Hepatoses in highly productive cows, their treatment and prevention

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Abstract. Ketone bodies in the urine of first-born heifers on the first day after calving constitute an indicator within the normal range, but by the 30th day after calving in sick animals, the reaction to ketone bodies is 8 times higher than normal. All changes indicate violations of protein and fat metabolism, as well as changes in the acid-base balance in the animal's body, which is associated with impaired liver function and damage to this organ. In order to find the most effective method of pharmacoprophylaxis and pharmacotherapy of hepatoses and fatty liver dystrophy in the first heifers, the drug "Hepatoject", a hepatoprotective choleretic drug, was used on the farm. To prevent liver dysfunction and treat animals with hepatosis, 100 ml of hepatoject was administered intravenously after calving for 5 days, which led to 100% preservation of animals with normalization of liver function, milk productivity, biochemical parameters of blood and urine.

1 Introduction

One of the important factors for the preservation of livestock and increasing the production of milk and other livestock products is the reduction of animal morbidity. The main share among non-communicable diseases is occupied by a violation of the functional activity of the liver and rumen, especially in new-bodied animals, which is very common in livestock complexes where highly productive cows are kept. The frequency of liver damage after calving is due to its huge role in all types of inter-daily metabolism, since the liver is the main link between the portal and the general circulation and participates in all physiological processes occurring in the animal's body [1,2,3].

The leading place among liver pathology in dairy complexes in new-bodied cows and heifers is occupied by fatty and toxic dystrophy, which causes great economic damage, consisting of the cost of treatment, which turns out to be ineffective due to an irreversible decrease in milk productivity, symptomatic infertility acquired as a result of depletion of the liver (biological reserve of the body) and, finally, during animal slaughter it is necessary to dispose of the liver, which at the same time is a valuable food product [4,5].

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The critical moment for the liver and for the entire animal body as a whole is the postpartum period, since the liver is the dominant organ involved in maintaining the constancy of the internal environment and eliminating diseases. A large load falls on her during lactation. It is known that for the production of 1 liter of milk, at least 500 liters of blood must pass through the liver of a cow. After calving, the animal's high milk production implies an increased formation of lactose, the synthesis of which requires a certain amount of glucose [3]. According to some authors, up to 2 kg of glucose is required for a cow with a milk yield of 20 liters of milk. In the absence or deficiency of easily digestible carbohydrates in the diet, the animal's body does not receive enough glucose, as a result of which the synthesis of propionic acid decreases, which, in turn, is a precursor of glucose with the formation of glycogen in the liver. Due to this, there is a significant consumption of glycogen with depletion of its reserves in the liver [4].

Also, one of the main reasons for the development of liver damage is the lack of active exercise in animals. Ketone bodies formed in the liver are actively used by muscles as a source of energy. If ketone bodies are not used, they accumulate in the blood and urine, which leads to an acidotic state of the body, i.e. to subclinical ketosis. After calving, this can lead to the death of the animal or to forced slaughter. All this reduces the period of productive use of cows. In most dairy complexes in Europe, America and Russia, it is 2-3 lactation per their lifetime [5]. In the absence of timely competent treatment, comprehensive diagnosis and the introduction of measures to prevent liver dysfunction in highly productive animals after calving, persistent irreversible metabolic disorders will occur, which will entail the retirement of especially the first heifers from the herd and will be expressed by obvious economic losses for production, which will directly affect the profitability of dairy cattle breeding [6].

