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BIOCHEMICAL BLOOD PARAMETERS OF MINKS WITH FATTY HEPATOSIS

Research article

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Abstract

This publication provides information on the study of the main biochemical markers, which can be used to suspect the development of fatty hepatosis (fatty liver) in fur animals (minks). In the modern world, liver pathologies of a non-infectious nature, in particular, such as fatty degeneration of the liver (fatty hepatosis), are superior in percentage terms to absolutely all non-infectious pathologies in fur animals (and minks in particular) both in terms of the number of detections and in terms of coverage as well as the financial damage caused to producers. The experiments were carried out on minks, the main biochemical parameters were evaluated in those animals that, according to the clinical and physical examination, were classified as at risk for fatty hepatosis. As a result of the study, changes in such indicators as total bilirubin, de Ritis coefficient, cholesterol and alkaline phosphatase, relative to the reference intervals, should be considered as metabolic markers of liver pathologies in fur-bearing animals (in particular, minks).

Keywords: mink, biochemical parameters, liver pathology, fatty liver disease.

БИОХИМИЧЕСКИЕ ПОКАЗАТЕЛИ КРОВИ НОРОК ПРИ ЖИРОВОМ ГЕПАТОЗЕ

Научная статья

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Аннотация

В данной публикации приводятся сведения об исследовании основных биохимических маркеров, по которым можно заподозрить развитие у пушных зверей (норок) жирового гепатоза (жировой дистрофии печени). В современном мире патологии печени неинфекционной природы, в частности, такие как жировая дистрофия печени (жировой гепатоз) превосходят в процентном соотношении абсолютно все незаразные патологии у пушных зверей (и у норок в частности) как в плане количества выявлений, так и в плане охвата, а также по причиняемому производителям финансовому урону. Опыты проводили на норках, оценивали основные биохимические показатели у тех животных, которые по данным диспансеризации и физикального осмотра были отнесены в группу риска в отношении жирового гепатоза. В результате исследования изменение таких показателей, как общий билирубин, коэффициент де Ритиса, холестерин и щелочную фосфатазу, относительно референсных интервалов следует рассматривать как метаболические маркеры патологий печени у пушных зверей (в частности, норок).

Ключевые слова: норки, биохимические показатели, патологии печени, жировой гепатоз.

Introduction

In recent years, in veterinary medicine, growing number of the hepatobiliary system pathologies, affecting negatively the animal organism physiological status, has become particularly relevant problem, leading to further study of the main markers, including biochemical ones, which allow diagnosing such pathologies even at an asymptomatic level [1], [2], [3].

In the modern world, liver pathologies of a non-infectious nature, in particular, such as fatty degeneration of the liver (fatty hepatosis), are superior in percentage terms to absolutely all non-infectious pathologies in fur animals (and minks in particular) both in terms of the number of detections and in terms of coverage as well as the financial damage caused to producers [4], [5]. So, according to some researchers, about 90% of animal deaths in fur farming are associated with hepatobiliary pathologies [6], [7].

The main reason for the occurrence of fatty hepatosis (fatty liver) is either a violation of the norm of feeding during the fattening (winter) period, since high-calorie feeds with a high fat content are given, which creates a significant burden on the fat metabolism of the body as a whole and leads to pathological fat deposition in hepatocytes. On the other side use of low-quality feed in the diet of fur-bearing animals, contain fat oxidation products – aldehydes, ketones, low molecular weight acids, hydroxy acids, which have cytotoxic properties [6], [8], [9], [10].

The main goal of the study is to identify and analyze the main biochemical markers indicating the development of fatty hepatosis (fatty liver) in animals with specific clinical manifestations of such a pathology.

Research methods and principles

The experiments were carried out in 2022 at the Mermeriny fur farm (Mermeriny village, Kalinin district, Tver region). Palomino minks (*Mustela vison* Schreber, 1777) were chosen as model animals.

Before the study, the results of clinical examination received at the fur farm were analyzed, after which, based on the anamnesis and physical examination, candidate animals (10 females and 10 males, age – 1 year) were selected with suspected fatty liver disease. Subsequently, the presumptive diagnosis was confirmed on the basis of clinical and biochemical studies.

