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Evaluation of the Influence of a Polymolecular Complex Based on Protein with Chitosan on the Growth and Survival of Carps (Cyprinus Carpio) Grownin A Flowing Pond

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Summary: This article is about studies conducted in 2021, which were carried out in concrete pools with a volume of 7.5 m3 with flow systems in the experimental area of the Scientific Research Institute of Fisheries. The studies lasted for 60 days. The object of the experiment was carp (*Cyprinus carpio*), obtained during incubation by the staff of the laboratory of the Scientific Research Institute of Fisheries in 2021.

Introduction

Aquaculture is the most important branch of modern agriculture. This industry is an important source of income and provides the livelihood for millions of people around the world. According to the UN FAO, the total production in world aquaculture in 2018 amounted to 81 million tons, which is about 46% of the total production and cultivation of aquatic biological resources. At the same time, this indicator of fish production by 2030 should increase to 204 million tons. The increase is expected to be mainly related to the share of aquaculture (FAO, 2020).

Currently, the production of fish products is associated with the progress of fish farming in inland waters, as well as the breeding and rearing of fish by industrial methods. Until now, fish farmers in Uzbekistan have been cultivating representatives of the cyprinid fish family (Cyprinidae), which have fast growth, high fertility, and occupy the initial links of the food chain in ponds. Carp (*Cyprinus carpio*) is one of the main fish farming objects in many countries of the world. Growing carp is associated with its valuable qualities: it is unpretentious to environmental conditions, omnivorous, grows quickly, is easy to breed and has tasty meat (Woynarovich, A, et al., 2011, Kurbanov A. R. et al., 2018, Polyakov A.D. Buzmakov G.T. 2008).

Growing fish in intensive aquaculture requires careful attention to a number of stress factors in its composition: transportation, handling, replanting, stocking density, compound feed, medicines, imported

planting material, fish stock and equipment. One of the ways to prevent stress factors is the use of balanced feed (Golovina P.P., 2004, Chebanov M.S., Galich E.V., 2010).

Fish feed represents a significant part of the operating costs in aquaculture. Fishmeal is the main ingredient in the source of protein for farmed fish. The reduced supply and the high cost of fishmeal make it relevant to study the partial replacement of fishmeal in feed with an alternative ingredient. Animal-derived ingredients are considered the best alternative to protein sources in fish feed because they contain more essential amino acids than plant-derived materials (Robinson, Lee, 1998).

Uzbekistan ranks third in the world in terms of cocoon production after China and India. The extraction of all valuable components from silk production waste is an important strategic and technological task. Every year, 10-15 thousand tons of waste is accumulated in the Republic in the production of silk. Since the silkworm pupa contains up to 25% of fatty substances, a significant number of proteins is up to 50%. According to the SJSC "Uzbekyengilsanoat", the production of dry silkworm cocoons is 7,826 tons per year. Of this amount, about 4,000 tons go to waste. With a protein yield of 30% and the use of the entire amount of waste, 1200 tons of complete protein can be obtained.

A feature of the polymolecular complex based on protein with chitosan is not only an increase in the body's resistance, but also the ability to regulate and stimulate digestion. Many diseases of the gastrointestinal tract occur in a shorter time and in a mild form. Digestion improves and assimilation of feed increases, fish growth is stimulated.

To conduct a series of tests in the conditions of Uzbekistan, specialists of the Scientific Research Fish Farming with the feat of the development of scientists from the Institute of Chemistry and Physics of Polymers for the production of pure protein from a polymolecular complex based on protein with chitosan.

Table 1
Amino acid composition of proteins.
(According to the Institute of Chemistry and Physics of Polymers)

