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PROBIOTICS AS NUTRIENT SUPPLEMENT IN ARTIFICIAL FEED OF GOLD FISH *(CARASSIUS AURATUS)*

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ABSTRACT

The efficacy of three feeds incorporated with different probiotics - *Lactobacil, Vizylac* and *Cyfolac* as nutrient supplement was evaluated in an ornamental fish, *Carassius auratus* (Linn.). The basal diet (40% protein) was prepared and the probiotics were incorporated at different levels *viz. Lactobacil* at 8 x 10^7/100g and 12 x 10^7/100g, *Vizylac* at 8 x 10^7/100g and 12 x 10^7/100g and *Cyfolac* at 12 x 10^7/100g. Feeding trial was conducted for a period of 4 weeks. At the end of the experiment, bio-growth parameters and proximate composition of the fishes were studied. The growth, survival and protein content were improved in all the probiotic fed fishes compared to control. The maximum growth (0.74 g) and survival (85%) were observed in fishes fed with *Lactobacil* at 12 x 10^7/100g. It emphasizes that supplementation of feed with probiotics has a positive impact on the growth, survival and the body composition of goldfish.

Keywords: Gold fish, probiotics, nutrient supplement

INTRODUCTION

Ornamental fish culture is an important component of aquaculture industry and is one of the most economic and profitable areas of fish farming activities. The last four decades has witnessed considerable growth and diversification in the international trade in ornamental fishes. Gold fish, *Carassius auratus* (Linnaeus, 1758), a member of the cyprinidae family is one of the most popular aquarium fish and are extremely valuable commercially. Goldfish are not having only attractive colour but also are hardy and easy to culture, so they make excellent aquarium species as well as laboratory species. Moreover, their hardiness and ready availability give them scientific value for genetic and physiological research also.

The use of probiotics as a dietary supplement in aquaculture of food fishes like turbot, rainbow trout, salmon and cod to enhance both internal and external microbial environment, to increase the population of food organisms and to improve the nutritional level and immunity of cultured animals against pathogenic

microorganisms (Strom and Ringo, 1993; Gatesoupe, 1994, 1997; 1999; Gildberg *et. al.,* 1995; Austin *et al.,* 1995; Robertson *et al.,* 2000) has shown promising results, but the studies on the application of probiotics as a nutrient supplement in ornamental fish in scarce.

The present study was taken up with the objective to evaluate the effect of three probiotic-supplemented feeds on the bio-growth parameters and proximate composition of goldfish.

MATERIAL AND METHODS

The experiment was conducted for a period of four weeks in the Aquarium Laboratory of Central Institute of Fisheries Education, Kolkata. The test fish, Gold fish *(Carassius auratus)* was procured from a local aquarium shop and acclimatized for fifteen days in the plastic circular troughs of fifty litres capacity.

The experiment was conducted in six distinct experimental groups, namely D_0, D_1, D_2, D_3, D_4 and D_5 in replicates in twelve uniform sized plastic circular troughs of fifty litres capacity each. The troughs were disinfected with bore well water (40 litres) and continuous aeration was provided throughout the experiment. After taking the average length and weight of fishes, each trough was stocked with ten fishes.

The selected ingredients for preparing the control diet, D_0 (40 % protein) - wheat flour 50%, fish meal 25% and soybean meal 25%, were thoroughly mixed and a dough was prepared by adding required amount of water. The dough was autoclaved for fifteen minutes and pelletized using a hand pelletizer. The pelleted feed was sun dried, ground and kept in airtight bottles for use.

The five experimental diets D_1, D_2, D_3, D_4 and D_5 were prepared by incorporating *Cyfoloca, Vizylac* and *Lactobacil* capsules at different levels in control diet (Table 1). The probiotic capsules were added to the control diet after the dough were autoclaved and subsequently cooled, before pelletizing.

Table 1: Levels of probiotics in experimental diets

Feed	Probiotics used	Probiotic cells/100 g feed
D_1	Cyfolac	$1.2x10^8$
D_2	Vizylac	$8.0x10^7$
D_3	Vizylac	$1.2x10^8$
D_4	Lactobacil	$8.0x10^7$
D_5	Lactobacil	$1.2x10^8$

The fishes of each group were fed twice daily at the rate of 5% of body weight with respective diets for a period of four weeks. Five fishes from each trough were taken out randomly and were weighed once in fourteen days in a pre-weighed beaker. The growth performance of the fish was assessed based on the data collected during the experimental period using the formula:

Weight gain (%) = Final weight - Initial weight / Initial weight X 100

Food Conversion Ratio (F.C.R.)= Dry weight of the feed given / Wet weight gain

Survival (%) = No. of fish at the end of the experiment / No. of fish at the start of the experiment X 100

The fish tissue in all the treatment groups at the end of four weeks was analyzed for moisture, crude protein, fat and total ash (AOAC, 1995). One way ANOVA was followed to test the level of significance among the experimental diets (Snedecor and Cochran, 1962).