Blood sampling from animals was carried out taking into account the rules of asepsis and antisepsis by cutting the tip of the tail into vacuum test tubes for biochemical analysis, improvacuter with a coagulation activator.

The content of the main biochemical parameters, such as total protein, albumin, total bilirubin, alkaline phosphatase, glucose, cholesterol, total bile acids, aspartate aminotransferase and alanine aminotransferase (with further calculation of the de Ritis coefficient) was determined on a biochemical analyzer URIT 8021A VET (URIT Medical Electronic Group Co., Ltd, China). The de Ritis coefficient was calculated as the ratio of the activity of serum aspartate aminotransferase and alanine aminotransferase, the amount of total bilirubin was determined by the colorimetric diazomethod according to Jendrashik-Cleghorn-Groff with sodium nitrate (JSC LenReaktiv, Russia), albumins - by the colorimetric method using bromcresol green (JSC LenReaktiv, Russia), total protein - by the biuret method based on a color reaction with copper sulfate (JSC LenReaktiv, Russia) in an alkaline medium. Cholesterol content was assessed by the standard Ilka method (manufacturer of the Ilka reagent, JSC LenReaktiv, Russia), glucose content, by the glucose oxidant method (manufacturer of glucose oxidase, LLC BioPreparat, Russia).

Statistical processing of the results was carried out in the Statistica 6.0 software. Mean values of indicators (M), standard errors of means (\pm SEM) were calculated.

Main results

Biochemical parameters of the blood of the studied groups are presented in Table 1. The lack of reliability calculation was due to the exploratory nature of the study and the absence of control groups.

Table 1 - Biochemical parameters of the blood of the minks with fatty hepatitis

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Parameter	Males (n=10), fatty liver	Females (n=10), fatty liver	Reference values
Total protein, g/l	69,60 \pm 3,11	67,00 \pm 4,26	53-72
Albumins, g/l	36,80 \pm 4,32	38,43 \pm 3,28	33-41
De Ritis ratio (AST/ALT)	0,90	0,66	1,1-1,3
Alkaline phosphatase, IU/l	375,17 \pm 37,84	404,39 \pm 27,52	30-120
Glucose, mmol/l	4,98 \pm 0,23	5,7 \pm 0,26	3,4-7,3
Cholesterol, mmol/l	9,90 \pm 0,56	8,52 \pm 0,24	3,7-7,02
Bilirubin total, μ mol/l	10,00 \pm 0,83	12,20 \pm 1,04	1,71-8,55

Note: AST - aspartate aminotransferase, ALT - alanine aminotransferase

Analyzing the data obtained, it can be concluded that males and females with suspected fatty hepatitis have a significant increase in alkaline phosphatase activity (one of the main biochemical markers of liver pathologies), minor pigment metabolism disorders, and there is also a violation of fat metabolism characteristic of this pathology. So, the indicator of alkaline phosphatase in fatty degeneration of the liver, on average, increases by 3-3,5 times (however, this indicator is difficult to consider as a high-prognostic indicator, since it tends to increase with any cytotoxic effect on hepatocytes); total bilirubin and cholesterol in minks increase slightly, the maximum increase in total bilirubin – by 54,85%, cholesterol - by 49,0%. It should be noted that cholesterol increases most significantly in males than in females, which is primarily due to their pronounced physiological tendency to deposit fat molecules.

Of the greatest interest is the mutual change in the activity of transaminases (ALT and AST) and their ratio. Transaminases, or transferases, are enzymes that catalyze chemical reactions of nitrogen metabolism, the main task of which is to transport amino groups to form new amino acids. Biochemical processes requiring their participation are carried out mainly in the liver. The liver has transaminases that synthesize and break down amino acids and convert energy storage molecules. Serum (non-cellular part of the blood) concentrations of these transaminases are usually low. However, if the liver is damaged, the membrane of the liver cells (hepatocytes) becomes more permeable and some enzymes enter the bloodstream. This indicator is a reliable prognostic marker by which one can judge the pathologies of the hepatobiliary system, but its values in various animal species are not fully understood. However, in this particular case, we noted a significant decrease in the de Ritis coefficient below the reference value, which indicates the presence of a pathological process specifically in the liver.

