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The Influence of a Sorbing Pre-Probiotic Agent Used in Mixed Feed on The Carp Meat Quality.

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ABSTRACT

The article covers the results of the effectiveness of growing carp on mixed feed enriched with a new pre-probiotic supplement "Biocoretron" with sorbing properties. In experimental studies, it has been found that the carp consuming such mixed feed had an increase in the intramuscle fat accumulation in the muscle tissue and an increase in the yield of edible parts from their carcasses. In this case, the accumulation of lead decreases by 2.82-6.12% and cadmium by 35.87-48.56% in meat in comparison with the carp in the control group. The most expressed changes were manifested when using the supplement "Biocoretron" in a dose of 0.2% of the feed weight.

Keywords: marketable carp, pre-probiotic «Biocoretron», chemical composition, protein, heavy metals, morphological composition of the body.

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INTRODUCTION

While rearing fish in ponds the level of their organic contamination increases and the number of conditionally pathogenic microorganisms rises. When bacteria reach a certain concentration in the water of a pond a sharp rise of their number is observed in the organs and tissues of fish [1]. At the same time there are cases of their general condition weakening and emergence of various diseases that lead to the necessity of researches into the development of mixed feeds' formulations with preventive and curative action or the use of probiotic supplements [2]. Various probiotic medicines and feed additives are widely used as a means of maintaining and recovering normal microcenosis of the gastro-intestinal tract of animals. There is a growing interest among scientists and practitioners to the use of such supplements not only in agricultural production but also in freshwater aquaculture [3,4,5]. The action of probiotics, unlike that of antibiotics is directed towards the intestinal colonization with rival strains of bacteria-probiotics that provide the non-specific control over the population of conditionally pathogenic microflora by means of driving it out from the composition of intestinal microbiocenosis [3] and thus natural protective mechanisms of the organism are strengthened [6]. That is why the use of mixed feeds composed of modern probiotic preparations is a very important objective. Due to this the purpose of the study was to determine the effectiveness of use of a new probiotic preparation "Biocoretron" with adsorbing properties as a constituent component in mixed feeds for carp species.

OBJECT AND METHODS OF RESEARCH

The study was conducted at the LLC «Rybkhoz» in the village of Bolshie Klyuchischi, the Ulyanovsk district, the Ulyanovsk region. As the object of the study 750 one year old carp were selected of the German mirror breed which were divided into 3 groups using the analog principle and were placed in 3 ponds isolated from one another with 250 specimens in each. All the specimens of the three groups received a complex granulated mixed feed produced at the OJSC "Saratovsky mixed feed plant" according to TS 8-63-5-99. The carp of the second and third experimental groups received mixed feed enriched with preparation "Biocoretron" in a dose of 0,1 and 0,2% of its weight respectively.

Carp breeding was conducted under optimum conditions for this fish. The temperature regime of the water reservoir was regularly monitored (illustration 1), the content of dissolved oxygen in the water was determined once a week.

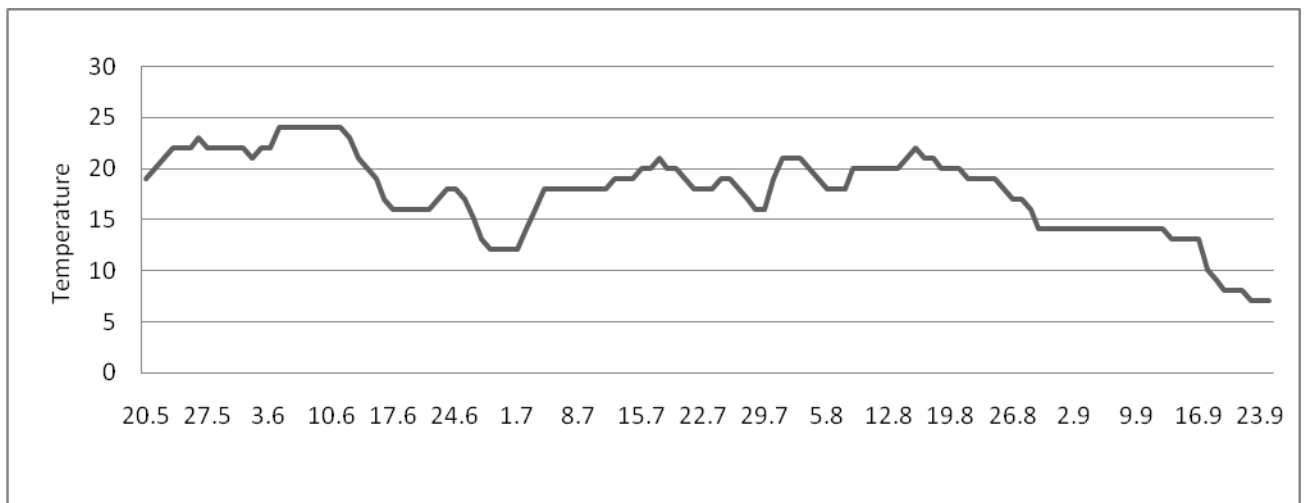


Illustration.1 – Temperature regime of the water reservoir

The fish growth check was conducted once in 15 days in the course of test fishing and weighing 25 pieces of fish (table 1).