RESULTS AND DISCUSSION

The body weight gain, F.C.R. values and survival of the different experimental groups are given in Table 2. The highest weight gain was recorded in D_0 and the highest survival values recorded in D_5. The differences in the percentage of weight gain, survival percentage and F.C.R. values of groups fed with different experimental diets, were however, statistically insignificant ($P>0.05$).

The proximate composition of the fish tissue in terms of moisture, protein, lipid and ash content at the beginning and the end of 4 weeks is given in Table 3. The moisture and ash contents were generally lesser at the end than at the beginning of the experiment. There was a general increase in the protein content of the fish with the maximum increase observed in D_5. The lipid content was found to be lower at the end of the experiment than at the beginning.

The changes recorded in the growth, survival and F.C.R. of the fishes could be mainly attributed to the influence of probiotics. It is well explained by Fuller

Table 2 : Mean body weight gain, survival and F.C.R. of different experimental groups of *C.auratus* during the experimental period

Treatment groups	Initial weight (g)	% weight gain after two weeks	% weight gain after four weeks	Survival (%)	F.C.R.
D0	2.04–2.16 (2.10±0.06)	6.80	13.60	60.0±0	2.52±0.07
D1	1.98 –2.20 (2.09±0.11)	9.80	17.60	65.0±5	2.45±0.07
D2	2.02–2.12 (2.07±0.05)	13.65	27.95	70.0±10	2.28±0.14
D3	2.05–2.19 (2.12±0.07)	16.00	30.90	80.0±0	2.21±0.11
D4	2.11–2.25 (2.18±0.07)	13.25	29.25	65.0±5	2.24±0.05
D5	2.10–2.26 (2.18±0.08)	15.70	32.30	85.0±5	2.13±0.15

(1992) that most probiotics are supplied as live supplements in food, which must have the ability to survive passage through the intestinal tract. Smoragiewicz *et al.,* (1993) expected that the benefit to the host may arise as nutritious components of the diet, which the host can then digest. The enhancement in bio-growth parameter and survival in the present study also follow the same concept. It is well known fact that the body composition varies from species to species and within the same species is influenced by age, sexual maturity and time of spawning, feeding conditions and chemical constituents of diet. There was an increase in protein content in probiotic treated fishes. This could be attributed to the fact that probiotics are directly involved in nutrient uptake or provide nutrients or vitamins (Ringo and Gatesoupe, 1998). The probiotic bacteria produce enzymes in the gut, which increases the digestive efficacy of the host animal thereby promoting protein digestion and growth (Lipton, 1998). Appropriate probiotic applications were shown to improve intestinal microbial balance, thus leading to improved food absorption (Parker, 1974; Fuller, 1989), and reduced pathogenic problems in the gastrointestinal tract (Cole and Fuller, 1984; Goren *et al.,* 1984). Several probiotic species were used, including *Lactobacillus* spp. (Muralidhara *et al.,* 1977; Pollman *et al.,* 1980; Jonsson, 1986). *Saccharomyces* sp. (Burnett and Neil, 1977; Surawicz *et al.,* 1989), *Bacillus* spp. (Ozawa *et al.,* 1981; Ogle and Inborr, 1987; Spriet *et al.,* 1987), and mixed cultures *(Pollman et al.,* 1980; Lessard and Brisson, 1987). With some trials, growth promotion was clearly demonstrated in poultry (Alder and Damassa, 1980) and pigs *(Pollman et al.,* 1980) compared with control groups. Similarly present result was also promising and gave confidence that further improvements in probiotic applications are possible.

Table 3 : Changes in proximate composition of *C.auratus* muscle fed with probiotics at the end of experimental period

Treatment groups	Protein % initial (dry matter basis)	Protein % increase (dry matter basis)	Fat % initial (dry matter basis)	Fat % decrease (dry matter basis)	Moisture % initial	Moisture % decrease	Ash % initial	Ash % decrease
D0	38.50	0.88	21.32	0.58	79.95	1.82	2.30	0.12
D1	41.12	1.75	19.39	0.34	81.22	2.07	2.42	0.79
D2	40.39	1.75	18.90	0.82	78.35	2.36	2.14	0.49
D3	36.75	2.62	23.07	1.07	79.80	2.83	1.81	0.21
D4	42.87	3.30	17.70	0.80	80.19	3.33	2.40	0.44
D5	42.0	4.12	17.20	0.74	81.15	3.68	2.15	0.35

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