can be used by the cow for energy. An increase in the level of ketones in the blood of dry cows leads to ketonemia, and this, in turn, leads to a violation of plastic processes in the fetus, and the birth of weak, underdeveloped young animals with structural and functional changes in organs and glands, mainly in the digestive tract, with a low level of protective and adaptive properties of their body prone to early disorders of the gastrointestinal tract [6-13].

Deficiency of macro- or microelements in the body of animals causes metabolic disorders and the development of morbidity [13]. Highly productive cows are especially sensitive to mineral deficiencies, because during intensive lactation, when milk production is significantly increased, a significant amount of them is excreted in milk. At the beginning of lactation, dairy cows often have a deficiency of Calcium and Phosphorus, which the body is forced to cover at the expense of its own reserves [18]. The function of regulation of endogenous reserves of mineral components in the body is performed by hormones, in particular parathyroid hormone and thyroid calcitonin. With intensive lactation of cows, a violation of energy metabolism is recorded, which is the cause of the development of ketosis [9,10]. Ketone bodies have a negative effect on the endocrine glands, which causes impaired synthesis and imbalance of hormones in the blood. Long-term exposure of ketone bodies to the thyroid and parathyroid glands causes their hypofunction, followed by the development of secondary osteodystrophy. At the same time, in cows with ketosis, the liver and kidneys are affected, where biologically active metabolites of vitamin D, which are involved in phosphorus-calcium metabolism, are synthesized, and this further aggravates the pathology.

One of the most important parts of calves' methabolism is rumen. Highly productive cows, compared to low-productive cows, use the body's energy reserves for milk secretion much more intensively and have a longer negative energy balance and, if this is not overcome, then, as a rule, the consequence is a premature deterioration of reproductive functions, health disorders and a decrease in productivity. The metabolism and the state of rumen digestion of highly productive cows during this period depend on the quantity and quality of feed, its physical form, regular and simultaneous intake of nutrients and biologically active substances with it.

Currently, in the Forest-Steppe zone of Ukraine, there is a lack of trace elements in the feeds of the diets of high-yielding cows, therefore, sulfate and chloride salts are used to compensate for them, which, due to their low absorption in the intestine, form insoluble complexes, and therefore, the absorption of trace elements is only 12–23.5%, which leads to an increase in their content in feces, urine and leads to environmental pollution.

In this regard, trace elements of organic origin, chelated complexes – metal compounds with amino acids lysine or methionine – are of particular interest. Trace elements from these compounds are well absorbed in the intestine and deposited in tissues without dissociation, easily included in metabolic active forms.

Therefore, the study of the mixed ligand complex of Cobalt, which is part of vitamin B12 and is an activator of many enzymes and hormones, and determining its optimal dose for highly productive cows is relevant, especially in the first 100 days of lactation.

The most common metabolic disease in ruminants, which develops against the background of impaired carbohydrate-lipid and protein metabolism, is ketosis, which ranks second after mastitis. Pathology causes significant losses to livestock farms, because the loss of dairy products in Ukraine reaches 70%.

There is not a single livestock farm in the world that would not be diagnosed with ketosis, which reduces the profitability of dairy enterprises. Most often, highly productive breeds of cows suffer.

At the same time, the production of ketone bodies – acetone, acetoacetate and beta-hydroxybutyrate – increases tenfold, which causes general intoxication. Normally, these are common metabolic intermediates that provide energy to peripheral tissues and are partially used for the synthesis of sterols, carboxylic acids, phosphatides, and non-essential amino acids [6]. Among the reasons provoking the development of the disease, it is necessary to note unbalanced feeding and improper maintenance and care of highly productive animals, namely: excessive protein content in the diet and insufficient carbohydrate content; feeding moldy feed, mainly cake or silage; endocrine disorders; Hypoglycemia; lack of exercise; deficiency of energy in the diet (primarily during the period of intensive lactation); feeding feed that contains excess butyric acid.

According to statistics, in the United States, of all metabolic disorders, ketosis in highly productive cows occupies the first positions, ahead of rumen acidosis and milk fever. It has been found that the losses from ketosis of cows for American farms are 178 euros/animal. A large-scale study in Canada, which included 25 dairy farms with tethered cows and separate feeding, found that the proportion of animals with subclinical ketosis was 16-24%. The diagnostic marker in these studies was the content of beta-hydroxybutyrate in the blood serum of cows during the first two weeks after calving. At the same time, it was found that reducing the incidence of subclinical ketosis in cows by 25% saves approximately 6308 euros per year for every 100 animals [4,9].

