Morphological and biochemical indicators of the blood of carp fish in artificial water reservoirs

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Abstract. In this article, morphological and biochemical parameters of the blood of carp fish in artificial reservoirs of Samarkand region are analyzed depending on their living conditions and hydro chemical parameters of water. One of the important features of intensive fish farming is the study of blood, morphological and biochemical parameters. The morphological and biochemical composition of blood varies depending on the habitat and lifestyle of different fish species.

1 Introduction

It is important to meet the demand of the population of our republic for animal products, including fish proteins and vitamins. Fish farming in Uzbekistan's reservoirs is aimed at intensive breeding of fast-growing fish species in specially equipped ponds. In connection with the transition of fishing to an industrial basis, the problem of studying the effect of unfavorable growing conditions on fish remains urgent.

One of the main problems of our time is providing food for the growing world population. In a general trend, the reduction in fish production in the world's oceans and seas has stimulated the development of aquaculture. In this regard, the cultivation of fish and fish products is becoming increasingly important in fisheries today. One of the advantages of traditional fish production is the extensive use of natural resources. At the same time, this creates a number of disadvantages, namely, the limiting factors are land, water and external environmental influences. As one of the promising solutions to these problems, the use of intensive and semi-intensive fish breeding technologies in industrial fishing is relevant.

Fish must not only live, but must have water bodies that provide good nutrition, growth, rapid weight gain and reproduction. The more the water quality and feed match the fish's needs, the more successful its growth will be [1-6].

Today, the global impact of anthropogenic factors on the external environment has changed dramatically and continues to change the living conditions of fish. The constant pollution of rivers and lakes is causing their number to decrease dramatically by destroying ecosystems. [7-12].

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Purpose of research. It consists of analyzing the adaptability of carp fish grown at the "Aq Amur" fishery farm (FX), Samarkand region, Samarkand district, under the influence of abiotic and biotic factors.

Research objective:

- Study of hydrochemical parameters of water in different seasons of the year.
- Determination of morphophysiological and hematological parameters of some cyprinids.
- Study the influence of hydrochemical parameters of a reservoir on the growth and viability of fish.

2 Materials and methods

The studies were carried out in March-June 2023 on fish raised in artificial ponds. For this purpose, water temperature was determined daily, and hydrochemical indicators were determined monthly at a depth of 1 m using standard methods.

For laboratory studies, samples of fish products, the environment and food items were taken in accordance with the rules of state standards for obtaining results (GOST 7731-85).

The physical properties of water were determined using generally accepted requirements and methods. The chemical composition of water was determined using the Expert-001-PBK device.

Blood samples were taken from 5 fish every month. The blood sample was taken from the heart of a freshly caught fish. The blood collection site was treated with 70° alcohol, and the mucous material was cleaned with cotton wool. ¬The blood was treated with sodium citrate or heparin as anticoagulants.

Hematological parameters of fish blood were studied using standard methods. The number of leukocytes was determined by direct and indirect counting methods [7, 12].

A biochemical analyzer was used to determine the biochemical parameters of fish blood. Therefore, in this experiment, we determined the total blood protein of carp by the biuret method, glucose by the glucose oxidase method, creatinine by the method based on the reaction with picric acid, cholesterol by the enzymatic method, and phosphorus by the UV method.

The fish were fed twice a day. In addition to all the above measures for the proper maintenance of fish, fish were caught every two weeks. At the same time, catch fish from different parts of the reservoir depending on the total number of fishes. 1% were caught. The caught fish was measured on scales, its morphophysiological state and the presence or absence of diseases were determined. The average, low and high values for each parameter obtained from the fish, as well as the error of the mean, were also determined. The experiments performed were processed by standard statistical methods.

3 Results and Discussion

The quality of water in artificial reservoirs is heterogeneous, so it is quite difficult to determine the chemical composition of water.

According to the results of our experiments, water indicators for breeding carp fish should meet state quality standards for artificial ponds. The following hydrochemical parameters of water have been determined ¬ (values according to GOST 15372-87 are indicated in parentheses): pH 7.5 – 7.6 (7.0 – 8.0); color 25 degrees (30); oxygen content – 6.2 – 10.0 mg/l (not less than 6); nitrogen of ammonium compounds – 0.45 mg/l (0.5); total hardness 3.7 mg/l (3.8-4.2).