Amino acid name	Protein Sample #1 - content of amino acids in %		Protein Sample #2 - content of amino acids in %		Protein Sample #3 - content of amino acids in %	
	n/mol	%	n/mol	%	n/mol	%
Asparagine, Asp	26,6	0,35	31,0	0,41	22,4	0,30
Threonine*, Thr	14,4	0,17	14,0	0,17	6,5	0,08
Serene, Ser	19,5	0,20	16,3	0,12	7,8	0,08
Glutamine, Glu	46,2	0,68	46,2	0,68	37,7	0,55
Proline , Pro	20,8	0,24	22,2	0,26	-	-
Glycine , Gly	28,7	0,22	26,2	0,20	12,8	0,10
Alanine, Ala	29,8	0,27	26,1	0,19	11,3	0,11
Cysteine, Cys		-		-	-	
Valine*, Val	16,5	0,19	17,2	0,20	8,2	0,08
Methionine*, Met	4,8	0,06	4,4	0,15	1,1	0,01
Isoleucine*, Ile	13,7	0,18	9,6	0,13	6,5	0,09
Leucine* , Leu	30,3	0,40	25,8	0,34	12,0	0,16
Tyrosine, Tyr	7,9	0,14	6,7	0,12	4,8	0,09
Phenyl Alanine*, Phe	11,2	0,18	9,1	0,15	7,6	0,13
Histidine*, His	11,3	0,16	10,6	0,15	6,0	0,08
Lysine* , Lys	11,7	0,17	12,3	0,18	7,4	0,11
Arginine , Arg	15,8	0,27	14,6	0,25	34,4	
	∑= 3,88		∑= 3,50		∑= 4,02	

In this regard, the development and further improvement of technologies for growing various live feeds continues.

To achieve this goal, the following tasks were set:

To determine the effectiveness of the use of a polymolecular complex based on a protein with chitosan of a feed additive as part of mixed feed (with a crude protein content of 33.3%) in terms of fish breeding indicators (fish output, survival, feed efficiency).

Research methods

The studies were carried out on concrete pools with a volume of 7.5 m3 with flow systems in the experimental area of the Scientific Research Institute of Fisheries. The studies were carried out for 60 days. The experiment used carps (*Cyprinus carpio*) obtained during incubation by laboratory staff of the Scientific Research Institute of Fisheries s in 2021.

The experiment involved 760 carps (total biomass 75 kg) in each pool with an average weight of 95-100 gr. As part of the experiment, the carps were divided into 2 groups: Pool I - control group (food without the addition of a polymolecular complex based on protein with chitosan) Pool II - experimental group (food with the addition of a polymolecular complex based on protein with chitosan).

Table 2

Physico-chemical properties of the experimental feed

Name	**Quantity**
Humidity	4.80 %
Crude fat	8.99 %
Crude protein	33.33 %
Crude fiber	3.56 %
Raw ash	10.34 %
Sodium	0.34 %
Calcium	0.39 %
Phosphorus	0.86 %

Experimental fish were given 4% of the total biomass. The daily dose of food was divided into 3 parts and fed at 9:00, 13:00, 17:00. The control catch was carried out every 15 days, and the daily ration was adjusted in accordance with the growth of the fish.

The average water temperature during the study was 24oC∓0.5, and the hydrochemical parameters of the water (Table 3) were as follows:

Table 3

Hydrochemical parameters of water in experimental basins

Normative value according to technological requirements, mg / l.		I – Group	II- Group
Water temperature t c^0		24ºC∓0,5	24ºC∓0,5
pH	7-8	7.39	7.4
Oxygen	5.0	4.33	4.35
Nitrites NO_2	0,2	0.02	0.02
Nitrogen NH_4	1.0	0.4	0.5
Ammonia NH_3	0.01-0.07	0.02	0.02

The growth of fish and the quality of feed were evaluated by the following indicators:

• Body weight dW = W2 - W1, where W1 (g) - average initial body weight, W2 (g) - average final body weight;

• Average daily weight gain (g / day) = weight gain / t, where t - duration of the experiment per day;

• Feed unit (FCR) = pool feed (g) / weight gain (g);

• Survival = number of fish at the end of the experiment / number of fish at the beginning of the experiment *100

An analysis of the growth rates of fish in the experiment is presented in Table 4.

Research results

Fish in all groups grew positively during the experiment. In the control group, the average individual weight of fish at the beginning of the experiment was 96.2, and at the end of the experiment - 258.7 g. In 60 days, the fish grew by 162.5 grams more than the initial body weight. According to the growth indicators, the fish of the experimental group gained an average of 5.3 g of mass more than in the control group. At the same time, in fish of the 2nd group, the body weight increased from the initial body weight of 95.8 g to 263.8 g.

Table 4

Fish pace indicators during the experiment

Indicators	Experimental pools	
	I (control)	II (experiment)
Initial body weight, g	96.2±0.13	95.8±0.11
Final body weight, g.	258.7±0.22	263.6±0.55
Average body weight gain, g.	162.5±0.8	167.8±0.44
Average daily weight gain, g/day	2.70	2.78
Feed ratio (FCR)	3.11	2.96
Survival (%)	87	94

The daily growth rates of fish in g/day were practically the same. This indicator is 2.70 in the 1st group and 2.78 in the 2nd group. It is known that one of the main factors for achieving economic success in artificial fish farming is how many kg of feed are consumed per kg of live biomass. In our experiment, it showed a good result in 2 groups of fish and was equal to 2.96. In the control group, 3.11 kg of feed was consumed for an increase in 1 kg of live weight of fish, which is 0.15 more than in the experimental group.