Unsatisfactory conditions of keeping animals, such as poor microclimate, lack of or insufficient active exercise and technological stresses, are of great importance in the development of hepatosis. These reasons cause serious metabolic and liver dysfunctions, leading to intrauterine intoxication of the fetus in pregnant animals. In fresh and first-calving cows, they lead to the secretion of colostrum that is inadequate in physicochemical and biological composition; calves born from cows with metabolic disorders are characterized by growth and developmental delays, which causes their low body weight (24.3 ± 0.89 kg). These hypotrophic calves, as well as their mothers, have metabolic disorders characteristic of functional liver failure, such as hypoproteinemia against the background of severe hypoalbuminemia [7]. In this case, hypoalbuminemia progresses in the resulting offspring with age. These disorders in the blood system of hypotrophic calves are accompanied by damage to the architectonics of the liver tissue. Thus, histological preparations of liver tissue samples show an unformed beam structure, as well as the presence of single and multiple foci of micro- and macronecrosis [8]. Occasionally, foci of hematopoiesis are noted in the sinusoidal space, corresponding to the functional inferiority and fetalization of the organ. For the offspring obtained from cows with inadequate feeding during the dry period, metabolic disorders and liver function are characteristic. Symptomatically, these pathologies manifest themselves in 32.00% of newborn calves with low body weight (up to 25.00 kg). Their clinical signs are: the presence of diarrhea in the first days of life, leading to a decrease in fatness; dry skin, sloughing of the epidermis, disheveled and dull hair; a pulse of weak strength with insufficient filling [9]. As concomitant diseases, secondary hepatoses develop against the background of obesity, ketosis, diabetes mellitus, poisoning, cachexia, as well as many other pathologies caused by metabolic disorders and endocrine organ functions. In addition, liver dystrophies are often a consequence of infectious and invasive diseases, as well as chronic diseases of the gastrointestinal tract, kidneys, uterus, heart and other organs. Thus, analyzing the data from literary sources, it can be noted that the reasons contributing to the occurrence and

development of hepatoses can be: imbalance in the diet of late-pregnant heifers in terms of nutrients (excess metabolic energy and protein, sugar deficiency); lack of exercise both in winter and summer (year-round stall keeping); violation of microclimate indicators in animal housing (reduced ventilation rate, high air humidity, increased ammonia content) [10]. The above factors lead to metabolic disorders in the animal organism, as well as to disorders of normal liver function. In this regard, there is an acceleration of lipid peroxidation processes, accumulation of under-oxidized decay products in the blood and, as a consequence, the occurrence of general acidosis and intoxication of the organism [11].

The purpose and objectives of the work. Many hepatoprotectors have been proposed by science and practice, but their effectiveness is controversial.

Therefore, the task of our research was to find the most effective method of preventing liver dysfunction (hepatosis) in the postpartum period in highly.

2 Materials and Methods

The work was carried out in the conditions of the milk complex of JSC "Urozhodnoye" of the Novoalexandrovsky district of the Stavropol Territory on the first heifers of the Yaroslavl Holstein breed at the age of 2.5 years, above average fatness and body weight of 450 kg. At the same time, the documentation on calving and disposal of animals in the period from January to June 2023 inclusive was analyzed, biochemical studies of urine and blood serum were performed, and clinical methods for diagnosing the liver condition in animals before and after treatment were used.

3 Results and Discussion

When studying the documentation, we came to the conclusion that the dairy complex monthly during the current year saw the departure of the first heifers within two to three weeks after calving. The data is presented in table 1.

Table 1. Calving and disposal of first-year heifers for the first half of 2023.

Month	Total calved, goal.	Retirement due to fatty liver disease	
		goal.	% of calves
January	18	6	33
February	19	1	5
March	15	0	0
April	18	3	16
May	22	4	18
June	43	11	25
Total	135	25	19

The digital material presented in Table 1 indicates that the highest percentage of first-calf disposals after calving was observed in January and June, and in March not a single animal was eliminated after calving. During forced slaughter, liver changes characteristic of fatty degeneration were noted in all animals. When cut, the edges do not converge, a fatty plaque remains on the knife, liver tissue is easily torn. Metabolic disorders are indicated by the results of biochemical urine analysis (Table 2).

The studies were conducted early in the morning before feeding the animals, samples were taken from two groups of animals: the first group – first calves immediately after calving, the second group – first calves a month after calving. The studies were carried out using Urine Reagent Strips for Urinalysis (URS – 10) test strips from TECO DIAGNOSTICS.

Table 2. Biochemical parameters of urine in primary hepatosis hepatosis.

Indicator	On the first day after calving	30 days after calving	Standard
Protein, g/l	1.0±0.09	-	–
Ketone bodies, mmol/l	0.5±0.02	16±3.2	0.1-2
pH	8.0±0.4	6.5±0.7	7.8–8.2
Glucose, mol/l	–	100±17.2	–

The material in table 2 indicates that the urine values studied in the first hepatocytes with signs of hepatosis have a deviation from the norm, which indicates a metabolic disorder.

