THE EFFECT OF *SACCHAROMYCES BOULARDII* YEAST FEED SUPPLEMENTATION ON GROWTH PARAMETERS AND BIOCHEMICAL COMPOSITION OF CARP (*CYPRINUS CARPIO*)

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Abstract

The aim of this study is to evaluate the effect of the yeast Sacharomices Boulardii (SB), on the growth performance, the health and the survival rate of the carp (Cyprinus carpio) grown in recirculating system, by analyzing the biotechnological and biochemical indicators.

The experiment was performed over a period of 30 days. The biological material used in this experiment was carp (Cyprinus carpio). A number of 150 fish, with an average body weight of approximately 100 grams, were equally distributed in 2 experimental tank and 1 control tank in the recirculating system. The yeast was supplemented with food, in a classic feed with a content of 32% protein, according to the specialized literature (SC Aquasarb, 1998)[15], in percentage of 0.75% in B1, respectively 2.5 % in B2. In the control tank, B0, a classic feed was administered, without the addition of yeast. The growth parameters and the biochemical composition were determined at the beginning and the end of the experiment. The results showed that there are not very big differences regarding the individual weight growth between the 3 tank; however, the highest weight gain (33.95 g) was obtained in B2 compared to the lowest (33.51 g) obtained in the control tank, B0. The results also showed that at the end of the experiment the survival rate in B1 and B2 was 100%, compared to 96% in the control basin B0. A better food conversion rate, FCR, was obtained in B2 (1.20), compared to 1.30 in B1, respectively 1.45 in B0. The highest protein content in the fish carcass was present in B2 (18.01%), compared to 17.01 in B0, respectively 17.60 in B1.

The conclusion is that supplementation of the carp feed grown in the recirculating system with probiotics from yeast Sacharomices boulardii has positive results on the growth performance, the health and the survival rate of the carp, the best results being obtained with a supplement of 2.5% probiotics.

Key words*:* yeast, growth parameters, biochemical composition, *Cyprinus carpio*

INTRODUCTION

Recirculating systems are often used in aquaculture because large productions are obtained on small volumes, and the culture biomass grows rapidly in weight, due to the rigorous control of feed [7].

However, in recirculating systems aquatic creatures are exposed to stressful living conditions, often with disease issues. In most cases, the diseases are caused by the pathogenic germs and the quality of the aquatic environment in which they live.

Diseases are a real problem in growth of many aquatic species, leading to the widespread use of antimicrobial drugs in aquaculture worldwide.

The global trend is to limit the use of antibiotics in animal feed, because of the risks posed by antibiotic-resistant bacteria, which can lead to health problems for both animals and humans.

Because in the U.E. most antibiotics for animal feed are forbidden by law, as an alternative to their use in the management of aquatic diseases, probiotics added into the food are increasingly used.

Probiotics are used as additives in animal feed because they have improved feed

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digestibility, contributing to increased absorption of nutrients in both fish and other animals and as a result, they can improve their health and their growth performance [3, 8].

The present study aims to evaluate the effect of the yeast *Sacharomices Boulardii*, on the growth performance, the health and the survival of the carp (*Cyprinus carpio*) grown in recirculating system, by analyzing the biotechnological and biochemical indicators.

Saccharomyces boulardii (SB) is a unique probiotic and biotherapeutic yeast, known to survive in gastric acidity and is neither adversely affected nor inhibited by antibiotics or does not alter or adversely affect the normal microbiota.

MATERIAL AND METHOD

The biological material used in the experiment was the common carp (*Cyprinus carpio*), the most representative species in our country, grown at the Research-Development Institute for Aquatic Ecology, Fisheries and Aquaculture, Galați.

The experiment lasted 30 days and it was carried out on a number of 150 one year old fish with an average weight of 100 grams, divided into 3 lots: the control lot and two experimental ones, equally distributed into 3 basins in the recirculating system.

The experimental feed was obtained by introducing two different doses of the yeast *Sacharomyces Boulardii* into a classic extruded feed, of type Soprofish 32/7, with the size of the grain of 4 mm and a biochemical composition presented in table 1, as follows:

- Basin B0 - classic feed, without yeast
- Basin B1 - classic feed with 0.75% yeast addition
- Basin B2 - classic feed with 2.5% yeast addition.

