Effect of Commercial Dry Yeast *Saccharomyces cerevisiae* on Growth Performance in Common Carp *Cyprinus carpio* L.

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Abstract

This study was designed to investigate the effect of adding different level of commercial dry yeast *Saccharomyces cerevisiae* in three different concentrations with three treatments T1 (0%), T2 (3%), and T3 (7%) on growth performance of common carp *Cyprinus carpio* L., the trail was conducted for 56 days and by using 200 fingerlings common carp with mean initial weight (46g). Fish were acclimated to concrete ponds belongs to department of Animal Sources/ College of Agriculture/ University of Duhok. Fish were fed with control pellets (31% protein) prior to the feeding trials for 21 days. There was significant differences in the final weight attained by common carp at all levels of dry yeast incorporation as compared to the control diet. However, the addition of 7% dry yeast resulted in significantly increase in fish specific and relative growth rate.

Key Words: Growth, Dry Yeast, Weight Gain, Specific Growth, Relative Growth,and Survival Rate

تأثير الخميرة الجافة التجارية *Saccharomyces cerevisiae* في أداء نمو اسماك الكارب الشائع *Cyprinus carpio* L.

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الخلاصة

صممت التجربة لبيان تأثير إضافة تراكيز مختلفة من الخميرة الجاهزة التجارية بثلاث تراكيز الى علائق الاسماك وكما يلي المعاملة الاولى T1 (0%) والمعاملة الثانية T2 (3%) والمعاملة الثالثة T3 (7%) في بعض عناصر الاداء الانتاجي لاسماك الكارب الشائع *Cyprinus carpio* L. استمرت التجربة لمدة 56 يوما، باستخدام 200 اصبعية بمعدل وزن (46 غم/ سمكة). تم اقلمة الاسماك لظروف التربية في احواض كونكريتية تابعة الى قسم الثروة الحيوانية/كلية الزراعة والغابات/ جامعة دهوك. وتم تغذيتها بعليقة تجارية (نسبة البروتين 31%) قبل التجربة ولمدة 21 يوما. لوحظت إختلافات معنوية في الوزن النهائي للاسماك في تركيزي الخميرة المستخدمة، ادى استخدام الخميرة بتركيز 7% الى زيادة معنوية في النمو في معدل النمو النوعي والنسبي لاسماك التجربة.

الكلمات المفتاحية: النمو، الخميرة الجافة، النمو النوعي، النمو النسبي ونسبة البقاء

Introduction

Yeasts are rich source of protein (35%) and B-complex vitamins. They have been used successfully as a complementary protein source in fish diet, in addition, they have been used as a supplement in animals feed to compensate for the amino acids and vitamin deficiencies of cereals, they are recommended as a substitute for soybean oil in diets for Poultry (*Gohl, 1991*). As well as, they are considered a cheaper dietary supplement because they are easily produced on an industrial level from a number of carbon-rich substrate by-products *(Lee and Kim 2001*).

Omar et al. (1989) found that active yeast (*Saccharomyces cerevisiae*) showed significant effect on the growth of tilapia and carp over inactive yeast. Possible use of baker's yeast in fish diets has many advantages, firstly, they can be produced rapidly, easily and inexpensively and, at the same time, they are very stable and can be recycled from other industries (*Omar et al. (1989*). This is somehow in agreement with those found by Jafarnodeh, (2010). Altogether, the relatively enhanced growth performance and feed efficiency in the common carp fingerlings fed the supplemented diets could be related to the improvement of intestinal microbiota *(Jafarnodeh, 2010*). The utilization of dried yeast at reduced levels may effectively improve growth (Oliva-Teles and Goncalves, 2001) and non-specific immune responses (*Paulsen et al., 2003*) in a variety of fish species. They are also natural substances so no negative effects may be expected either to the animals or environment. With this aim, the present study discusses the effects of the dietary intake of the baker's yeast as supplementary feed and possible difference with using of control diets are also established.

Materials and Methods

The experiment was conducted for eight weeks, using common carp (*Cyprinus carpio*, 46 ± 0.7 g average weight) obtained from a commercial ponds. The experimental system was carried out in concrete ponds.

Experimental Diets and Design

The tested commercial dry yeast probiotics (*Saccharomyces cerevisiae*) were used to study their effects on the growth performance of common carp (*Cyprinus carpio*). Fish were allowed to adapt to the experimental condition for three weeks and fed with a conventional diet. Three treatments were formulated by adding yeast at levels 0, 3 and 7 %, the treatments were randomly assigned to the concrete ponds with three replicates per treatment. The chemical composition of the experimental diets were shown in Table (1).