The study of the effect of chelated compounds on productivity, metabolism in the body of animals and reduction of the level of heavy metals in metabolic products is carried out by a lot of scietists, who conduct their research on poultry, pigs and cattle. However, to date, the optimal norms of the mixed ligand complex of Cobalt in the diets of highly productive cows have not been established, and the uncontrolled use of imported premixes leads to the culling of cows in 2-3 years of lactation, which is associated with the occurrence of various diseases.

A characteristic manifestation of ketosis in animals is ketonemia, ketonuria and ketonolactia. Ketonemia in highly productive cows is accompanied by an increase in the concentration of ketone bodies in urine and milk and the development of hypoglycemia. In the blood plasma of cows with chronic ketosis, there is an increased activity of enzymes indicative for the liver – alanine and aspartic aminotransferases. Digestive processes in the forestomachs of ruminants are characterized by a decrease in pH to 6.5–6.0, which is also characteristic of the latent course of rumen acidosis, and a change in the ratio between individual representatives of volatile fatty acids with an increase in the proportion of butyric acid.

Numerous questions about changes in the body of cows during the development of ketosis at the molecular level still need to be studied in detail. Obtaining new results on the peculiarities of the course of biochemical processes in organs and tissues in this pathology in the future will contribute to the development of new approaches in the prevention, diagnosis and therapy of sick animals [9, 10].

An important indicator of the functional capacity of the animal body is changes in carbohydrate metabolism indicators. In highly productive cows, carbohydrate and hormonal status can change and become an important pathogenetic factor during critical physiological periods (childbirth), metabolic shifts (ketosis, fatty hepatosis, etc.), under the influence of drugs used (anti-inflammatory drugs) [9].

2 Literature review

Thus, according to the literature review, early lactation in cows showed a decrease in the level of insulin, glucose, triacylglycerols in the blood plasma and an increase in the amount of free fatty acids and cholesterol. Administration of insulin to pregnant cows stimulated the synthesis of adipose tissue, but its effect was minimal in animals with a negative energy balance during the early lactation period [5].

It is known that growth hormone, insulin, and glucose levels remained unchanged throughout pregnancy and lactation in beef cows. In Holsteins (with milk production 10 times greater), with the onset of lactation, the level of growth hormone increased and insulin decreased, and the secretion of insulin for the administration of glucose was much less. These data indicate that high-yielding cows are less able to maintain the anabolic effects of insulin and minimize the catabolic effects of growth hormone, compared to low-performing beef cows. Some authors point to the important role of hormonal status disorders in the development of pathologies of various origins in cows [5].

The administration of insulin in the postpartum period helps to increase appetite and productivity in cows. As the dose of insulin increased, the concentration of hepatic triacylglycerols gradually decreased and the concentration of glycogen increased [5].

Thus, it is worth noting: as practice shows, the treatment of sick animals' costs farmers much more than balanced feeding and high-quality veterinary care. The situation with the spread of metabolic diseases in productive animals is one of those issues of concern, requiring in-depth analysis and professional solution.

V Sachnuk and V. Levchenko [14] create their own message about ketosis and recommendations to prevent the disease. They told, that in the United States, Holsteins with an average daily milk yield of 18 kg and a body weight of 500-550 kg spend 61% of the energy of the consumed feed on milk production, and animals with a productivity of 40 kg (average weight of 572 kg) – 70%. The standard and dream of all breeders is a cow with a daily milk yield of 49 kg (m = 700 kg), which spends 80-81% of the net energy of the consumed feed on milk production. Today, taking into account modern scientific developments and the great potential of Holsteins, they are trying to increase their productivity as much as possible while reducing feed costs. Ukrainian black-and-white and red-and-white breeds with a productivity of more than 6 thousand tons; kg of milk per lactation, well adapted to the industrial technology of maintenance.

