PARASITOLOGICAL SCIENCES

EFFECT OF EUSTRONGYLIDES EXCISUS ON BIOCHEMICAL PARAMETERS OF BLOOD SERUM OF COMMON CARP

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Abstract

Most parasitic organisms are opportunistic and can be present in small numbers in a water body or on fish at all times and cause disease only when the fish is stressed. Eustrongylides spp. is considered a zoonotic nematode of freshwater and predatory fish. In the waters of Odesa region, the larvae of the nematode E. excisus were first diagnosed in common carp (Cyprinus carpio). In the pathological examination of carps of 3 years of age, the larvae of the nematode E. excisus were found on the serous membrane of the abdominal cavity and liver. In the biochemical parameters of the blood serum of carps in the spontaneous course of eustrongylidiosis, a decrease in the content of total protein by 24.7 %, albumin by 38.9 %, an increase in the content of ß-globulins by 39.1 %, the activity of AlAt enzymes by 112.2 % and a decrease in urea by 40.6 % were recorded, indicating an allergic reaction to E. excisus larvae and liver damage and renal failure.

Keywords: carp, eustorgylidosis, biochemistry, blood serum.

Parasites affect the health of fish both in the wild and in aquaculture. They can weaken the fish's immune system, making them more susceptible to secondary infections caused by bacteria, viruses and other harmful microorganisms [1].

Many fish diseases cause huge mortality in aquaculture and some also cause disease in humans. Most parasitic organisms are opportunistic and can be present in small numbers in the water or on the fish at all times and cause disease only when the fish are stressed [2]. Outbreaks of parasitic diseases are also caused by poor water quality and malnutrition [3].

Nematodes are common parasites of freshwater and marine fish [4]. Most adult nematodes that parasitize fish live in their intestinal tract. Larval nematodes of fish can be found in almost every organ, but are most commonly found in the mesentery, liver, and muscle [5, 6].

The main parasite species that affect different fish species are the trematodes Clinostomum and Euclinostomum, the nematodes Contracaecum and Eustrongylides, and the cestodes Ligula intestinalis and Proteocephalus, which are the most commonly affected: *Clarias gariepinus, Oreochromis niloticus, Barbus* and *Cyprinus carpio* [7].

Eustrongylides spp. is considered to be a zoonotic nematode of freshwater fish and has been recorded in six edible fish from Lake Trasimeno: European perch (Perca fluviatilis), goldfish (Carassius auratus), largemouth bass (Micropterus salmoides), tench (Tinca tinca), carp (Cyprinus carpio) and smelt (Atherina boyeri). [8, 9].

In the waters of Odesa region, the larvae of the nematode Eustrongylides excisus were first diagnosed in common carp (Cyprinus carpio). The places of their localization were the liver, kidneys and walls of the digestive tract. In the case of perforation of the intestinal wall, edema, hyperemia and hemorrhage with mechanical tissue damage were recorded [10].

Certain blood-feeding parasites can cause anemia in fish by depleting their blood, leading to weakness and reduced viability [11].

Hematological tests have two main purposes: firstly, they help to establish the normal state of health of the body and secondly, they help to diagnose diseases caused by a number of factors, including parasitic infections, nutritional imbalances, pollution, genotoxicity, exposure to pollutants, environmental stress and heavy metal exposure [12].

By studying changes in biochemical parameters associated with exposure to various parasites registered in the database, these tests can help diagnose diseases and apply appropriate treatments or preventive measures [13].

Parasites cause a decrease in red blood cells, hemoglobin, and an increase in the number of leukocytes, which is associated with a defense mechanism and an immunological reaction against them [14]. In the blood serum of fish with mixed infection caused by Lernea cyprinacea and Dactylogyrus vastator, a decrease in total protein content by 18.4 %, an increase in ß- and γ-globulin fractions by 19.5 % and 27.2 % was found [15].

The study of immunological parameters is important for the detection of immunodeficiency and immunopathological conditions, the initial assessment of the immune status of the body, as well as for the diagnosis, treatment and prognosis of diseases.

Purpose of the work. To determine the effect of E. excisus nematode larvae on the biochemical parameters of blood serum of common carp.

Materials and methods. In the fish farms of Aquarest LLC and Aquacity LLC in Odesa region, during 2022-2023, studies were conducted on the effect of Eustrongylides excisus on the biochemical parameters of blood serum of common carp. The fish were taken during the planned control catch, and also purchased from fishermen at the place of catch. A total of 20 carps of 3 years old were studied. The first experimental group of fish was spontaneously infected carps, the control group of fish was not infected. The diagnosis of eustrongylidosis was made by careful examination of carp scales and internal organs and serous membranes of the abdominal cavity during the dissection of the fish from the anus to the head. Nematode larvae were collected in Petri dishes and fixed with 70% ethyl alcohol.

Blood was drawn from the heart using a disposable syringe. The blood tubes were settled to obtain serum. The obtained blood serum without hemolysis was used for biochemical studies, which were performed on an automatic biochemical analyzer IDEXX VestTest (IDEXX Laboratories, USA) with appropriate reagent kits (Diagnosticum Zrt, Hungary). The content of total protein was determined by the biuretophore reaction and its fractions, the activity of the enzymes ALT and ACAT was determined by the Reitman-Frenkel method, and the content of urea and glucose was determined [16]. The study was conducted at the Department of Physiology, Pathophysiology and Biochemistry of Odesa State Agrarian University.

