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**METHODS FOR PHARMACOCORRECTION OF NON-CONTAGIOUS HEPATOPATHOLOGIES IN MINKS  
(REVIEW)**

Review article

**Понамарев В.С.<sup>1,\*</sup>**

<sup>1</sup>ORCID : 0000-0002-6852-3110;

<sup>1</sup> St. Petersburg State University of Veterinary Medicine, Saint-Petersburg, Russian Federation

\* Corresponding author (pseudopyos[at]mail.ru)

**Abstract**

This article discusses the information available in the scientific literature on the methods of pharmacocorrection of non-contagious liver pathologies in fur animals (minks).

First of all, it should be noted that information on the pharmacological correction of hepatic pathologies in minks is insufficient and contradictory. Pharmacocorrection could help minimize the economic damage from such pathologies, however, some sources, including foreign ones, do not provide information on the methods of treating hepatic pathologies, focusing only on prevention.

It is also worth paying attention to the fact that the protocols for the treatment of minks with various liver diseases differ from the protocols for other farm animals, due to differences in the etiology and pathogenesis of such pathologies. Hepatoprotectors specific for fur animals are rarely used, due to the unclear economic effect.

Analyzing the scientific literature, it can be concluded that a continuous search is currently underway for new chemical compounds with hepatoprotective effects, and the direction of pharmacocorrection is increasingly directed towards the presence of a complex universal integral pharmacological response in the drug.

**Keywords:** minks, pharmacocorrection, hepatopathy, liver.

**МЕТОДЫ ФАРМАКОКОРРЕКЦИИ НЕИНФЕКЦИОННЫХ ГЕПАТОПАТОЛОГИЙ У НОРОК (ОБЗОР)**

Обзор

**Понамарёв В.С.<sup>1,\*</sup>**

<sup>1</sup>ORCID : 0000-0002-6852-3110;

<sup>1</sup> Санкт-Петербургский государственный университет ветеринарной медицины, Санкт-Петербург, Российская Федерация

\* Корреспондирующий автор (pseudopyos[at]mail.ru)

**Аннотация**

В статье рассматриваются имеющиеся в научной литературе сведения о методах фармакокоррекции незаразных патологий печени у пушных зверей (норок).

Прежде всего, следует отметить, что информация о фармакологической коррекции печеночных патологий у норок недостаточна и противоречива. Фармакокоррекция могла бы помочь минимизировать экономический ущерб от подобных патологий, однако некоторые источники, в том числе и зарубежные, не дают информации о методах лечения печеночных патологий, делая упор только на профилактику.

Следует также обратить внимание на то, что протоколы лечения норок с различными заболеваниями печени отличаются от протоколов для других сельскохозяйственных животных, что связано с различиями в этиологии и патогенезе таких патологий. Специфические для пушных зверей гепатопротекторы применяются редко из-за неопределенного экономического эффекта.

Анализируя научную литературу, можно сделать вывод, что в настоящее время ведется непрерывный поиск новых химических соединений, обладающих гепатопротекторным действием, а направление фармакокоррекции все больше устремляется в область наличия у препарата сложного универсального интегрального фармакологического ответа.

**Ключевые слова:** норки, фармакокоррекция, гепатопатия, печень.

**Introduction**

The liver is one of the most important organs in the organism. It performs many functions, including nutrient processing, vitamin and mineral storage, bile production, and metabolism. However, as well as in other animals, a number of pathological conditions can occur in minks that can have a negative impact on their health and viability [1], [2].

It is important to note that the mink liver can be easily exposed to toxic substances. Due to their lifestyle, minks can be exposed to industrial waste, chemicals, and drugs. This can lead to liver failure and liver cell damage, known as "toxic hepatitis". Hepatitis in minks can be acute or chronic. The acute form is characterized by liver inflammation accompanied by fever, weight loss, and digestive problems. Chronic hepatitis can lead to liver degeneration and cirrhosis, which poses a serious threat to the life of minks [3], [4], [5].

Another pathology that occurs in minks is fatty liver. This condition is characterized by the accumulation of fatty droplets in the liver, which can interfere with normal liver function. Fatty degeneration can be caused by poor food quality, a lack of certain vitamins or metabolic disorders [6], [7].

The main purpose of this review is to determine the main strategies for pharmacocorrection of various hepatopathologies in minks.

### Materials and methods

The scientific significance of this publication lies in the fact that it represents a comprehensive review of studies conducted in the field of pharmacocorrection of pathologies of the hepatobiliary system using various methods. The authors studied the most promising approaches in veterinary hepatology and considered the possibilities of their implementation in practice. The search and analysis of scientific publications was carried out in accordance with the recommendations of H. Snyder on writing review articles [8]. The methodology included a review of specialized search engines and databases, such as Scopus, WoS, PubMed, and the scientific electronic library eLIBRARY.RU over the past 10 years. The most informative publications were selected, the results were analyzed and compared by relevance. Articles published prior to 2013 were used only if they contained critical information that was not presented in more recent publications.

### Results

First of all, it should be noted that information on the pharmacological correction of hepatic pathologies in minks is insufficient and contradictory [9], [10], [11]. Pharmacocorrection could help minimize the economic damage from such pathologies, however, some sources, including foreign ones, do not provide information on the methods of treating hepatic pathologies, focusing only on prevention.

It is also worth paying attention to the fact that the protocols for the treatment of minks with various liver diseases differ from the protocols for other farm animals, due to differences in the etiology and pathogenesis of such pathologies. Hepatoprotectors specific for fur animals are rarely used, due to the unclear economic effect.