3 Theoretical framework

Any malnutrition of highly productive cows, especially in the period close to calving, and in the first 15-20 days of the postpartum period, leads to the occurrence and development of metabolic diseases, primarily ketosis, as well as diseases of the liver, kidneys, heart, endocrine glands, dystonia of the proventricles, damage to the limbs, etc. ketone bodies (β-hydroxybutyric, acetoacetic acid and acetone), dystrophic changes in the liver, heart, kidneys, ovaries, thyroid and parathyroid glands, pituitary gland. It should be noted that higher levels of ketone bodies are observed in animals with higher milk production. This is explained by the fact that the increase in the level of milk production is associated with an increase in the mobilization of fats, which entails an increase in the concentration of acetone, β-hydroxybutyric and acetoacetic acids (ketones) in the blood.

Thus, the range of the disease among the livestock of the 61 most highly productive dairy herds in the United States was from 0 to 20%. However, studies in recent years indicate that the transition period is critical in dairy cows, which begins two to three weeks before giving birth and ends three weeks after it, and metabolic disorders can occur already in the first days after calving more nutrients than they can consume.

In healthy cows, the need for energy on the fourth day after calving exceeds consumption by 26% and protein by 25%. During this period, when cows, due to biological characteristics, are unable to consume the amount of feed adequate to the body's expenditures for milk production, a negative energy balance occurs, which lasts at least the first three months of lactation and is especially dangerous in the first weeks after childbirth. After all, it is known that the highest milk yield per day is observed in the 6th-8th week of lactation, and the maximum feed consumption by cows is observed in the 10th-12th week. During this period, the energy deficit is compensated by using the reserves of fat, glycogen and muscle tissue. As a result, cows lose up to 10-12% of their body weight (50-80 kg). A negative energy balance causes metabolic disorders and a variety of diseases. It is during this period that the maximum number of metabolic disorders and infectious diseases occurs, which causes significant losses to dairy farming [7].

Thair medical examination of about one and a half thousand highly productive Holstein cows in the farms of Kyiv, Dnipropetrovsk, Vinnytsia, Zhytomyr, Cherkasy, Mykolaiv and Ternopil regions showed that ketosis is diagnosed in an average of 17.6% (8.4-34.1%) of animals. Our research on the development of "early" ketosis in cows makes significant changes in the view of ketosis as a disease of the highest lactation period. An experimentally induced 25% reduction in the energy supply of cows on the fifth day of lactation led to the development of ketosis in 80% of cows, while the restriction of dry matter intake by 25% starting on the 14th day after calving, or by 50% on the sixth or seventh week of lactation, was not effective in provoking ketosis [13].

The main cause of ketosis is an energy deficit in the diet of cow with a daily productivity of 25 liters of milk should receive 1 k. unit. (10.5 mJ of metabolizable energy) in 1 kg of dry matter of feed, 30 l – 1.05 (11.0 mJ), 35–40 is l – 1.1 (11.5 mJ), over 40 is l – 1.15–1.20 k.u. (11.5–12.0 mJ). Some cows already in the first three weeks of lactation give 30-35 liters, and they are fed only 18 kg of dry matter, which is not enough, since their daily requirement is 20-22 kg with a high concentration of energy in dry matter (250–275 mJ of metabolizable energy).

Energy deficiency increases sharply with impaired feeding and the development of various pathologies in the first days of the postpartum period: retention of the afterbirth, hypocalcemia, hypophosphatemia, endometritis, mastitis, scar hypotension, abomasum displacement, limb diseases, etc. For example, the daily sugar requirement of a highly productive cow for a milk yield of 25 liters is 1.9 kg, 30 – 2.4 kg, 35 liters – 3.1 kg; in starch, respectively, 2.8; 3.7 and 4.8 kg. Ketosis develops when there is a sugar deficiency (56 to 72%) in the diet and a low ratio between it and digestible protein ((0.35–0.6):1). The sugar-protein ratio for milk yield of 25 liters should be (0.95–1.1):1; 30–35 l – 1.1:1; 40 liters and more – 1.2:1. No less important is the ratio of the total amount of sugar and starch to digestible protein: it increases from 2.3:1 to 2.7:1 (average 2.5:1) with an increase in the productivity of cows.

A clinically healthy cow spends more energy and nutrients on milk production than she can consume feed even with a full diet and free access to feed with loose housing (a period of negative energy balance). Average fatness (3.5–3.7 points) is optimal, characterized by roundness and smooth contours of the iliac and ischial bones and spine, noticeable contours of the last three ribs. Obesity is one of the causes of difficult childbirth, which leads to the retention of the afterbirth and injury to the birth canal with their subsequent infection, the development of catarrhal-purulent endometritis and the deepening of energy deficiency. An obese cow has a reduced appetite. At the same time, on the 15-20th day after calving, she should consume at least 18 kg of dry matter of the diet (compare with 12 kg in the last three weeks of dead wood).