Rearing of experimental fish was in three concrete ponds divided in to three partition by pens. The pond dimensions were 300*220*86 cm and the water level was 70 cm. A daily record was kept of feed offered. A total weight was measured weekly to follow growth in weight and calculate survival and feeding ration. Briefly, the fish were taken from each tank; were weighed by an electronic balance, feeding level of all experimental diets was 6% of the total biomass of the fish per day. The amount of feed was divided into two equal portions and distributed by hand in one side of the pond two times daily at 9 a.m.,and 2 p.m. The performance parameters included Weight Gain (WG), Daily Weight Gain (DWG), Specific Growth Rate % (SGR), Relative Growth Rate (RGR), Food Conversion Ratio (FCR), Food Conversion Efficiency (FCE), and Survival Rate (%).

Results and Discussion

At the end of the experimental period each treatments received probiotics supplemented diets revealed significant increases ($P \leq 0.05$) in the weight gain (W G), specific growth rate (SGR), protein efficiency ratio (PER). A significant decreases in feed conversion ratio (FCR) in comparison with control group was found. These results were demonstrated in Tables 2 and 3 respectively.

Table (1) Chemical Composition of Experimental Diets

Treatments	Protein %	Fat %	Ash %	Moisture %
T1	27.31	1.25	10.25	6.04
T2	35.84	1.8	8.52	5.47
T3	36.93	3.0	8.34	5.53

Table (2) The Biological Parameters of the Fish in the Treatments

Treatments	Weight Gain	Daily Growth	Specific Growth	Relative Growth	Survival Rate
	Gm		%		
T1	14.887 b	0.236 b	0.193b	32.362 b	100 a
T2	15.667 b	0.249 b	0.202b	34.058 b	99 a
T3	20.333 a	0.323 a	0.252 a	44.203 a	98 a

Mean Values with Different Superscripts within a Column Differ Significantly ($P \leq 0.05$). According to Duncan's Multiple Range Test for Equal Numbers of Replicates.

Table (3) Effect of Adding Development Dry Yeast to Common Carp Diets on Fish

Treatments	Food Conversion Ratio	Food Conversion Efficiency
T1	1.078 b	0.93 a
T2	1.136 b	0.88 a
T3	1.474 a	0.68 b

Mean Values with Different Superscripts within a Column Differ Significantly ($P \leq 0.05$). According to Duncan's Multiple Range Test for Equal Numbers of Replicates.

Table (2) illustrated that the T3 have the greater weight gain (20.333), which is significantly ($P \leq 0.05$) higher than other treatments. In addition, T3 have the same trend in each DGR, RGR, SGR and FCR by obtaining the higher significant ($P \leq 0.05$) values as compared to other treatments 0.323, 44.203, 0.252 and 1.474 respectively, no significant differences observed in survival rate ($P \geq 0.05$). In the last two decades, many substances have proved their usefulness in fish culture because of their properties to stimulate the immune system and increase disease resistance. Among these Immunes stimulants the role of isolated β-glucans, chitin or vitamins is well documented. However, the use of whole organisms instead of their

isolated components has hardly been evaluated. In this way, whole yeast cells (mainly *S. cerevisiae*), which represent a major commercial source of ß-glucans, have recently been described as good immunostimulants in fish. Researchers have evaluated the nutritional value of brewer's yeast *S. cerevisiae* in rainbow trout (Rumsey *et al*., 1991), sea bass (Oliva-teles and Goncalves, 2001) and hybrid striped bass (Li *et al*., 2003) by comparing with growth performance, feed efficiency, liver urinate and nitrogen retention.

All the probiotic-supplemented diets resulted in growth higher than that of the control diets, suggesting that the addition of probiotics mitigated the effects of the 4 stress factors. This resulted in better fish performance with better growth results in the diets supplemented with the yeast. Also in the study of Faramarzi *et al*., (2011) stated the significant effect of the yeast.

The best FCR values observed with probiotic-supplemented diets suggest that addition of probiotics improved feed utilization even under stress conditions with yeast being the most effective of the supplements tested in the present study. In practical terms, this means that probiotic use can decrease the amount of feed necessary for animal growth that could result in production cost reductions (Faramarzi *et al*., (2011).