Changes in the composition of the reservoir did not significantly affect the number of red blood cells and hemoglobin in the blood of carp. In our experiments, we found that carp's need for oxygen is reduced or increased compared to the norm (Table 1). Based on the results of our scientific research, it has been established that the morphological indicators of the number of erythrocytes, leukocytes and hemoglobin in the blood of cyprinid fish are normal.

Table 1. Hematological parameters of fish blood.

Indicators	Norm	Studyperiod			
		March	April	Maybe	June
Redbloodcells, * 10^{12}/l	0.5-2.0	0.58±0.026	0.65±0.028	0.61±0.033	0.51±0.014
Leukocytes, * 10^{9}/l	4.9-8.1	5.5±0.172	5.6±0.373	5.8±0.24	5.3±0.20
Hemoglobin, g/l	30-100	47.1±1.226	53.3±1.416	48.1±2.326	45.8±1.434
SGE, pp.	50-80	79.70	80.5	80.1	90.0

Our research has shown that, compared to the blood values of carp, the number of red blood cells in the blood of farmed fish is lower.

Hematological parameters of one-year-old carp showed that juvenile carp reared in artificial ponds had a low growth rate, hemoglobin content in the blood (45.8-53.3 g/l) and red blood cell count (0.51-0. this corresponded to 0,65* 10^{12}/l). During the ongoing studies, the amount of hemoglobin in red blood cells remains quite high. A decrease in the amount of hemoglobin and red blood cells can be caused by many biotic, abiotic and anthropogenic factors. Hemoglobin saturation in erythrocytes (SGE, pg) was normal at all times of the study.

During the research, quantitative indicators of erythrocytes, hemoglobin, leukocytes, and hematocrit were studied in a morphological analysis of the blood of one-year-old fish of the experimental group. These indicators were taken in the experiment at the beginning and end of the growing season.

Blood was taken from the heart of hungry fish 10-20 minutes after blood collection from well-aerated water. To collect blood, the puncture site was cleared of particles, wiped with a dry swab to remove mucus, and wiped with 700% ethyl alcohol. Vacuum tubes containing anticoagulants were used to prevent clotting of blood collected for hematology testing before being sent to the laboratory for testing.

In our scientific research, a morphological analysis of the blood of carp of different breeds was studied. Analysis of the data showed that at the end of the experiment, as a result of an increase in the live weight of one-year-old carp, it was found that the number of erythrocytes in the fish increased. This number of erythrocytes was 1.74 1012/l or 45% in carp of the 1st experimental group, 1.46 1012/l or 28.9% in carp of the 2nd experimental group, and in carp – 1.69 1012/l, or 45.8% higher.

The number of erythrocytes in the blood of carp increased from 1.17 1012/l to 1.69 1012/l, or 47%, which indicates a positive increase in the number of erythrocytes of carp.

The number of red blood cells in fish is 7-10 times less than in mammals. Their amount in freshwater fish is 3 times less than in the blood of fish living in the sea. Even the number of red blood cells in the blood of one species of fish can change many times depending on the external environment.

White blood cells help provide the body with immune responses. The number of total leukocytes at the end of the experiment compared to the number at the beginning of the experiment was 8.4 in the study groups, respectively; 2.3; and decreased by 12.7 percent to 109.8 10^{9}/l; 107.1 • 10^{9}/l; and amounted to 117.87 10^{9}/l pcs. It was found that the number

of leukocytes in the blood of fish changed slightly during the experiment: it increased in the spring months of the year at the beginning of the study and decreased in the fall.

It was found that the leukocytes of the studied fish have clear lymphoid characteristics (Table-2).

Table 2. Leukocyte formula, %.