During the period of rearing (35–40 days of lactation), a highly productive cow should consume 22–25 kg of dry matter, since its productivity reaches 40–45 kg of milk per day, with a concentration of 11.0–11.5 mJ of metabolizable energy (1.05–1.15 k.u.) per 1 kg, 11.2–11.4% of digestible protein and 20–18% of crude fiber – at a milk yield of 30 liters and 18–16% at higher productivity [5,16].

Ketosis can occur subclinically and clinically. and the subclinical course is mostly observed in the first three weeks after calving. Depression, decreased performance, tachycardia (80-90 beats per 1 min), tachypnea, scar hypotonia, taste distortion, and ketonuria are detected. The clinical form of ketosis is characterized by gastroenteral, hepatotoxic, neurotic and acetonemic syndromes, which in their pure form are quite rare. Acetonemic syndrome is characterized by lethargy, decreased appetite, hypotension of the proventricles, and anemia. Tachycardia (90-110), tachypnea (35-60 respiratory movements) are observed, sometimes breathing is slow (8-12), exhaled air often has the smell of acetone. This syndrome is accompanied by dystrophic changes in the heart, liver and kidneys. The content of ketone bodies in the blood increases several times, ketonemia and ketonolactia develop. Hepatotoxic syndrome is manifested by a decrease in appetite, cardiovascular insufficiency. There is an increase in the area of hepatic blunting (hepatomegaly), kidney damage, and the development of secondary osteodystrophy. Gastroenteral syndrome is characterized by changes in the gastrointestinal tract. The rhythm of chewing periods is disturbed, appetite is reduced, scar contractions are liquid, flabby, weakened, fixations alternate with diarrhea. In animals, body weight decreases rapidly. Neurotic syndrome is more often observed in cows in the first two days after calving. Increased excitability, hyperesthesia of the skin in the neck, chest, and lower back are manifested. Nervous phenomena are complemented by muscle tremors, tonic cramps of the abdominal muscles, gnashing of teeth. Excitation is quickly replaced by depression: animals are drowsy, slow to react to the distribution of food, stand with their heads down, mostly lie down, get up with difficulty (soporous state). Fatness and productivity decline rapidly. Body temperature is within normal limits [2,8,9].

When diagnosing ketosis, animal productivity, diet structure, symptoms, results of determining the content of ketone bodies in urine, blood and milk are taken into account. Characteristic signs of the subclinical and acute course of ketosis are an increase in the content of ketone bodies in the blood by more than 1.5 mmol/l (over 9.0 mg/100 ml - ketonemia), in the urine - more than 1.7 mmol/l (10.2 mg/100 ml - ketonuria) and in milk - by more than 1.5 mmol/l (ketonolactia). Often, at the beginning of the development of the disease, the concentration of ketone bodies in the urine of cows reaches 7–10 and even 15 mmol/l, which is 4.1-8.8 times the maximum physiological limit.

To diagnose ketosis, it is recommended to use KetoPhan indicator strips, Hepta- or Penta-Phan universal indicator strips (La-Chema, Czech Republic), Ketur-Test, Combur-Test (Germany) or Lestrade reagent. Moisten the indicator strip with urine and compare the color with the standard. Recently, the Precision Xceed device (Germany) has been used to quantify ketone bodies (b-hydroxybutyric acid) in the blood of cows on a farm. Acute course of the disease, and with its protracted nature and decreased appetite, the content of ketone bodies, in particular in the urine, is in the range of 1.7-2.5 mmol/l, that is, slightly higher than the upper limit of normal.

With a pronounced pathology of the liver, ketonuria may not manifest itself at all, since the oxidation of fatty acids and, accordingly, the formation of ketone bodies is disturbed. In this case, to diagnose the disease, it is necessary to analyze feeding, pay attention to the clinical symptoms of the disease (the most typical are signs of hepatodystrophy and secondary osteodystrophy), determine the content of glucose in the blood (decreases to 1.2–2.0 mmol/l, in healthy cows - 2.2–3.5 mmol/l).

