

# Effects of Various Levels of Spirulina on Growth Performance in *CARASSIUS AURATUS*

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**Abstract-** The goldfish, *Carassius auratus* is one of the most commonly kept aquarium fish added to stagnant water bodies to reduce mosquito populations. Spirulina is one of the most natural sources of nutrition known for both terrestrial and aquatic animals. Spirulina contains 60-70% of protein and is the richest source of vitamin B-12,  $\beta$ -carotene (twenty times that of carrots) with essential fatty acids and minerals. The study was conducted to determine the optimum level of dried Spirulina in test diets for goldfish. The growth rate was measured after 35 days. The fish (T1, T2, and T3) which were fed with the diet supplemented with dried Spirulina at a concentration of 0.5, 1.0 and 1.5 percent, the growth rate was significant compared to the control. The growth rate was highest in T2 when compared to other Spirulina supplemented groups. Maximum growth rate was observed in the group supplemented with 1.0% spirulina.

Keywords: *Carassius auratus*, Spirulina

## I. INTRODUCTION

Gold fish is one of the most commonly kept aquarium fish. It feeds on a wide range of food including plants, small crustaceans and detritus. With the increasing demand as a possible source of protein to be used directly or indirectly for human consumption, Spirulina had gained popularity and importance throughout the world. Recently it had found application in various fields like agriculture, waste-water treatment (Borowitzka and Borowitzka, 1988) aquaculture, nutrient recycling and production of valuable chemicals ( $\beta$ -carotene and phycocyanin). The potential of Spirulina as a protein source was evident as early as 1940 when it was used as part of the diet of the village people in Africa and Mexico (Baldia et al., 1991). It has also been shown that Spirulina is an excellent source of proteins, vitamins and minerals (Ciferri, 1983). A special value of spirulina is that it is readily digestible due to the absence of cellulose in its cell walls and after 18 h > 85% of its protein digested and assimilated (Sasson, 1997). It can be used as a partial supplementation or complete replacement for protein in aqua-feeds and as a cheaper feed ingredient than other animal origin (Habib et al., 2008). Spirulina is a powerful tonic for the immune system. Many authors have studied the effect of Spirulina diet or extract on growth and immune responses in various animals. The present study has been carried out to analyse the impact of different levels of Spirulina diet on growth.

## MATERIALS AND METHOD:

### Systematic position of *Carassius auratus*:

Kingdom: Animalia; Phylum: Chordata; Class: Actinopterygii; Order: Cypriniformes; Family: Cyprinidae; Genus: *Carassius*; Species: *auratus*

Gold fish natively live in ponds with still or slow moving bodies in depths up to 20m. Their native climate is subtropical

to tropical and they live in fresh water with a pH of 6.0-8.0 and a temperature range 40° F- 106° F.

Juvenile *Carassius auratus* were collected from Tuty aquarium in Thoothukudi. They were divided into four groups – control, T1, T2 & T3, each consisting of 10 individuals and reared in circular plastic container containing 20 litre of water. The fish were acclimatized to the ambient temperature (28o C), salinity and pH (7.5) for about 7 days. Triplicates were maintained for each Spirulina diet. Fifty percent water exchange was carried out once in three days.

Feed formulation was done according to Hardy, 1980. The dried and powdered ingredients of diets were blended at first to make a homogenous mixture. Subsequently mixed with suitable level of Spirulina powder with an aliquot of boiled water and steam cooked for 15-20 minutes. After moderate cooling, pellets were prepared with a hand operated pelletizer and dried in sunlight. The feed was prepared with 30% protein. Fish were fed experimental diets supplemented with Spirulina at 0.5, 1.0 and 1.5% concentration and a control diet devoid of probiont (C) were formulated. During the experimental period of 35 days, the prepared diets were fed to the experimental animals 3 times a day at 5% of body weight. The water quality parameters were also observed during the study period.