Table 1 Biochemical composition of the clasic feed used during the experiment

Feed Soprofish 32/7	
Biochemical composition	**Quantity**
Crude protein	min. 32 %
Lipids	min. 7 %
Moisture	min. 10 %
Crude cellulose	min. 6 %
Calcium	min. 1 %
Phosphorous	min. 0.7 %
Vitamin A	min. 10.000 UI/kg
Vitamin D3	min. 1.800 UI/kg
Vitamin E	min. 60 mg/kg
Vitamin C	120 mg/kg
Lysine	min. 1.5 %
Methionine	min. 1.0 %
Raw energy	16.5 MJ/kg
Metabolic energy	13 MJ/kg

The biochemical composition of the fish meat was analyzed using the standard methods of analysis.

Moisture was determined according to standard official analyzes (AOAC, 1990), the ash content - by calcining the sample in the electric oven (AOAC, 1990), the lipids - by the Soxhlet method (AOAC, 1990), and the protein content was calculated by the Kjeldahl method which meant determining the nitrogen content which was converted into protein equivalent by multiplying by factor 6.25. (AOAC, 1990) [2].

At the end of the experimental period the growth parameters were determined, according to Cho methodology (1992) [6] to evaluate the general development of the biological material.

✓ *Real growth rate* – (Sr) – was calculated with the formula: Sr = Bf - Bi [kg], Bf – final fish biomass and Bi- initial fish biomass [kg].

✓ *Individual growth rate* – was determined with the formula: (Wf – Wi)/ N [g/ex.], Wf, – final fish weight and Wi- initial fish weight [g]; N – fish number [ex.].

✓ *Daily growth rate – (DGR)* – was determined with the formula: (Wf – Wi)/ T [g/day], Wf – final fish weight and Wi- initial fish weight [g]; T – rearing period [days].

✓ *Specific growth rate* – (SGR) – was determined with formula: SGR = (lnWflnWi)*100/T [%/day], Wf –final figh wight and -Wi-initial fish weight [g]; T – rearing period [days].

✓ *Food conversion rate* – (FCR) – was calculated with formula: FCR = F/ (Bf – Bi)[kg/kg], F – administrated fodder quantity [kg]; Bf– final fish biomass and Bi- initial fish biomass [kg].

Statistical analysis

All determinations were made in duplicate. Statistical processing of the obtained data was performed using Excel tools. Average values were reported together with standard deviations. Statistical interpretation of the data indicates differences according to a significance threshold of $P < 0.05$.

RESULTS AND DISCUSSIONS

In recent years, there has been a lot of research showing the benefits of supplementing animal feed with probiotics [9,11,18,19].

The present study aimed to evaluate the effect of the yeast *Sacharomyces Boulardii* on growth parameters and the biochemical composition of the common carp (*Cyprinus carpio*).

Growth performance

All specimens involved in the experiment accepted the experimental diets.

Survival is a key indicator of health status [16]. The survival rate of the biological material was maximum in the experimental basins B1 and B2 in which the fish were fed with feed enriched with the probiotic yeast *Sacharomyces boulardii* (SB), compared to the control basin B0, in which the biological material was fed with classical feed, without yeast addition (96%).

The growth parameters for the organic material fed with classic feed, in which different levels of yeast *Sacharomyces boulardii* were added, are presented in table 2.

Table 2 Growth parameters of common carp (*Cyprinus Carpio*) grown in the pilot recirculatory system, fed with the experimental diets for 30 days)

Parameters	Experimental variants		
	B0 (0% SB**)	***B1 (0,75% SB**)***	***B2 (2.5 % SB**)***
Populations			
Numbers	50	50	50
Individual weight ,g (Average± SD*)	101.49±2.05	102.89±1.99	102.85±2.01
Initial biomass - kg-	5.074	5.145	5.148
Harvesting			
Numbers	48	50	50
Final individual weight, g (Average± SD*)	135.00±2.28	136.5±2.06	136.9±2.12
Final biomass -kg-	6.48	6.83	6.85
Rearing parameters			
Days of rearing	30	30	30
Survival - % -	96	100	100
Real growth rate - kg -	1.41	1.68	1.70
Individual growth rate - g/ex -	33.51	33.61	33.95
Total distributed feed - kg -	2.04	2.18	2.04
Daily growth rate DGR - g/day -	1.12	1.12	1.13
Specific growth rate (SGR) - %/day -	0.81	0.94	0.95
Feed Conversion Rate (FCR) - kg fooder/kg fish	1.45	1.30	1.20

* Standard deviation; ** *Sacharomyces boulardii*

At the end of the experimental period, the real growth rate was higher in the case of biological material from basins B1 (1.68 kg) and B2 (1.70 kg), fed with experimental feed, compared to the control basin B0, where the value was 1.41 kg. Thus, the group with the addition of 2.5% yeast SB had a significantly (P<0.05%) higher value than the control group. There were insignificant differences (P> 0.05%) between experimental groups B1 and B2.