Protein and energy nutrition are brought into line with the norm, the sugar-protein ratio is regulated, introducing fodder, semi-sugar and sugar beets, molasses (1-2 kg) into the diet, cows are given potatoes (6-7 kg), high-quality hay (8-10 kg), haylage of good quality (8-10 kg), from concentrated feed - barley and corn turf, extruded peas.

For 3-5 days (for a cow weighing 600 kg - 0.75-1.5 l of a 20% solution), a 5% glucose solution can be injected into the abdominal cavity (1-2 l). Since the renal threshold for glucose in sick cows is lowered, then, if possible, insulin is administered subcutaneously 30–60 minutes before glucose injection at a dose of 0.2–0.3 units per 1 kg of body weight. propylene glycol (250 ml twice a day), cholinol (300 ml each) or sodium propionate (80-100 ml twice a day, orally 1:1 with water). Specialists can use sugar 150 g twice a day with water. To prevent liver pathology and restore its function, the following are used: heparinol - 50 ml (diluted 1:10 with water), hepavex-200 (250 ml twice a day), choline chloride - up to 25 g or intravenously 10% solution 20-25 ml together with glucose, E-selenium or eutesol 10 ml intramuscularly, methionine - 12-15 g (orally with warm water 1:20), bicohepar 20-40 ml intramuscularly or intravenously [6, 8, 13].

B.L. Collard, P.J. Boettcher, J.C.M. Dekkers, D. Petitclerc and L.R. Schaeffer [2] determined the connection between energy balance in early lactation and health and reproduction in that lactation. It was approved, that there are some similarities between energy balance and health [2].

A.I. Macrae, E. Burrough, J. Forrest, A. Corbishley, G. Russell and D.J. Shaw [11] determined, that subclinical ketosis usually occurs in first 20 days of lactation [11].

J.J. Gross and R.M. Bruckmaier [3] determined the relation of lactational performance of dairy cows (especially for last days) and higher nutritional requirements.

P. Lacasse, N. Vanacker, S. Ollier, C. Ster [4] described the incidence of metabolic and infectious diseases during the lactation cycle. They determine some varieties of diseases.

Vengai Mavangira, Lorraine M. Sordillo [7] in their scientific work described the role of lipid metabolism in pathological process. In their opinion, it is closely connected with metabolism of oxygen.

A. Vieira-Neto, I.R.P. Lima, Lopes F. Jr., C. Lopera, R. Zimpel , L.D.P. Sinedino , K.C. Jeong, K. Galvão, W.W. Thatcher, C.D. Nelson, J.E.P. Santos [17] in their scientific work determined the effects of an injectable formulation of calcitriol on mineral metabolism and immune function in postpartum Holstein cows that received an acidogenic diet prepartum to minimize hypocalcemia.

V.A.E. Becker, E. Stamer, H. Spiekers, G. Thaller [1] in their scientific work told, that Residual energy intake (REI) is an often-suggested trait to correct feeding. Cows with lower REI seem to be more efficient but are also in a more severe negative energy balance.

J. Schenkenfelder and C. Winckler [15] reportedabout implementation a third-party animal-based assessment of health and welfare in Australia. It helped to stimulate welfare improvements on farms.

M. Khansefid, M. Haile-Mariam, J.E. Pryce [4] in thair scientific work determined, that the level of lameness incidence rates in Holstein and Jersey cows. In their opinion, the main reason of desease is lack of feading.

Jianlong Wang and Yanan Yin [19] in thair scientific work described, that medium chain carboxylates (MCCs) have significant popularity in various industries, but the traditional MCCs production methods are costly and unsustainable. However, the underlying microbial pathways are not well understood.

The purpose of our work is to investigate the effectiveness of antenatal prophylaxis of acute digestive disorders in calves of the neonatal period, with the addition of propylene glycol to the diet of cows during the transient period, which increases the amount of propionic acid in the rumen and Cholin-Chloridum, which affects lipid metabolism, prevents fatty liver infiltration and ketosis.

4 Materials and methods

To conduct the experiment, two groups of cows (5 in each) of the transient period (three weeks before and three after calving) were formed, the first (control) cows of which received the usual diet provided for on the farm, the second (experimental) received 20 g of feed additive Cholin-Chloridum and 150 g of dry propylene glycol in the diet. Venous blood was taken for laboratory tests. In blood plasma, the content of total protein, total cholesterol, triacylglycerols, urea, glucose, ketone bodies were determined. The study was carried out before the start of the experiment and at the end. The study was carried out on the biochemical analyzer STAT Fax 1904. Researches also used the Optium Xceed device to determine ketone bodies in the blood, namely β-hydroxybutyrate.