Thus, it is the change in these indicators relative to the reference intervals that should be considered as metabolic markers of liver pathologies in fur-bearing animals (minks in particular). Further studies require confirmation using morphological methods of research with the analysis of modern statistical methods.

Conclusion

One of the main problems in addressing the prevention and treatment of hepatopathy in fur animals is the lack of a relevant diagnostic base for the timely detection of this type of pathology. Most liver diseases pass latently or with nonspecific symptoms with the rapid development of pathological processes, while clinical and biochemical manifestations, although highly variable for further differentiation of the pathology, are at the same time considered the most promising and easily reproducible.

Финансирование

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Конфликт интересов

Не указан.

Рецензия

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Conflict of Interest

None declared.

Review

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Список литературы / References

1. Краснолобова Е.П. Гепатопатии моногастричных животных в условиях Северного Зауралья / Е.П. Краснолобова, К.А. Сидорова, Н.А. Череменина // Международный вестник ветеринарии. — 2022. — No. 4. — С. 308-313. — DOI 10.52419/issn2072-2419.2022.4.308. — EDN QMENIW.
2. Сулайманова Г. В. Анализ распространенности заболеваний печени и желчевыводящей системы у кошек в условиях мегаполиса / Г. В. Сулайманова, О. А. Бауэр, Р. С. Катаргин // Международный вестник ветеринарии. — 2017. — No. 4. — С. 87-91. — EDN ZWTUYJ.
3. Воинова А. А. Этиология и клиническое проявление гепатоза у коров / А. А. Воинова, С. П. Ковалев, В. А. Трушкин и др. // Международный вестник ветеринарии. — 2017. — No. 4. — С. 91-96. — EDN ZWTUYT
4. Курдеко А. П. Распространение и клинико-гематологическая характеристика гепатоза у высокопродуктивных коров / А. П. Курдеко // Международный вестник ветеринарии. — 2016. — No. 3. — С. 133-138. — EDN WNEATL.
5. Воинова А. А. Изменение показателей пигментного обмена при лечении коров, больных хроническим гепатозом / А. А. Воинова, С. П. Ковалев, В. А. Трушкин и др. // Международный вестник ветеринарии. — 2018. — No. 1. — С. 114-118. — EDN YUCIMS.
6. Зотова А. С. Динамика морфо-функциональных показателей печени в норме и при гепатозе норок : специальность 16.00.02 : автореферат диссертации на соискание ученой степени кандидата ветеринарных наук / Зотова Анна Сергеевна. — Иваново, 2006. — 17 с. — EDN NJVZBZ.
7. Колосова О. В. Влияние шрота каллусной культуры биоженшеня на морфофункциональные показатели печени норок с гепатозами / О. В. Колосова // Вестник Омского государственного аграрного университета. — 2016. — No. 1 (21). — С. 168-174. — EDN VVQHMN.
8. Харламов В. К. Коррекция гепатоза у норок при помощи энтеросорбента полифепан / В. К. Харламов, Б. В. Уша // Разработка инновационных инструментальных методов исследования внутренних болезней животных, Москва, 12–13 февраля 2015 года. — Москва: Издательский Комплекс МГУПП, 2015. — С. 107-111. — EDN UNWOKF.
9. Окулова И. И. Влияние препарата Аркусит на обменные процессы у норок и перспективы его применения / И. И. Окулова, М. А. Кошурникова, Ю. А. Березина [и др.] // Аграрный вестник Верхневолжья. — 2018. — № 4(25). — С. 55-59. — EDN VQCWRG.
10. Мантатова Н. В. Патологоанатомическая картина при "сечении" волосяного покрова норок / Н. В. Мантатова, Д. В. Кладова, С. Е. Санжиева // Аграрный научный журнал. — 2020. — No. 11. — P. 88-90. — DOI 10.28983/asj.y2020i11pp88-90. — EDN RAWZLS.