Table 1: Carp live weight dynamics according to the data of test fishing

Group	Date								
	20.05	6.06	20.06	8.07	21.07	4.08	19.08	2.09	17.09
I-C	27,7	37,1 ±0,36	97,1 ±0,7	151 ±1,02	249 ± 1,14	339 ± 1,7	444 ± 2,05	500 ± 2,07	537 ± 2,39
II-Exp	27,3	37,2 ±0,4	98,4 ±0,71	155 ±1,27x	261 ±1,48 xxx	347 ±2,22xxx	465 ± 2,06 xxx	527 ± 2,48 xxx	563 ± 2,37 xxx
III-Exp	27,5	38,5 ±0,48	101 ± 0,8x	160 ±1,39 xxx	269 ± 1,56 xxx	359 ± 1,90 xxx	479 ± 2,41 xxx	542 ± 2,18 xxx	580 ± 2,36 xxx

Note: * P<0,05; **P<0,01; ***P<0,001

The feeding of fish was carried out twice a day at the same time with the use of feeding tables. A day ration of mixed feed was calculated in view of the water temperature and fish weight according to commonly accepted rates.

Carp slaughtering and determining the chemical composition of muscle tissue was conducted according to accepted techniques in fish farming and animal science. The content of toxic metals (Pb and Cd) in its muscle tissue and liver was determined with the method of atomic absorption spectrometry with electrothermal atomization of chemical elements on the "Quant-Z-eta" device.

THE STUDY RESULTS

It is important to know specific features of the anatomy of fish and morphological composition of tissues for a commercial assessment of the fish meat quality and to determine the nutritional value of fish it is required to ascertain the yield of edible parts. To this end, the carp slaughter was carried out at the end of the scientific and production experiment. Five carp specimens were selected for the slaughter with the weight that corresponds to an average weight of this group.

We can see from the results of the carpslaughter (table 2) that incorporating mixed feeds with the addition of the preparation into a ration has a positive effect on the indexes of its morphological composition and the yield of edible parts of a fish carcass. With the increase of the amount of supplement "Biocoretron" in the composition of granulated feed the yield of edible parts of the carp goes up from 57,90% in the control group up to 59,22% in the second and 60,52% in the third group.

Table 2: Morphological composition of the carp carcass

Index	Group					
	I-C		II-Exp		III-Exp	
	г	%	г	%	Г	%
Weight of fish	542,30± 8,96	100	569,80± 2,09x	100	590,08± 2,73xxx	100
Weight of: the head	102,81± 1,76	18,96	102,08± 1,64	17,92	100,91± 1,75	17,1
the fins	27,62± 1,12	5,09	29,76± 0,84	5,22	30,85± 1,03	5,23
the scales	10,67±1,3	1,96	10,8±0,61	1,9	11,0±0,83	1,86
the skin	26,78± 0,44	4,94	28,86± 0,78x	5,06	30,89± 1,01xx	5,23
muscle tissue	262,59± 4,34	48,42	280,40± 1,02xx	49,21	296,17± 1,46xxx	50,19

internal fat, heart, liver	24,62± 0,41	4,54	28,18± 0,69xx	4,95	30,08± 0,63xxx	5,1
intestines, gills, blood, cavity fluid	32,64± 0,53	6,02	34,98± 0,57x	6,14	36,50± 0,61xx	6,19
bone fluid	54,6±2,53	10,07	54,74± 1,63	9,61	53,69± 1,61	9,10
edible parts	313,99± 5,19	57,90	337,37± 2,08xx	59,22	357,15± 2,0 xxx	60,52
non-edible parts	228,34± 4,35	42,10	232,37± 0,55	40,78	232,95± 2,03	39,48

Note: * P<0,05; **P<0,01; ***P<0,001.

It is necessary to note that the increase of the yield of edible parts from the fish body goes up due to an intensive growth of muscle tissue, the absolute and relative weight of which raises from 262,59g and 48,42% in the control group to 280,4 g and 49,21% in the second and 296,17g with 50,19% in the third group. Consequently, the absolute and relative weight of muscle tissue in the carp of the second and third experimental groups was higher than in the control group by 17,81 and 33,58 g and by 0,79 and 1,77%. The carp of the second and third groups were characterized by the greater absolute weight by 23,38 and 43,16 g and greater relative weight by 1,32 and 2,62% of edible parts versus the carp which did not receive a feed supplement in the composition of mixed feed.

The carp survival analysis and chemical composition of meat showed that feeding fish with mixed feed enriched and non-enriched with a pre-probiotic additive had an uneven influence on these values (table 3).