Propylene glycol, 1,2 propanediol Propylenglycolum (Ph Eur), Propylene glycol (USP, BP, JP), 1,2-Propanediol (CAS No. 57–55–6, (–)-1,2-Propanediol № 4254–14–2, (+)-1,2-Propanediol № 4254–15–3), C3H6(OH)2, mol. m. 76.10 is an aliphatic dihydric alcohol used in pharmacy as an excipient: a solvent for many water-insoluble APIs; prevents drying of the aqueous phase in ointments, gels, creams o/v; softens the consistency of polymer films, promotes the absorption of many APIs. Propylene glycol exhibits stabilizing and osmotic properties; It has an antioxidant, preservative effect, prevents mold (a 50% solution in aerosols is used to disinfect the air).

Propylene glycol is a colorless, sweet-tasting thick liquid (density 1.035–1.037 g/cm3), well miscible with water, ethyl, benzyl alcohols, miscible with most organic solvents (acetone, chloroform, etc.), poorly soluble in ether (1:6), petroleum ether, benzene, and does not mix with fatty oils.

Propyleneglycol is a low-toxic liquid (LD50 when administered orally to rats is 26.38 g/kg), does not irritate the skin. When injected into the eye, it causes irritation of the conjunctiva, which is explained by its significant hygroscopicity. It is widely used in pharmaceutical prescriptions, is considered a nontoxic substance, and is used in many cosmetic and food products. It is rapidly absorbed from the gastrointestinal tract and through intact skin; It is intensively metabolized in the liver, excreted unchanged in the urine. The intensifying effect of ethyl alcohol is about one-third of that of ethyl alcohol, which has a negative effect on the central nervous system, especially in children. Side effects are observed when consumed in large quantities, used in children under 4 years of age and pregnant women, as well as patients concomitantly using metronidazole. On the basis of the data of metabolism and toxicity, the WHO has established an acceptable (permissible) dose of 25 mg/kg of body weight. Solutions containing 35% P. may exhibit hemolysis. In animal tests, no teratogenic or mutagenic effects were noted. Other glycols are more toxic and therefore are not used in the manufacture of solutions for injection. Propylene glycol is also used for film-forming varnishes as an softening component.

P. alginate, Propylene glycol alginate (USPNF, CAS № 9005–37–2), which is a linear glucurone polymer – a complex ester of P. and alginic acid, is also used in pharmaceutical drug technology.

It is obtained by reacting alginic acid with propylene oxide. Various forms of P. alginate can be obtained, differing in composition depending on the degree of esterification and the percentage composition of carboxyl groups in the molecule; However, complete esterification of alginic acid is not possible. Ester is soluble in dilute acids and water to form stable, viscous, colloidal solutions (at pH 3.0). Depending on esterification, ester can be soluble in a water-alcohol solution with an alcohol content of (95%) up to 60%. The viscosity (dynamic) of aqueous solutions depends on the substance used. Typically, a 1% solution has a viscosity of 20–400 mPa·s. Viscosity can vary depending on concentration, pH, temperature, and the presence of metal ions.

With long-term storage and elevated temperatures, it becomes less soluble. Solutions are stable at pH in the range of 3.0–6.0; The viscosity of the solutions changes markedly during sterilization.

Propylene glycol alginate is used as a stabilizer, gelling agent and emulsifier in medical practice for oral and topical use, usually at a concentration of 0.3–5%, which may vary depending on the purpose and type of ester used. It can be used as an antifoaming agent, flavor corrector and thickener. Propylene glycol alginate is also used in cosmetology and the food industry [9,10].

Other excipients that have properties similar to this medication alginate are alginic acid, sodium alginate.