Food conservation ratio (FCR) specific growth rate (SGR) and weight gain were expressed as following

$$FCR = \frac{\text{Amount of dry food consumed}}{\text{live weight gain}}$$

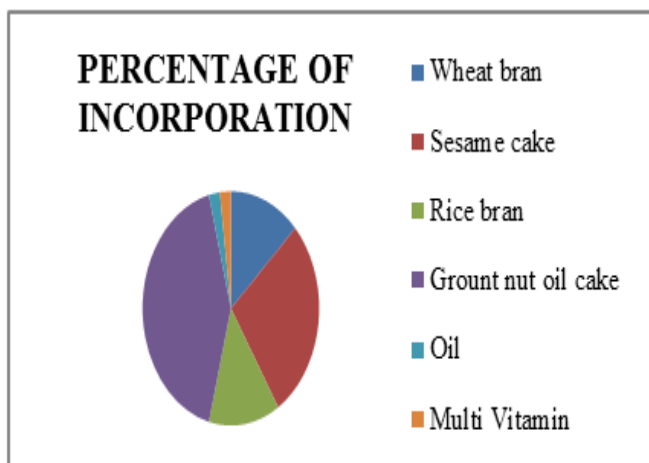
$$SGR = \frac{\ln \log \text{ final weight} - \ln \log \text{ initial weight} \times 100}{\text{Experimental duration (35)}}$$

$$\text{Weight gain} = \text{Final weight (g)} - \text{Initial Weight(g)}$$

Statistical analysis: Data were statistically processed for one way analysis of variance to find out any significant differences among the experimental groups. A significant level of  $p < 0.05$  was used.

### RESULT AND DISCUSSION

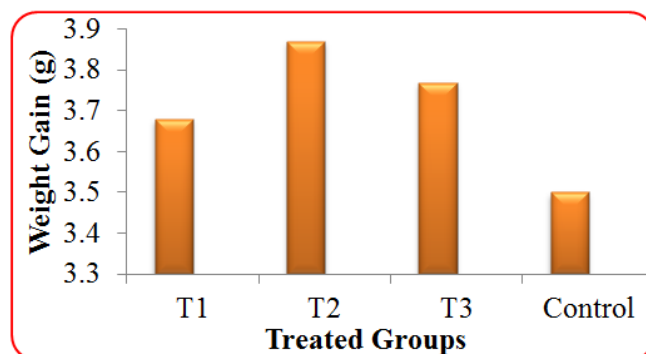
Basal diet maintains the body fit and healthy. Intake of basal diet like fiber, protein content food keeps the body away from diseases. Figure – 1 shows the feed formulation of the basal diet.



The weight gain was obtained for control, T1, T2 and T3. The maximum weight gain was noticed in T2. The initial weight of the fish was  $2.16 \pm 0.04$ g and the final weight was  $6.03 \pm 0.17$ g. The maximum weight gain was  $3.87 \pm 0.91$  in fish treated with experimental diets supplemented with Spirulina at 1.0% concentration. It was followed by fishes fed with T3 ( $3.77 \pm 0.08$ ), T1 ( $3.68 \pm 0.05$ ). The maximum specific growth rate found in T1, T2 and T3 was  $2.84 \pm 0.03$ ,  $2.931 \pm 0.05$  and  $2.88 \pm 0.13$  respectively. The best feed conversion ratio in T1, T2 and T3 was  $2.465 \pm 0.15$ ,  $2.344 \pm 0.13$  and  $2.406 \pm 0.12$  respectively. The better survival was observed in fishes which were fed with probiotics (T1, T2 & T3), when compared to that of the control. The fishes were fed probiotics feed had a maximum survival of 98% in T2, 96% in T3, 95% in T1 and 90% in control.