Table 3: Fish capacity and chemical composition of carp meat

Index	Group		
	I - C	II - Exp	III - Exp
I-Fish capacity			
At the start of the experiment:			
Placed one year old carp	250	250	250
Weight at the time of placing, (g).	27,70	27,30	27,50
At the end of the experiment:			
Two year old carp	206	212	210
Average weight per specimen at the end of the experiment, (g).	540,20±3,71	569,30±4,90 xxx	586,20±4,25 xxx
Fish capacity, (kg/ha)	1113	1207	1231
% to the control group	-	108,45	110,60
Survivability, (%)	82,40	84,80	84,00
II-chemical composition of carp meat			
Moisture, (%)	75,85±0,46	77,00±0,19 ^x	77,04±0,27
% to the control group	-	101,52	101,57
Dry matter,(%)	24,15±0,46	23,00±0,19 ^x	22,96±0,27
% to the control group	-	95,24	95,07
Protein, (%)	16,10±0,33	14,79±0,14 ^{xx}	14,44±0,18 ^{xx}
% to the control group	-	91,86	89,69
Fat, (%)	6,95±0,16	7,15±0,1	7,43±0,1 ^x
% to the control group	-	102,88	106,91
Ash, (%)	1,10±0,05	1,06±0,03	1,09±0,02
% to the control group	-	96,36	99,09
Muscle tissue, (g).	262,59±4,34	280,40±1,02xx	296,17±1,46xxx

% to the control group	-	106,78	112,79
Gross yield, (g).	-		
protein	42,28±1,77	41,48±0,29	42,57±0,63
% to the control group	-	98,11	100,69
Fat	18,25±0,81	20,05±0,28 ^x	22,03±0,34 ^{xxx}
% to the control group	-	109,86	120,71

Note: ^xP<0,05; ^{xx}P<0,01 ^{xxx}P<0,001.

Carp meat of the experimental groups in comparison with the control one had an increase of the water content and a decrease of dry matter at the expense of the protein reduction in it with a simultaneous increase of the fat content. For example, if there was 75,85% of water, 16,10% of protein and 6,95% of fat in carp meat of the control groups, then the following figures in carp meat of the second group were – 77,00%, 14,79%, 7,15%, and in the third group – 77,04%, 14,44%, 7,43% respectively.

The ash content in carp meat was practically the same in all the groups. It should be noted that the gross yield of protein in carp meat of the experimental groups was practically similar and the gross yield of fat in comparison with the carp of the control group was significantly higher by 9,86% (P<0,05) in group II and 20,71%(P<0,001.) in group III.

Apart from the named parameters the quality of meat to a great extent depends on its ecological cleanliness. Under conditions of mounting environmental contamination the concentration of such highly toxic substances as lead, cadmium, arsenic and mercury in feeds of plant origin sharply rises and through them it increases in the organism and in products which poses a threat to health [7-10]. These elements are able to accumulate in the organism for many years causing changes in the human heart and blood vessels that can lead to an early development of arteriosclerosis and ischemic disease. The conducted analysis of muscle tissue and liver of carp on the content of lead and cadmium showed that their concentration (table 4) in both the control group and experimental one did not exceed the maximum permissible concentration (0,5 and 0,05 mg/kg).

Table 4: Content of toxic metals in the meat and liver of carp, mg/kg

Index	Group		
	I - C	II - Exp	III - Exp
Content in the meat:			
lead:	0,04510±0,00254	0,04383±0,00266	0,04234±0,00170
% to the control group		97,18	93,88
cadmium:	0,00867±0,00052	0,00556±0,00029 ^{xx}	0,00446±0,00013 ^{xxx}
% to the control group		64,13	51,44
In the liver			
lead:	0,07398±0,0021	0,06462±0,00158 ^{xx}	0,06085±0,00334 ^{xx}
% to the control group		87,35	82,25
cadmium:	0,05866±0,00305	0,04523±0,00193 ^{xx}	0,03718±0,00202 ^{xxx}
% to the control group		77,11	63,38

Note: ^{xx}P<0,01 ^{xxx}P<0,001.

However, the content of toxic metals in the liver of carp in the compared groups in relation to muscle tissue was much higher: in group I – the control group lead in 1,64, but cadmium in 6,77 times, and in group II – in 1,47 and 8,13 times respectively, and in group III – in 1,44 and 8,33 times. At the same time, feeding carp with feeds that were previously enriched with the bio-preparation gave a reduction of the accumulation of lead and cadmium in meat in the second group by 2,82 and 35,87 %, and in group III by 6,12 and 48,56%. The decrease of the lead accumulation in the liver in group II was by 12,65 and 22,89 %, and in group III by 17,75 and 36,62% respectively.

CONCLUSIONS

Raising marketable carp with the use of mixed feeds in their rations, with the addition of pre-probiotic supplement "Biocoretron" helps to realize its biologic resources fully, to reduce the toxic burden on the organism and raise its natural resistance, to improve the survival of carp and chemical composition of meat, to increase the yield of edible parts, to prevent the accumulation of heavy metals (cadmium and lead) in meat up to the ecologically safe level, that is significantly lower than maximum permissible concentrations set for the output of fish farming. Feeding carp with mixed feed with the addition of 0,2% "Biocoretron" had the greatest effect.

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