Most educational and methodological materials talk about the following protocol for the treatment of hepatopathy: In individual treatment, first of all, drugs improving lipid metabolism and blood formation, as well as drugs containing vitamins, amino acids, electrolyte solutions and symptomatic agents are used. Vitamins B12, B9 (folic acid), C, E, choline, methionine, lipocaine, aminopeptide or hydrolysin, glucose, sodium chloride in combination with calcium chloride, sodium bicarbonate, glucose and water, as well as extracts from the liver of cattle are commonly used. The diet of sick animals, or the entire herd in case group treatment, includes raw bovine liver, whole fish, low-fat cottage cheese, skimmed milk, fresh-frozen offal, herbs and multivitamins. However, this approach to treatment cannot be called purposeful and complex, since there are no pathogenetically justified points of application of drugs [12].

Another method of treatment is also described in the literature: before feeding with meat and fish feed, they are soaked in a solution of potassium permanganate (1 : 10 000) and washed thoroughly with water. Lipotropic pharmaceuticals, such as methionine, lipocaine and vitamin B4 (choline chloride), are added to the feed at a dose of 0.05 g/kg of animal weight daily for 14 days. Vitamin E (tocopherol) at a dose of 0.005 g/kg, vitamin A (retinol) at a dose of 250 IU/kg and vitamin C (ascorbic acid) at a dose of 0.01-0.02 g/kg are also added. The diet also includes raw liver at a dose of 6-8 g per 100 kcal of feed, 10-15 g of milk (cottage cheese) and protein hydrolysates (hydrolysin, aminopeptide) at a dose of 5-10 ml/kg. The feed mixture is thoroughly combined with medicines and vitamins. Antioxidants are used, such as sodium selenite at a dose of 0.1 mg/kg of animal weight with food, in two 7-day courses with a 7-day break between them. For arctic foxes and foxes, a 0.1% solution of sodium selenite is used at a dose of 0.4-0.5 ml intramuscularly twice with an interval of 4 days. The feed is also supplemented with Diludin and Santohin at a dose of 0.25 g/kg of feed, as well as Ionol at a dose of 0.05 g/kg of animal weight. To prevent spoilage and reduce bacterial contamination of the feed, orthophosphoric acid is used at a dose of 0.25-0.5% by weight of the feed. To reduce intoxication of the body with products of impaired metabolism and equalize water-salt metabolism, electrolyte and glucose solutions are used, consisting of sodium chloride (9 g), potassium chloride (0.2 g), calcium chloride (0.2 g), sodium bicarbonate (0.2 g), glucose (1 g), and distilled water (up to 1000 ml) [13], [14]. The disadvantages of this method are similar to the previous one.

One of the promising areas of pharmacological correction of liver pathologies in fur animals is the use of medicines with sorption properties (including phytosorbents). Thus, treatment regimens using sorbent clay-bentonites are known. For example: in one of the experiments, adding bentonite to the mink diets in the amount of 0.5; 1.0; 1.5% by weight of the feed led to an improvement in morphological and biochemical blood parameters, an increase in the live weight gain of the minks of the experimental groups compared to that of the control groups, a decrease in the intensity of the manifestation of hepatosis and plasmacytosis with the best results in animals receiving natural mineral in the amount of 0.5% [15]. In another example: The use of enterosorbents "Polysorb" and "Polysorb VP" based on polyphedan for therapeutic purposes in puppies after weaning and adult minks gives a positive effect on all major morphological and biochemical blood parameters, reaching the physiological norm for this type of animal or significantly approaching them [16].

Some experimental hepatoprotective compositions are also known: for example, patents for inventions registered in the Russian Federation contain information about the use for the prevention and for the treatment, a single intramuscular injection of 2 ml of 0.1% aqueous solution of sodium selenite and 0.05-0.1% aqueous solution of hydroquinone in a ratio of 1:1, respectively [17]. A method that provides for a differentiated, once a week, introduction of the organoselenium preparation DAPS-25 (diacetophenonyl selenide) at a dose of 2 g/t of feed mixture into the main diet of fur-bearing animals [18].

Analyzing the literature data presented above, we can conclude that a continuous search for new chemical compounds with hepatoprotective effects is currently underway, and the direction of pharmacocorrection is increasingly directed towards the presence of a complex universal integral pharmacological response in the drug.

### Conclusion

The main goal of developing new protocols for the pharmacological correction of hepatopathy is to increase the effectiveness of the treatment of liver diseases, which subsequently leads to an increase in the terms of their economic use. Preparations with a hepatoprotective effect contribute to the normalization of liver functions, strengthening the cells of the

organ, reducing inflammation and stimulating the regeneration of damaged tissues. They can also help protect against the toxic effects of drugs or harmful substances, which is especially important in our time.

However, despite the currently available drugs, the effectiveness of some of them remains insufficient, and problems associated with side effects also arise. In this regard, the development of new hepatoprotectors remains one of the main challenges for the pharmaceutical industry.

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#### Конфликт интересов

Не указан.

#### Рецензия

Все статьи проходят рецензирование. Но рецензент или автор статьи предпочли не публиковать рецензию к этой статье в открытом доступе. Рецензия может быть предоставлена компетентным органам по запросу.

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#### Conflict of Interest

None declared.

#### Review

All articles are peer-reviewed. But the reviewer or the author of the article chose not to publish a review of this article in the public domain. The review can be provided to the competent authorities upon request.

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