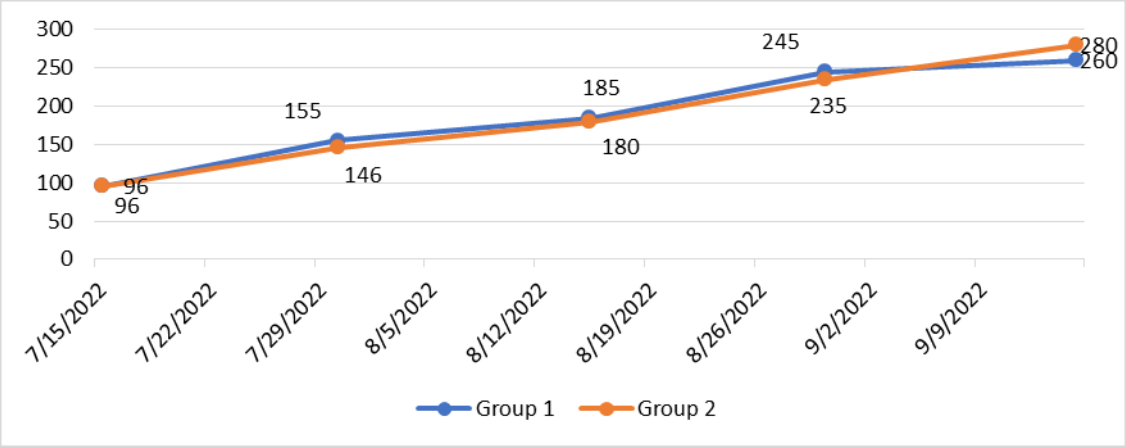

Figure 1. The rate of weight gain in fish, gr

Everyone knows that the population of our republic is increasing every year, given the limited land and water resources, their rational use is becoming an urgent issue at the republican level. Today, the fishing industry in our country is developing intensively. At the same time, the goal of every entrepreneur is to achieve high productivity from each cubic meter of water.

For high productivity in fish farming, the following factors are important: the technology used, the hydrochemical composition of water, the breeding stock and, most importantly, high-quality feed. The survival of fish depends on the hydrochemical composition of water and a balanced feed with essential

amino acids that can satisfy the physiological needs of fish. In our experience, the hydrochemical parameters of water were positive for cyprinids.

A polymolecular complex based on protein with chitosan, the additive used in our studies, is rich in amino acids essential for fish, which was clearly felt in the experiment. During the experiment, the survival rate of fish in the control group was 85.7%, and in the experimental group this figure was higher by 3.7% and amounted to 89.4%.

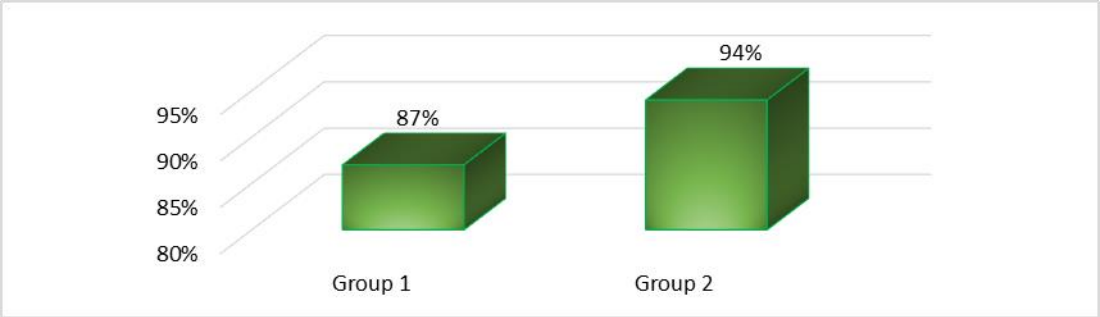

Figure 2. Fish Survival Percentage

Conclusions

The polymer-chitosan additive had a positive effect on fish growth, food unit and fish survival. At the same time, it is recommended to conduct more extensive research on feeding fish with this supplement.

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