The daily growth rate DGR has no significant values (P> 0.05%).

SGR, the parameter that most accurately indicates the dynamics of individual growth, recorded similar values in B1 (0.94% day) and B2 (0.95% day), higher than in the control basin B0 (0.81% day). The high values of SGR indicate a better assimilation of the feed administered to the fish.

Comparing FCR from experimental basins B1 and B2, it is observed that the lowest value was recorded in basin B2 (1.20 kg feed / kg fish), corresponding to a diet with 2,5% SB added, followed by basin B1 (1, 30 kg feed / kg fish), in which the quantity of yeast introduced into the feed was 0.75%. The highest value was recorded in the B0 control basin (1.45 kg feed / kg fish).

The use of yeast in the diet has been shown to have positive effects on the performance and well-being of several fish species, such as hybrid striped bass Morone chrysops × M. saxatilis [13], Israeli carp [14], Labeo rohita fingerlings [10].

Lara-Flores and colleagues [12] concluded that the use of yeast as a probiotic for feeding tilapia larvae resulted in good growth performance, indicating that enrichment of food with yeast promotes adequate growth of tilapia larvae. Similar results were also obtained by Abdulrahman et al., 2012 [1].

Biochemical composition of biological material

The effects of the enriched diet with yeast *Sacharomyces boulardii* on the biochemical composition of the common carp (*Cyprinus Carpio*) grown in the recirculating system, are presented in Table 3.

Table 3 The chemical composition of common carp (*Cyprinus Carpio*) grown in the pilot recirculatory system, fed with the experimental diets for 30 days)

		Protein (%) Average±SD*	Lipids (%) Average±SD*	Moisture (%) Average±SD*	Ash (%) Average±SD*
Initial	**I**	16.92± 0.069	1.42 ±0.009	80.41 ± 0.013	1.25 ± 0.010
Final	**B0**	17.01± 0.009	1.41 ± 0.016	80.15 ± 0.039	1.43 ± 0.006
	B1	17.60± 0.014	1.35 ± 0.007	80.12 ± 0.003	0.91 ± 0.002
	B2	18.01± 0.039	1.25 ± 0.018	79.64 ± 0.135	1.1 ± 0.078

* Standard deviation

Analyzing the obtained data regarding the protein content of the meat of the biological material involved in the study, it is observed that there are significant differences (P<0.05) between the beginning of the experiment and after 30 days of experiment, as well as between the control lot B0 and the two experimental lots B1 and B2.

Compared to the initial protein content (16.92%), an increase is observed at the end of the experiment in both the control basin B0 (17.01) and in basins B1 (17.60%) and B2 (18.01%), where the diet was enriched with different percentages of SB yeast.

The lipid content from the meat of the biological material decreased as the yeast concentration added to the diet increased. The lipid content of lot B2, fed with 2,5% yeast-enriched feed, was significantly (P<0.05) lower (1.25%) compared to the control lot, fed only with classical feed.

The values obtained for protein and fat in the case of carp meat are similar to the values found in the literature [4, 5].

The synthetic indicator of the overall protein quality is the water / protein ratio, the value of which is not influenced by the variation of the fat content [17].

No significant differences were observed (P <0.05) regarding the ash content of the fish meat.

CONCLUSIONS

Although some researchers have not had satisfactory results, the use of yeast *Sacharomyces boulardii* as a probiotic in fish diets is promising in terms of growth performance and nutritional quality of meat.

The present study shows that yeast-supplemented diets stimulate growth, feed efficiency and survival rate.

❖ The administration of *Sacharomyces boulardii* to the carp has determined a higher growth rate, the accumulation of biomass being accelerated in the experimental lots, compared to the control lot.

❖ The nutritional value of the fish meat has been improved with the introduction of probiotic yeast in the feed, the highest value being obtained for a level of 2.5% yeast *Sacharomyces boulardii*.

❖ The positive results obtained during this study, encourage further research on the administration of probiotic yeasts in carp diet.

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