Research results. During the pathological examination of 3-year-old carps, larvae of the nematode Eustrongylides excisus were recorded on the serous membrane of the abdominal cavity and liver. The intensity of the lesion ranged from 6 to 15 specimens per fish. (Fig. 1).

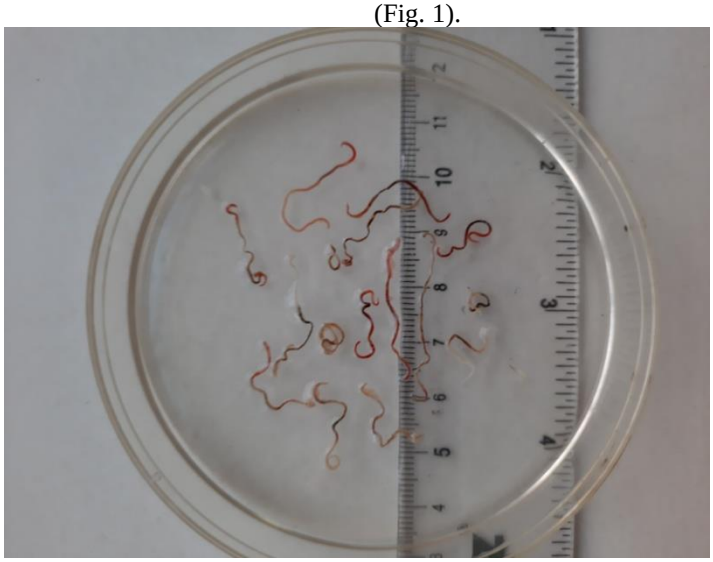

Fig. 1 Larvae of the nematode Eustrongylides excisus removed from the abdominal cavity of a 3-year-old common carp

Parasitization of larvae of the nematode E. excisus in carp leads to general allergic reactions in the fish body and to significant changes in biochemical parameters of blood serum.

The content of total protein in the blood serum of carps infected with E. excisus was significantly ($p<0.001$) 24.7% lower than in non-infected fish and amounted to 49.94±1.01 g/l versus 66.31±0.75 g/l (Table 1).

Table 1

Biochemical parameters of blood serum of common carp, affected *Eustrongylides excisus* (M±m, n=10)

Indicators	Groups of fish		% to control
	experimental	control	
Total protein, g/l	49,94±1,01***	66,31±0,75	-24,7
Albumin, g/l	20,59±0,52***	32,10±1,01	-38,9
Total globulins, g/l	29,35±1,12**	34,21±0,98	-14,2
Albumin, %	38,16±0,98***	46,51±1,05	-17,9
α-globulins, %	17,40±1,02*	20,88±1,01	-16,7
ß-globulins, %	21,01±0,55***	15,10±0,35	+39,1
γ-globulins, %	23,43±1,01***	17,51±1,02	+34,2
A/G ratio	0,70	0,94	-25,5
AsAT, U/l	73,61±0,92***	54,9±1,01	+34,1
AlAT, U/l	90,21±1,03***	42,52±0,96	+112,2
De Ritis coefficient	0,82	1,29	-36,4
Urea, mmol/l	4,10±0,02***	6,91±0,05	-40,6
Glucose, mmol/l	8,92±0,65**	10,95±0,12	-18,5

Note: * – $p<0,05$; ** – $p<0,01$; *** – $p<0,001$ compared to the control

A significant decrease in albumin content by 38.9 % ($p<0.001$) indicates a slowdown in fish growth and weight loss. In the infected carps, the index was 20.59±0.52 g/l, compared to 32.10±1.01 g/l in the control group.

The content of total globulins significantly ($p<0.01$) decreased by 14.2 % and amounted to 29.35±1.12 g/l, compared to the control - 34.21±0.98 g/l. A significant ($p<0.001$) increase in the content of ß-globulins by 39.1 % in infected carp compared to the control indicates liver damage and hemorrhage due to infection by the larvae of the nematode E. excisus.

Also, in the experimental group of carps, hypergamaglobulinemia was recorded by 34.2%, which occurs due to activation of immune reactions and increased secretion of globulins and indicates liver damage.

The albumin-globulin coefficient in the control group of carps that were clinically healthy was 0.94, while in the infected carps it was 0.70, that is 25.5% less.

In the study of the enzyme AlAt, which is an indicator of liver damage, a significant ($p<0.001$) increase in the experimental group of carps by 112.2 % (73.61±0.92 U/l) was recorded compared to the control group of fish (54.9±1.01 U/l) and an increase in the enzyme AsAT by 34.1 %. Thus, the de Ritis coefficient in the experimental group of carps was 0.82, and in the control group - 1.29, which is 36.4 % less.

In the experimental group of carps, a significant ($p<0.001$) decrease in urea level by 40.6 % (4.10±0.02 mmol/l) was found compared to the control group, where this indicator was 6.91±0.05 mmol/l, indicating the presence of renal failure.

Glucose level is used as an indicator of stress and is a universal bioenergy substrate that is rapidly transferred through plasma to tissues. In infected carps, the glucose content was 18.5% lower ($p<0.05$) and amounted to 8.92±0.65 mmol/l, while in clinically healthy carps the index was 10.95±0.12 mmol/l.

Conclusion.

In 3-year-old carps affected by the larvae of the nematode Eustrongylides excisus, changes in the biochemical parameters of blood serum were recorded. The spontaneous course of eustrongylidosis in carps is accompanied by an increase in the content of ß-globulins by 39.1 %, the activity of AlAt enzymes by 112.2 % and a decrease in urea level by 40.6 %, indicating an allergic reaction to the parasite and liver damage and renal failure.

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