Protein in the urine of first-born heifers on the first day after calving averages 1.0±0.09 g/l in the group, and a month after calving, only traces of protein are found in animals with clinical signs of hepatosis. Ketone bodies in the urine of first-born heifers on the first day after calving constitute an indicator within the normal range, but by the 30th day after calving in sick animals, the reaction to ketone bodies is sharply positive and the indicator is 8 times higher than normal.

Also, the pH in sick animals a month after calving is 6.5, and after calving this indicator is within the normal range.

Glucose levels in sick animals are found to be at a high level a month after calving, while in new-bodied animals it is absent.

The above-mentioned changes indicate violations of protein and fat metabolism, as well as a change in the acid-base balance in the animal's body, which is associated with impaired liver function and damage to this organ.

In order to find the most effective method of pharmacoprophylaxis and pharmacotherapy of hepatosis and fatty liver dystrophy in heifers, the farm used a drug from the company "ApiSan" hepatoject, which is mainly used for racehorse breeds. It is a hepatoprotective choleretic drug, it contains L-ornithine, L-citruline, L-arginine, betaine, sorbitol, lidocaine hydrochloride. Thus, according to ApiSan, the manufacturer of the drug, hepatoject L–ornithone reduces the increased level of ammonia in liver diseases in the body, promotes the production of insulin, improves protein metabolism. L-citruline is an amino acid involved in the urea cycle, activates its formation and excretion from the body. L-arginine is an amino acid that plays an important role in the cycle of urea formation, regulates arterial tone, activates cellular metabolism, urea metabolism, promotes the neutralization and excretion of ammonia, stimulates the release of growth hormone from the pituitary gland, regulates blood sugar levels, normalizes the processes of nervous regulation, reduces lactic acidosis.

Betaine has a hepatoprotective, choleretic, lipotropic effect, activates metabolic methylation in the liver. Sorbitol has an osmotic, detoxifying, choleretic, laxative, sweetening effect.

Taking into account the therapeutic measures, two groups of animals were formed: the first group included heifers immediately after calving, the second group of animals – a month after calving. Liver pathology was indicated by an increase in its boundaries during percussion, in the second group there were animals with clinical signs of deep liver dystrophy, in particular cachexia, refusal of feed, loss of milk productivity.

The course of treatment was 5 days, the drug was administered intravenously at a dose of 100 ml once a day, which allowed it to be delivered faster and directly to the affected organ.

Liver percussion was performed in all animals before and after treatment in order to determine its boundaries, as well as auscultation of the scar in order to determine its contractile activity.

The technique of percussion of the liver borders is simple: along the twelfth intercostal space, the border of hepatic bluntness is at the level of the middle of the scapula, and in the tenth intercostal space, the dull sound of the liver turns sharply into the tympanic sound of the lung.

During auscultation of the scar in the middle of the hungry fossa, atony is noted in sick animals, a faint "rustling" sound is heard for a short time. The criterion of a positive result should be considered an improvement in the general condition of the animal, a decrease in the boundaries of the liver to the limits of the norm.

Thus, we found that in the first group of animals, the boundaries of liver dulling during percussion decreased by 37.7% by the 5th day of treatment, and in the group with sick animals, a month after calving, the boundaries of the liver decreased by 40.9%. The positive result of the treatment is also confirmed by a significant improvement in the general condition of the animals. Increased appetite and active chewing indicate a resumption of the motility of the scar.

The effectiveness of using the drug hepatoject is also confirmed by the results of a biochemical blood test in cows with signs of fatty liver dystrophy. The digital material in Table 4 indicates normalization of ALT, AST and LDH values in the blood after treatment. Before treatment, these indicators exceeded the limits of the physiological norm several times.

3 Conclusion

Thus, we believe that intravenous administration of 100 ml of hepatoject daily for 5 days immediately after calving leads to 100% preservation of animals, normalization of their metabolism and liver function, increased appetite, productivity and improvement of general condition. We believe that the method we tested on the farm for the treatment and prevention of fatty liver dystrophy (hepatosis) in first-born heifers and cows immediately after calving is highly effective, prolongs the period of productive longevity of dairy cows, and we recommend using it in dairy complexes.

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