Indicators	Studyperiod			
	March	**April**	**Maybe**	**June**
Neutrophilmyelocytes	4.00+0.113	3.89±0.2	3.81±0.072	3.73±0.12
Metamyelocytesareneutrophils.	3.84±0.165	4.00±0.18	4.00±0.13	3.36±0.20
Ribbonneutrophils	2.61±0.168	2.73±0.142	2.73±0.115	2.81±0.03
Segmentedneutrophils	3.06±0.085	2.55±0.064	2.61±0.085	2.51±0.08
Pseudoeosinophils	-	0.31±0.056	0.11±0.017	-
Monocytes	0.4±0.017	0.21±0.015	0.10±0.025	-
Large lymphocytes	6.06±0.293	7.11±0.218	6.77±0.220	6.51±0.191
Small lymphocytes	79.14±3.47	78.20±2.75	84.69±2.29	82.14±2.43

The number of leukocytes in the blood of the carp was normal, but the number of granular leukocytes in the leukocyte formula was partially increased. This leads to an increase in the overall resistance of the body of carp fish.

In our experiments, the presence of different types of leukocytes in the peripheral blood of carp is characterized by a higher number of leukocytes compared to phagocytes. This is explained by the physiological characteristics of carp fish.

It is characterized by the presence of the following elements in the peripheral blood of carp: myelocytes and neutrophilic metamyelocytes, banded neutrophils, segmented neutrophils and pseudoeosinophils.

In the leukocyte formula, the second place in percentage was occupied by neutrophils, their percentage was within the physiological norm (polymorphonuclear - 3.0-4.0%, neutrophils - 2.0-4.0%, eosinophils - up to one percent, monocytes - 3.0-7.2%, and lymphocytes from 75 - 85% to 93%, respectively, in our experiments.

It was established that the biochemical parameters of carp blood serum in the experiment were normal. Studying the amount of protein in the blood of carp fish (Table 3), in our experiments we observed its amount, while a small amount of protein changes not only in fish, but also in fish belonging to the same species.

Table 3. Biochemical blood test of carp`indicators.

Indicators	Norm	March	April	Maybe	June
Totalprotein, g/l	10-30	9.7±0.06	14.4±0.30	24.1±0.31	28.91±0.41
Glucose, mmol/l	1.5-4.0	1.57±0.007	1.56±0.020	2.17±0.002	2.30±0.014
Creatinine, µmol/l	0.27-0.8	0.35±0.02	0.41±0.012	0.60±0.07	0.58±0.071
Cholesterol, mmol/l	1.94-3.9	2.7±0.1	2.6±0.08	3.3±0.21	2.71±0.03
Phosphorus, mmol/l	0.4-9.6	4.20±0.13	5.3±0.08	5.6±0.02	5.81±0.02

These indicators are closely related to metabolism and are determined by the intensity of feeding. Lack of protein in the body of fish leads to infectious diseases and kidney damage in the body of carp fish.

The research results showed that the total protein in the blood serum during spawning of one-year-old carp in artificial ponds is normally 10-30 g/l, in March (9.7 g/l), in April 14.4 g/l. l in May, 24.1 g/l and 28.91 g/l in June. The phosphorus content is normal (0.4-9.6 mmol/l), in March (4.20 mmol/l), April (5.3 mmol/l), May (5.6 mmol/l) and June (5.81 mmol/l) concentrations available.

Our studies have shown that the biochemical indicators of protein and phosphorus content in the blood serum of cyprinid fish were within normal limits. In this experiment, with the growth of carp fish and an increase in body weight, an acceleration of metabolism in the body is observed. In the blood serum, the concentration of total protein, glucose, phosphorus and cholesterol increased significantly.

The results of our scientific research showed that the concentration of total protein in the blood serum of carp fish increased from 9.7 g/l to 28.91 g/l, glucose - from 1.57 to 2.30 mmol/l. In addition, phosphorus levels were found to be within the normal range of 4.20 to 5.81 mmol/l.

One of the informative biochemical indicators is the sugar (glucose) content in the blood. Studies have shown that blood glucose levels in carp fish increase with age. In carp, these values increased from 1.57 mmol/l to 2.30 mmol/l (Table 3). It has been established that sugar is within physiological norms, but dynamically increases them. It was noted that the amount of cholesterol in the blood serum obtained from cyprinid fish ranges from 2.6 mmol/l to 3.3 mmol/l, that is, within the biochemical norm.

4 Conclusion

Data obtained from the results of scientific research show that blood parameters and morphophysiological changes in carp indicate that they were able to adapt well to farming conditions. Experiments have shown that "Ak Amur" is in the physiological state of carp fish on the farm.

In the course of our research, it was established that there are no significant differences in the hematological parameters of carp fish kept in the Ak Amur fish farm.

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