**Table - 2: Effect of Basal Diet treated with differet probiotics (T1-T3) on growth performance of C.Auratus.**

| Treatment | Initial wt (g)  | Final wt (g)    | Weight Gain (g) | SGR              | FCR              | Survival Rate (%) |
|-----------|-----------------|-----------------|-----------------|------------------|------------------|-------------------|
| Control   | $2.16 \pm 0.03$ | $5.66 \pm 0.15$ | $3.50 \pm 0.05$ | $2.75 \pm 0.12$  | $2.592 \pm 0.09$ | 90                |
| T1 (0.5%) | $2.16 \pm 0.03$ | $5.84 \pm 0.85$ | $3.68 \pm 0.07$ | $2.84 \pm 0.03$  | $2.465 \pm 0.15$ | 95                |
| T2 (1%)   | $2.16 \pm 0.04$ | $6.03 \pm 0.17$ | $3.87 \pm 0.91$ | $2.931 \pm 0.05$ | $2.344 \pm 0.73$ | 98                |
| T3 (1.5%) | $2.16 \pm 0.03$ | $5.93 \pm 0.16$ | $3.77 \pm 0.08$ | $2.885 \pm 0.13$ | $2.406 \pm 0.12$ | 96                |



**Figure - 2: Effect of Basal Diet treated with differet probiotics (T1-T3) on growth gain of C. Auratus.**

The present investigation reveals that fish fed with 1% Spirulina diet elicited the maximum growth parameters like Initial weight, Final weight, Weight Gain, SGR, FGR and Survival Rate. It may be due to the high amount of protein (45%) and growth stimulatory effect of Spirulina in the diet. Spirulina has been identified as a potential protein source for animal feed (Braun, 1988). It contains high protein and many essential amino acids, gamma linolenic acid, beta carotene and phycocyanin pigments, vitamins and minerals in large quantities. James and Sampath, 2004 found that 45% animal protein or plant protein significantly enhanced the feed consumption and growth rate in Xhellari, which supports the observations made in the present study. Scaria et al., 2000 found that ornamental fishes guppy (*Poecilia reticulata*) and platy (*Xiphophorus maculatus*) consumed maximum amount of spirulina substituted feed than those fed with mushroom and azolla. According to Sayed, 1994 Aquaculture is one of the most important options in animal protein production, and required high – quality feeds with protein content as well as some complementary additives to keep organism healthy and favor growth. Higher growth was observed in fish diets containing spirulina than control. Spirulina is considered a rich source of protein, vitamin, minerals essential amino acid and fatty acids gamma linolenic acid (GLA) and antioxidant pigments such as carotenoids as stated by Belay et al., 1996. According to Belay, 1997 Spirulina has a relative high pro vit-A concentration. James et al., (2006) evaluated the effect of dietary spirulina level on growth performance and feed intake in red swordtail and they reported that SGR, feed intake and mean body weight increased with increasing level of spirulina. Mustafa et al., (1994) found that 3-5% incorporation of Spirulina meal produced a significant enhancement of feed utilization and growth in one year-old red sea bream, *Pagrus major*, supports the present investigation. Aravindan et al. (2001) reported that dietary  $\beta$  carotene contents (10-30 mg 100g<sup>-1</sup>) increased the specific growth rate (in terms of mean body length and weight) as compared to non- $\beta$ -carotene diet in gold fish *Carassius auratus*. They also reported that  $\beta$ -carotene treatments did not show significant difference with each other. Paripatananont et al. (1991) reported that dietary supplementation of astaxanthin (36-37 mg/ kg diet) has not significantly ( $p > 0.05$ ) increased the weight gain in gold fish, *C. auratus*. Kiriratnikom et al., 2005 reported that the test diet supplemented with 3% Spirulina resulted in the highest growth performance in gold fish.

Snigdha Baski et al., 2017 reported that the after 60 days of experiment growth rate was found increasing significantly ( $p < 0.05$ ) when they were fed with different dose of spirulina powder incorporated diet and best result were obtained at 2g/kg treated feed in aspects of growth rate and enhanced colouration in *Trichogaster lalius*. Based on the result of the present investigation, it was observed that 1% of Spirulina diet produced more growth in gold fish, *C. auratus* then other treatments.

#### CONCLUSION:

As a result, having no toxicity effect of it. Like the other fields arising of its functions in terms of aquaculture will increase the demand to this microalgae. Using gold fish as a model, the present study showed the usage of spirulina of 1% can be possible in the other aquarium fish food.

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