Diagnosis of hepatopathy in Holstein cattle with metabolic disorders

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Abstract. This article is devoted to the pathologies of the hepatobiliary system in highly productive imported Holstein cattle against the background of metabolic disorders. The basic principles of diagnostics of hepatopathies, which include a biochemical blood test and ultrasonographic studies of the liver and gallbladder in the studied animals, are considered. The dynamics of changes in the parameters of alanine aminotransferase, aspartate aminotransferase and total bilirubin in highly productive cattle, depending on the physiological state of animals, was analyzed, as well as the main ultrasonographic changes in the liver of cows with metabolic disorders.

1. Introduction
Metabolic diseases occupy a leading place among the diseases of highly productive Holstein cattle and are the reason for the mass culling of animals. The main share among metabolic diseases is occupied by pathologies associated with impaired liver function. The task of our research was to find the most effective methods for diagnosing diseases of the hepatobiliary system in imported cattle during the time around the parturitions [1-5].

2. Materials and methods
The studies were carried out at the Department of Animal Diseases and VSE of the Faculty of Veterinary Medicine, Food Technologies and Biotechnology, Saratov State Agrarian University named after N.I. Vavilov, as well as on the basis of JSC "Breeding farm" Trudovoy "Markovskoy district, Saratov region on the number of Holstein cattle (n = 60). The methodological approach to the set tasks of the study consisted in a systematic and comprehensive study of the objects of study (pregnant heifers and Holstein cows), analysis and generalization of the results. The material was obtained using laboratory and ultrasonographic research methods. Blood for research was taken from the jugular and tail veins into vacuum tubes and simplers. Biochemical studies were carried out on analyzers Osmetech OPTL CCA using reagents "IFA - Vector - best" and PLC "Olvex Diagnosticum". Ultrasonographic studies were carried out on a MINDRAY-DP50 ultrasound machine, using a 13 MHz transducer [6-11].
3. Results

The set of blood serum indicators for determining metabolic parameters included 18 items. This article displays the most significant, in our opinion, indicators that most accurately characterize the pathology of the hepatobiliary system: total bilirubin, alanine aminotransferase (ALT) and aspartate aminotransferase (AST).

In the process of analyzing the results of the biochemical blood test, we formed three groups of 20 animals each: clinically healthy animals, cows with a subclinical course of the disease and with a pronounced picture of metabolic diseases (table 1). All studies conducted over three time intervals. Blood obtained from heifers 7 and 9 months of pregnancy, as well as from cows one day after calving. The recruitment of groups of experimental animals was carried out according to the principle of analogues, taking into account the breed, age, physiological state and approximately the same body weight.

Table 1. Biochemical blood tests.

| Parameters | Heifers, 7 months of pregnancy | Heifers, 9 months of pregnancy | Cows, 1 day after calving |
|-----------|-------------------------------|-------------------------------|-------------------------|
| Common    |                               |                               |                         |
| Bilirubin, μmol / l | 5.17 ± 2.26 | 7.74 ± 2.11 | 13.67 ± 2.14 | 5.94 ± 2.11 | 8.1 ± 2.41 | 14.11 ± 2.11 | 6.03 ± 2.11 | 10.21 ± 2.11 | 16.89 ± 2.11 |
| ALT, IU/l | 12.43 ± 2.14 | 15.21 ± 2.34 | 20.64 ± 2.34 | 19.74 ± 2.19 | 20.21 ± 2.53 | 25.73 ± 2.53 | 19.74 ± 2.27 | 20.21 ± 2.58 | 25.73 ± 2.88 | 23.92 ± 2.38 | 23.41 ± 2.38 | 24.97 ± 2.38 |
| AST IU/l | 93.52 ± 3.52 | 78.34 ± 3.42 | 40.38 ± 3.42 | 99.13 ± 3.42 | 68.24 ± 3.42 | 56.93 ± 3.42 | 93.92 ± 3.42 | 71.44 ± 3.42 | 62.94 ± 3.42 | 83.92 ± 3.42 | 71.44 ± 3.42 | 62.94 ± 3.42 |

Note: * - limits of physiological fluctuations according to the research of I.P. Kondrakhin; **P <0.01.

The total bilirubin index in clinically sick animals exceeded the reference values (0.17 - 8.55 μmol/l) throughout the entire study period, and in subclinically sick cows the total bilirubin level exceeded normal values one day after calving. The dynamics of the concentration of this indicator in the animals under study, in our opinion, indicates serious violations of the liver in highly productive animals.

The level of the alanine aminotransferase index in all studied animals at three time intervals was in the range of reference values, while the activity of aspartate aminotransferase, at the key moments of pregnancy and calving of the group of the studied animals, according to our data, had a reduced level in subclinically and clinically sick animals. This phenomenon is associated with many reasons, including a pathogenetic nature, however, a statistically low content of ACT in the blood serum is recorded in 60 ± 4.2% of clinically healthy cows.

The indications for ultrasound examination of the abdominal organs, in particular the liver, in our studies were the suspicion of the presence of pathological changes in this organ according to the results of clinical and laboratory studies, in particular, when an increase in hepatic enzymes and bilirubin was detected in animals in the experimental groups.

When examining the organ in healthy animals, as a rule, we observed the following picture: the liver had a homogeneous echo structure and was hypoechoic relative to the adipose tissue of the crescent ligament of the organ adjacent to it, while the liver had a hypoechoic structure relative to the spleen (figure 1).
When examining the liver in subclinical and clinically sick cows, we observed the following picture: in most cases, we revealed diffuse changes in the liver parenchyma. In some animals, an increase in liver echogenicity was established, which may indicate a wide range of pathological conditions, including fatty liver disease. In this situation, the structure of the liver was, as a rule, homogeneous, but its echogenicity increased and was isoechoic to the spleen tissues. In most cases, this pathology was accompanied by an increase in organ size, except when the cause is a chronic organ pathology (figure 2).

In a small group of studied animals, we found a decrease in the echogenicity of the liver parenchyma, which, in our opinion, may be a consequence of toxic liver damage, metabolic disorders, and liver amyloidosis (figure 3).

Thus, during the ultrasound examination of the liver in healthy cows of the Holstein breed, no pathological changes were found in the examined organ, while in subclinically and clinically sick animals, pathological changes were found that occurred due to metabolic disorders.

4. Discussion
Based on the results of the studies, the main biochemical and ultrasonographic parameters were determined that characterize the pathology of the hepato-biliary system resulting from metabolic
disorders in Holstein cows. The work carried out to study the etiology and pathogenesis of hepatopathy in highly productive cattle allows practicing veterinarians to better understand the development of this pathology, as well as expand the possibilities of early diagnosis of liver diseases.

5. Conclusion
As a result of the study, the main biochemical markers that determine the group of liver diseases were identified. In subclinically and clinically sick cows, a significant increase in the level of total bilirubin (up to 16.89 ± 2.51 μmol / l) and a decrease in the concentration of aspartate aminotransferase (up to 40.38 ± 3.01) were recorded, which indicates severe disorders of the hepatobiliary system.

When conducting ultrasonographic examination of the liver in subclinically and clinically sick cows, the following changes in the liver parenchyma were visualized: in some of the animals studied, signs of fatty degeneration of the liver (lipidosis) were diagnosed - as evidenced by diffuse hyperechoic lesions of the liver parenchyma, which were isoechoic to the spleen tissues.

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