Brewers' yeast, *S. cerevisiae* has been recognized to have potential as a substitute for live food in the production of certain fish or as a potential replacement for fish meal (Oliva-teles and Gonçalves, 2001). In the present study, the supplementation of commercial live yeast, *S. cerevisiae*, improved growth and feed utilization. These results agree with that obtained with catla carp, mrigal carp (Swain *et al*., 1996), hybrid striped bass (Li and Gatlin, 2004), and Japanese flounder (Taoka *et al*., 2006). Similar results were obtained when *S. cerevisiae* was added to fish diet for Israeli carp *Cyprinus carpio nodus* (Noh *et al*., 1994) and Nile tilapia (Lara- Flores *et al*., 2003).

The improved fish growth and feed utilization may possibly be due to improved nutrient digestibility. In this regard, Tovar *et al*. (2004), Lara-Flores *et al*. (2003), Abdel-Tawwab *et al*., 2008, Tovar-Ramírez *et al*., 2004, Abdulrahman *et al*., 2012 found that the addition of live yeast improved diet and protein digestibility, which may explain the better growth and feed efficiency seen with yeast supplements. In addition, De Schrijver and Ollevier (2000) reported a positive effect on apparent protein digestion when supplementing turbot feeds with the bacteria Vibrio proteolytic. As inasmuch, dried yeast is a source of nucleic acids and non-starch polysaccharides, including β-1, 3 glucan, which in high concentrations may play a role of antinutritional factors. At high concentrations, such compounds are known to hamper nutrient digestion and/or absorption. In avian species, β-glucans may affect the absorption of nutrients, possibly by increasing gut viscosity, while high concentration in nucleic acids may affect nutrient metabolism in humans and most monogastric animals (Ozório *et al*., 2012). This resulted in better fish performance, with better growth results in the diets supplemented with the yeast. Similar results were observed by Vazquez *et al* (1997) when yeast isolated from the intestines of wild rainbow trout was introduced into the digestive tracts of domestic rainbow trout, producing a significant increase in the growth of the cultured trout. In contrast, the use of Amax in three concentration of enrichment suspension caused growth increases significantly when compared to the control. In accordance with the findings of Lashkar *et al*. (2011) when using probiotic yeast in *Artemia urmiana* nauplii broth, for feeding *Acipenser persicus* larvae had good effects on growth parameters

(Jafaryan *et al*., 2008). These results may be explained by the greater adaptive capacity of yeasts in aquatic environments in contrast to bacteria such as *Lactobacillus* and *Streptococcus*. It is also necessary, however, to consider the possibility of interspecies differences, as suggested by Noh *et al*. (1994), who studied the effect of supplementing common carp feeds with different additives, including antibiotics, yeast (*S. cerevisiae*) and bacteria (*S. faecium*). Generally, the data illustrated in the study of Abdulrahman and Muhammad, (2012) showed that 7% yeast were more effective in enhancement of body weight of common carp *C. carpio*. Sedaghat, *et al*., (2012), stated that the adding of Probiotic Bioplus 2B positively affect Growth Indices of Zebra Fish (*Danio rerio*). The diets of Ghazalah *et al*., (2010) on Nile tilapia with 27.5% crude protein (CP) were superior to the corresponding diet with the same CP level but without probiotic supplementation, this may be due to the effect of the tested probiotics, which improved absorption of nutrients, and depressed harmful bacterial affects that cause's growth depression. The results of the study of Adineh *et al*., (2011) clearly demonstrate that the silver carp (*Hypophthalmichthys molitrix*) larvae had different growth and feeding performance in effecting of various concentrations of probiotic bacillus and yeast via bioencapsulation of *Artemia urmiana* nauplii.

Possible use of baker's yeast in fish diets has many advantages. Firstly, they can be produced rapidly, easily and inexpensively and, at the same time, they are very stable and can be recycled from other industries. They are also natural substances so no negative effects may be expected either to the animals or to the environment. Moreover, there is no need to isolate their components, which consists mainly of cell wall sugars (β-glucans, mannoproteins and chitin), all are well-proved immunostimulant compounds (Tewary and Patra, 2011; Tapia-Paniagua *et al*., 2011). Growth performance of young common carp supplemented with probiotic was improved compared with other treatments. This might suggest that the addition of probiotics mitigated the effects of the stress factors and resulted in better fish performance. *S. cerevisiae* is a protein source by conventional definition and in non-salmonid dietary supplementation of *S. cerevisiae* and other yeast species has improved fish growth (Manju *et al*., 2011). To conclude the present results provide evidences that Baker's yeast (*S. cerevisiae*) added in a common fish diet, exhibit better growth, better nutrient utilization and activate the innate immunity, as well as increase the survivability of *L. rohita*. Optimal doses and administration time have been established in an attempt to provide a useful approach for protecting culture fish against infectious diseases.

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