
ANIMAL HUSBANDRY

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THE PARAMETER "TOTAL BILE ACIDS" IN MINKS (*MUSTELA VISON*) WITH SHED KEEPING IN THE TVER REGION CLIMATE

Research article

Abstract

Changes in the metabolism and transport of bile acids lead to pathological conditions. This highlights the importance of a balanced circulation of these substances due to their significant role in homeostasis. The main purpose of the study is to evaluate the indicator "total bile acids" in minks with shed keeping in the climatic conditions of the Tver region. The study of the total amount of bile acids is a promising way to identify pathologies of the hepatobiliary system. Venous blood was taken from 200 minks for analysis. As a result of a clinical study of mink blood, no significant pathological changes were revealed. The data obtained make it possible to refer the above animals to the category of "clinically healthy" for further exploratory studies.

Keywords: algae, chemical compounds, extract, brown algae.

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ПАРАМЕТР «ОБЩИЕ ЖЁЛЧНЫЕ КИСЛОТЫ» У НОРОК (*MUSTELA VISON*) ПРИ ШЕДОВОМ СОДЕРЖАНИИ В ПРИРОДНО-КЛИМАТИЧЕСКИХ УСЛОВИЯХ ТВЕРСКОЙ ОБЛАСТИ

Научная статья

Аннотация

Изменения метаболизма и транспорта желчных кислот приводят к патологическим состояниям. Это подчеркивает важность сбалансированного циркулирования данных веществ из-за их значительной роли в гомеостазе. Основная цель исследования – оценить показатель «общие жёлчные кислоты» у норок при шедовом содержании в климатических условиях Тверской области. Исследование общего количества жёлчных кислот является перспективным способом выявления патологий гепатобилиарной системы. Для проведения анализа отбирали венозную кровь 200 норок. В результате клинического исследования крови норок значительных патологических изменений выявлено не было. Полученные данные позволяют отнести вышеуказанных животных к категории «клинически здоровых» для проведения дальнейших поисковых исследований.

Ключевые слова: желчные кислоты, общие желчные кислоты, норки, гематология, гепатопатология.

1. Introduction

Bile acids are surfactants, at a concentration of more than 2 mmol / l they form micelles (aggregates of molecules, the hydrophilic sides of which are directed into water, and the hydrophobic ones are facing each other). Due to the formation of such micelles, hydrophobic compounds are absorbed. Cyclic circulation of bile acids in the digestive tract, in which they are synthesized by the liver, excreted in the bile into the duodenum, reabsorbed in the intestine, transported by the bloodstream to the liver and reused in bile secretion is called the enterohepatic circulation (portal-biliary circulation, enterohepatic circulation).

Bile acids have a steroidal structure. The molecule of cholestesoxycholic acid (CDCA) has a carboxyl group, as well as two hydroxyl groups in the -position. Due to this structure, the CDCA molecule, like the molecules of most other bile acids, has a polar (hydrophilic) and a non-polar (lipophilic) side. Because of this structure, bile acids are also called amphiphilic. This property gives them the ability to form micelles with lipids, making them water-soluble. However, the same mechanism determines their

potential toxicity. It is believed that bile acids "sit down" on cell membranes and begin to destroy (dissolve) them. This detergent effect compromises membrane integrity and stability.

Over the past one and a half to two decades, a huge factual material has been accumulated on the research of the biosynthesis and metabolism of bile acids. Nonetheless, the currently available various literature data on the investigation of the circulation of bile acids in different liver lesions are contradictory in many respects and do not reveal all the processes of the participation of bile acids in the progress of diseases. Last but not least, this is as the result that the schemes used until recently for evaluating bile acids had a variety of disadvantages: big labor intensity, insufficient accuracy and particularity, and most importantly, the impossibility of determining all individual bile acids, which play an ambiguous function in bile synthesis, bile secretion, and transport lipids, in changing the role of cell membranes and other processes which take place in the liver and intestines

Bile acids are a class of steroids with a set of unique properties, and which plays an important function in vertebrate organisms facies amphiphilic properties of bile acid molecules, i.e. ability to bind with its hydrophilic and hydrophobic surfaces with substrates of the comparable nature make them very attractive objects for inclusion of their fragments into the structure of the ionic receptor to increase its affinity for the cell membrane. Currently, more than 20 bile acids are known.

Bile acids (also called "cholic acids" or "steroid acids") are organic molecules that are unique components of bile and have a lot of purpose in the metabolism and absorption of lipids, as well as in some other processes happening in the gastrointestinal tract, involved in the transport of lipids in the aquatic environment. Bile acids are also the final product of cholesterol circulation.

One of the main functions of bile acids, the transport of lipids in the aquatic environment, is associated with their detergent properties. They dissolve lipids by forming a micellar solution. These abilities of bile acids appear in the liver tissue, where, with their participation, micelles are formed (or finally formed) from a number of bile components, which are called the bile lipid complex. Because of the inclusion in this complex, lipids secreted by the liver and some other hydrophobic substances are transferred to the intestine in the form of a homogeneous solution as part of bile.

The total concentration of bile acids in the blood and their ratio vary significantly in a number of the liver illnesses and gallbladder disorders. This blood parameter is used for diagnostic purposes. With parenchymal lesions of the liver, the ability of liver cells to catch bile acids from the blood is highly reduced, as a result of which they accumulate in the blood and are excreted in the urine. Increased concentration of bile acids in the blood is also observed with difficulty in the outflow of bile, especially with obstruction of the common bile duct, which is also accompanied by a violation of the hepato-intestinal circulation with a high decrease or disappearance of deoxycholate conjugates from bile. A prolonged and significant increase in the concentration of bile acids in the blood can cause damage of the liver cells with necrosis and changes in the activity of certain enzymes in the blood serum as a terminal stage.