Choline-chloridum is a very important nutrient for the normal growth and development of farm animals. One of its most common uses is its introduction into animal feed/compound feed as an additive. Why do they do this? If consider, for example, feed for chickens, then the functional responsibilities of the additive are a significant intensification of the growth processes of poultry. In general, this vitamin is introduced into food for various livestock and poultry, both adults and juveniles. But it is most beneficial for chickens and pigs. If choline enters the animal's body in improper volumes, a violation of fat and carbohydrate metabolism is no exception, which, in turn, threatens with poor use of feed. By the way, together with manganese and niacin, this substance also stands guard over the development of perosis in birds. How and how much choline to inject into feed? The first thing to do is to calculate the required amount, taking into account the percentage of choline chloride in the drug. Next, you need to add the product to a tenth of the feed, and only then mix with the rest of the food. It is worth adding medicines to the feed on the day of their creation, immediately before feeding. Doses depend on the goals and the animals themselves. So, for prophylactic purposes, the recommended number of grams per kilogram of dry food is 0.7 and 0.9 – for fattening sows and sows in other periods, respectively; 0.8 and 1.1 – for piglets weaned from the mother, and sucklings; - 1 – for chickens, roosters and chickens, for turkeys, turkey poults, goslings and ducklings. If it is not a matter of prevention, but of treatment, then one cannot do without the use of increased doses, namely 4-10 g/kg of feed. There are no contraindications to the use of the drug. If the dosages are observed, side effects will not occur. If you use increased amounts of this compound, shallow breathing may become more frequent, intestinal spasm, salivation, cyanosis and convulsions may occur. When poisoning becomes chronic, it will have a bad effect on growth, the volume of fat in the tissues will decrease and hypoglycemia will appear. To eliminate the negative effects, atropine can be used: the introduction of 0.01-0.06 g of drugs for cattle and 0.005-0.5 g for pigs under the skin [9,10].

Clinical and hematological studies of newborn calves obtained from cows of the control and experimental groups were also carried out.

It is known that on the determination of biochemical parameters of blood that the development of measures for the prevention of metabolic disorders in the body of farm animals is based. This is due to the fact that the shift in metabolic processes is adequately reflected in the composition of the blood

- the internal environment of the body. Adaptive and protective capabilities of animals characterize such indicators of natural resistance and immunobiological reactivity of the organism as biochemical composition of blood, total protein and its fractions, and others. However, in animals, it is necessary to control not only the indicators of protein, carbohydrate, nitrogen and fat metabolism, but also the dynamics of biologically active substances, in particular the level of enzymes that trigger biochemical processes in the body of animals, and their rate depends on the concentration of many substances and especially macro- and microelements.

The above determines the relevance of scientific research on the state of metabolic processes of cattle in the conditions of each specific farm and the development of recommendations for the prevention of metabolic disorders.

Biochemical blood figures were determined, using the analyzer. It works on the base of photometry. The photometric analysis method can be used for a large range. Determined concentrations. It is used both for determining the main components of various complex substances, and for determining the trace impurities in the objects. Combination with some methods of separation and enrichment - chromatographic, extraction - allows increasing the sensitivity of photometric methods by several orders of magnitude. The photometric properties of the solute are characterized by the transmittance T (τ), the reflection coefficient R (ρ), and the absorption coefficient A (α), which for the same substance are related by the relation T + R + A = 1. The determination of the dimensionless quantities T, R and A is performed using photometers (instruments for measuring a photometric value) by recording the reactions. Receiver of optical radiation on the corresponding radiation fluxes. In routine laboratory practice, it is customary to designate devices that detect the absorption of light by matter, photometers, and reflection by reflective photometers [5].

5 Results and discussion

Thus, at the beginning of the experiment from Table 1, we see that such indicators as total protein, total cholesterol, triacylglycerols, urea, glucose, ketone bodies, β-hydroxybutyrate were almost at the same level and did not differ between the groups. The addition of propylene glycol and the complex additive Cholin-Chloridum to the diet of cows significantly affected the biochemical parameters of the blood being studied.

Table 1. Biochemical parameters of blood plasma of cows.

Indicators	Groups of cows	
	Control	Research
	Beginning of the experiment	
Total protein, g/l	72.35 ± 1.72	72.88 ±1.91
Albumin, g/l	32.1± 1.05	32.0± 1.03
Split mmol/L	4.58 ± 0.14	4.55 ± 0.19
Glucose mmol/L	2.39 ± 0.09	2.35 ± 0.12
Triacylglycerol mmol/L	0.33 ± 0.02	0.30 ± 0.01
Total cholesterol mmol/L	4.21 ± 0.16	4.20 ± 0.13
β-hydroxybutyrate mmol/L	1.14 ± 0.05	1.16 ± 0.06
Sum of ketone bodies mmol/L	1.59 ± 0.05	1.60 ± 0.04
	End of the experiment	
Total protein, g/l	75.45 ± 0.87	78.61 ± 1.12
Albumin, g/l	33.2± 1.06	39.2 ± 1.08
Split mmol/L	4.24 ± 0.20	4.92 ± 0.17
Glucose mmol/L	2.20 ± 0.11	3.14 ± 0.07
Triacylglycerol mmol/L	0.39 ± 0.01	0.29 ± 0.03
Total cholesterol mmol/L	4.46 ± 0.18	4.02 ± 0.12
β-hydroxybutyrate mmol/L	1.68 ± 0.03	1.02 ± 0.06
Sum of ketone bodies mmol/L	1.99 ± 0.02	1.26 ± 0.05