Список литературы на английском языке / References in English

1. Krasnolobova E.P. Gepatopatii monogastrichnyh zhivotnyh v usloviyah Severnogo Zaural'ya [Hepatopathy of Monogastric Animals in the Conditions of the Northern Trans-Urals] / E.P. Krasnolobova, K.A. Sidorova, N.A. Cheremenina // International Veterinary Bulletin. — 2022. — No. 4. — P. 308-313. — DOI 10.52419/issn2072-2419.2022.4.308. — EDN QMENIW [in Russian].
2. Sulaimanova G.V. Analiz rasprostranennosti zabolevanij pecheni i zhelchevyvodyashchej sistemy u koshek v usloviyah megapolisa [Analysis of the Prevalence of Diseases of the Liver and Biliary System in Cats in a Metropolis] / G.V. Sulaymanova, O.A. Bauer, R.S. Katargin // International Veterinary Bulletin. — 2017. — No. 4. — P. 87-91. — EDN ZWTUYJ [in Russian].
3. Voinova A. A. Etiologiya i klinicheskoe proyavlenie gepatoza u korov [Etiology and Clinical Manifestation of Hepatosis in Cows] / A. A. Voinova, S. P. Kovalev, V. A. Trushkin [et al.] // International Veterinary Bulletin. — 2017. — No. 4. — P. 91-96. — EDN ZWTUYT [in Russian]

4. Kurdeko A.P. Rasprostranenie i kliniko-gematologicheskaya karakteristika gepatoza u vysokoproduktivnyh korov [Distribution and Clinical and Hematological Characteristics of Hepatosis in Highly Productive Cows] / A.P. Kurdeko // International Veterinary Bulletin. — 2016. — No. 3. — P. 133-138. — EDN WNEATL [in Russian].
5. Voinova A. A. Izmenenie pokazatelej pigmentnogo obmena pri lechenii korov, bol'nyh hronicheskim gepatozom [Changes in Pigment Metabolism in the Treatment of Cows with Chronic Hepatosis] / A. A. Voinova, S. P. Kovalev, V. A. Trushkin [et al.] // International Veterinary Bulletin. — 2018. — No. 1. — P. 114-118. — EDN YUCIMS [in Russian].
6. Zotova A.S. Dinamika morfo-funkcional'nyh pokazatelej pecheni v norme i pri gepatoze norok [Dynamics of Morpho-Functional Parameters of the Liver in Normal and Hepatosis Minks]: specialty 16.00.02: abstract of the dissertation for the degree of Candidate of Veterinary Sciences / A.S. Zotova. — Ivanovo, 2006. — 17 p. — EDN NJVZBZ [in Russian].
7. Kolosova O.V. Vliyanie shrota kallusnoj kul'tury biozhen'shenya na morfofunkcional'nye pokazateli pecheni norok s gepatozami [Influence of Meal of Bioginseng Callus Culture on Morphofunctional Parameters of Mink Liver with Hepatoses] / O.V. Kolosova // Bulletin of the Omsk State Agrarian University. — 2016. — No. 1 (21). — P. 168-174. — EDN VVQHMH [in Russian].
8. Kharlamov V. K. Korrekciya gepatoza u norok pri pomoshchi enterosorbenta polifepan [Correction of Hepatosis in Minks with the Help of Polyphepan Enterosorbent] / V. K. Kharlamov, B. V. Usha // Development of Innovative Instrumental Methods for Studying Internal Animal Diseases, Moscow, February 12–13, 2015. — Moscow: Publishing Complex MGUPP, 2015. — P. 107-111. — EDN UNWOKF [in Russian].
9. Okulova I. I. Vliyanie preparata Arkusit na obmennye processy u norok i perspektivy ego primeneniya [Effect of Arkusit on Metabolic Processes in Minks and Prospects for its Use] / I. I. Okulova, M. A. Koshurnikova, Yu. A. Berezina [et al.] // Agrarian Bulletin of the Upper Volga Region. — 2018. — No. 4 (25). — P. 55-59. — EDN VQCWRG [in Russian].
10. Mantatova N. V. Patologoanatomicheskaya kartina pri "sechenii" volosyanogo pokrova norok [Pathological and Anatomical Picture during the "Section" of the Mink Hairline] / N.V. Mantatova, D.V. Kladova, S.E. Sanzhieva // Agrarian Scientific Journal. — 2020. — No. 11. — P. 88-90. — DOI 10.28983/asj.y2020i11pp88-90. — EDN RAWZLS [in Russian].