Changes in the metabolism and transport of bile acids lead to pathological conditions [1]. For example, their increased level in the system in the enterohepatic circulation can cause pathologies of the liver and intestines [2]. Conversely, deficiency of this acids leads to nutrient malabsorption and fat-soluble vitamin deficiencies. Both extreme situations emphasize the importance of a balanced metabolism of these substances due to their significant role in homeostasis [3], [4].

The aim of the study was to evaluate the indicator "total bile acids" in minks with shed keeping in the climatic conditions of the Tver region, which are predictors of pathologies of the hepatobiliary system, in order to assess the use of the indicator of bile acids in blood serum as a diagnostic criterion. The study of the total amount of bile acids is a promising way to identify pathologies of the hepatobiliary system, especially those that are accompanied by a violation of protein and fat metabolism [5].

2. Methods

As part of the scientific research work, venous blood was collected from experimental animals (minks, females - 100 heads, males - 100 heads, age - 1 year) in the fur farm "Mermeriny" (Tver region, Kalinin district, Mermeriny village).

Blood sampling was carried out taking into account the rules of asepsis and antisepsis by cutting the tip of the tail into vacuum tubes for hematological studies with K3 EDTA [6].

There are several methods for detecting different types of bile acids: gas, column, liquid chromatography, enzymatic, mass spectrometry and radioimmunoassay. Unified enzymatic colorimetric method. It is based on the use of biologically active substances (enzymes), which act as catalysts, under the influence of which several bile acids are converted into formazan. The amount of this substance is determined at a wavelength of 530 nm. The intensity of its color is directly proportional to the amount of bile acid in the blood sample. The duration of the test does not exceed one day [7].

Total bile acids were determined using a BSBE bile acid kit (China). The method is based on the chemical properties of bile acids [8].

Statistical research methods were not used due to the exploratory nature of the studies and the lack of control groups [9], [10].

3. Results

The research results are presented in table 1 and figure 1.

Table 1 – Index "Total bile acids" in the studied minks

Parameters	Males, n=100	Female, n=100	References
Total bile acids, μmol/l	4,63±1,02	5,56±1,19	2,00-7,00

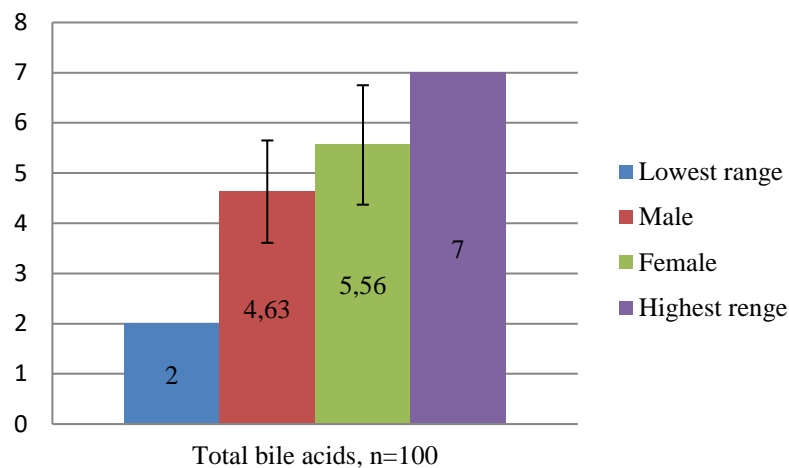


Fig. 1 – Index "Total bile acids" in the studied minks

As can be seen from the presented table, the state of protein, fat, carbohydrate and pigment metabolism, which are indicators of the functional state of the liver, can be characterized as a variant of the physiological norm, since the indicators did not go beyond the confidence intervals.

The absence of significant changes in the amount of bile acids of the group is associated with the peculiarity of their metabolism (enterohepatic circulation). After synthesis in the liver, bile salts are secreted into the bile ducts, from where they either enter the intestine or are stored in the gallbladder. Upon ingestion, cholecystokinin causes the gallbladder to contract and empty, causing bile to be secreted through the bile ducts into the intestine, where nutrients are emulsified. The vast majority of excreted bile acids (95%) then move through the portal circulation back to the liver. The remaining 5% is excreted in the feces and replaced by newly synthesized bile acids in the liver from cholesterol.

4. Conclusion

As a result of a laboratory study of mink blood, no significant pathological changes were observed.

Changes in some indicators above or below the reference values do not indicate pathological processes and are probably associated with the nature of feeding and water consumption, are reversible.

The data obtained make it possible to refer the analyzed animals to the category of "clinically healthy" for further scientific research.

Theoretically, every factor that affect the enterohepatic circulation leads to pathologies of the hepatobiliary system. However, there are still many unknown aspects when it comes to the control of bile acid homeostasis in the enterohepatic circulation.

In the last few decades, it is believed that the most important prerequisites for the occurrence of hepatopathy are the hypersecretion of bile cholesterol and the oversaturation of bile with it. Also, an important problem is the change in the composition of bile acids, since its various representatives differ both in chemical activity and in the mechanism of action (from cytotoxicity to cytoprotection).

It should also be noted that different animals have differences in the pool of bile acids, as well as in the nature of their metabolism. This indicates differences in the specificity, affinity, and activity of enzymes involved in the synthesis of bile acids. Thus, bile acids also affect the etiopathogenesis of diseases of the hepatobiliary system uniquely for each animal species, and, conversely, etiopathogenetic factors change the pool of bile acids depending on the individual characteristics of the species.

The study of the pool of bile acids in laboratory animals, which are used as experimental models, helps the scientist to correctly project the results to other animal species.

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Conflict of Interest

None declared.

Конфликт интересов

Не указан.

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