The content of total plasma protein, at the end of the experiment, did not differ significantly between the groups of cows.

The addition of propylene glycol and Choline-chloridum to the diet of the experimental group helps to increase the concentration of glucose in the blood plasma of cows. This action is characteristic of propylene glycol, since it stimulates the formation of propionate in the rumen, the main precursor of glucose in the body of ruminants. So, at the end of the experiment, the glucose content in the experimental group was higher, compared to the control by 30%, respectively. The addition of propylene glycol and Choline-Chloridum to the diet contributed to a 26.7% reduction in the content of triacylglycerols in the blood plasma compared to the control group of animals. Similar data were obtained for such an indicator of lipid metabolism as total cholesterol, it was lower in the experimental group of animals by 9.9% compared to the control group. Thus, the combined use of propylene glycol and Choline-chloridum contributed to the normalization of energy balance and substrate provision of lipid metabolism in the body of cows, thanks to choline-chloride, which is part of Choline-chlorid. Choline is necessary for the synthesis of structural components of liver cell membranes, and ensures a constant outflow of neutral fats from the liver.

The addition of propylene glycol and Cholin-Chloridum to the diet of cows during the transient period influenced the change in the content of β-hydroxybutyrate (HTA) and the amount of ketone bodies in the blood of animals in the experimental group of animals. In the experimental group of animals, these indicators were lower in the control group of animals, by 35% of β-hydroxybutyrate and 44% by the sum of ketone bodies. During the transient period and especially in the first months after calving, cows experience an energy deficit, so ketone bodies are formed to compensate for glucose deficiency. Since propylene glycol and Cholin-Chloridum increased the concentration of glucose in the blood, the need for the synthesis of ketone bodies decreased [1,2].

At the end of the experiment, the albumin fraction of serum proteins of the experimental group was higher compared to the control group of animals by 18.0%, respectively. This indicator reflects the functional state of the liver, and indicates the contribution of propylene glycol and Choline-Chloridum in the restoration of its protein-synthesizing function.

Calves obtained from cows of the control and experimental groups were also subjected to clinical examination and some biochemical parameters of blood were determined on the first day after birth (Table 2).

Table 2. Biochemical parameters of calves' blood (n=5, the first day after birth).

Indicators	Units of measurement	Control group	Research group
Glucose	mmol/L	1.03±0.32	3.44±0.36
Lactate	mmol/L	4.49±0.64	2.02±0.45
Urea	mmol/L	8.54±0.47	5.5 ±0.27
Total lipids	g/l	2.4±0.19	5.71±0.24

The data of Table 2 indicate a decrease in the blood glucose content of calves of the control group by almost 3 times, compared to the same indicator of the experimental group. It is clear that the low content of glucose in the blood of calves as an energy substance negatively affected not only carbohydrate metabolism, but also in general the overall metabolism of calves of the control group. The lactate content in the control group was twice as high in the experimental group. The blood urea content of calves in the control group was increased by 1.5 times compared to calves in the experimental group, while total lipids were higher in control.

A disorder in the metabolism in the body of cows - mothers during dead wood (increased content of ketone bodies) led to the occurrence of acute digestive disorders in calves of the control group in 80%, when in the experimental group this figure was only 20%.

6 Conclusions

It was determined, that the addition of propylene glycol and Choline-Chloridum to the diet of cows during the transient period contributes to an increase in plasma glucose content by 30% and decrease in the content of β-hydroxybutyrate and the amount of ketone bodies by 35% and 44%, respectively. Also adding propylene glycol and Choline-Chloridum to the diet of cows during the transient period, prevents the occurrence of acute digestive disorders in calves during the neonatal period in 80%.

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