

## Effect of *Spirulina platensis* meal as a feed additive on growth performance and survival of kissing Gourami (*Helostoma temminckii*).

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### Abstract

The present study evaluates the effect of *Spirulina platensis* as a feed supplement at different rates (1%, 2% and 3%) on the growth, feed conversion rate (FCR) and specific growth rate (SGR) in Gourami fish (*Helostoma temminckii*) as compared with the control feed. Fish fed with 3% *Spirulina* showed better growth performance than those fed with lower level of *Spirulina* diet. As far as the weight gain was concerned, significant differences between the control and the experimental groups ( $P < 0.05$ ) were observed. Significant differences were recorded in SGR and FCR between groups ( $P < 0.05$ ) and SGR and FCR were better in group fed with 3% *Spirulina*. So, 3% *Spirulina* supplemented diet has been recommended to get better growth, SGR and FCR in the Gourami fish.

**Keywords:** Kissing Gourami (*Helostoma temminckii*), Growth performance, Feed conversion rate, Specific growth rate, *Spirulina platensis*

### INTRODUCTION

*Spirulina* is a multicellular, filamentous bluegreen alga that has gained considerable popularity in the health food industry and increasingly as a protein and vitamin supplement to aquaculture diets. *Spirulina* has been used as a complementary dietary ingredient of feed for fish, shrimp and poultry. There has also been comprehensive research on the use of *Spirulina* as aquaculture feed additives in Japan (Habib *et al.*, 2008). Since it is rich in proteins, vitamins, minerals, essential amino acids and fatty acids (Jimenez *et al.*, 2003), *Spirulina* has been used as a potential protein source for fish feed (Nandeeshha *et al.*, 1998).

*Spirulina* can be used as a partial supplementation or complete replacement for protein in aqua feeds, since it is capable of improving growth, immunity and viability of fish as well as it is cheaper than other fish feeds which are of animal origins. Though many feed additives have been used in shrimp farming industries, *Spirulina* is the only microalgal additive which demonstrates benefits to the growers. *Spirulina* has been studied as a feed supplement for the Giant Fresh Water Prawn (*Macrobrachium rosenbergii*) and found to improve growth, survival and feed utilization significantly. The supplementation range was 5 – 20% (Nakagawa and

Gomez – Diaz, 1975). Feeding fish with *Spirulina* helps to improve disease resistance of high value fish resulting in an improvement in their survival rate from 15% - 30% (Habib *et al.*, 2008). The yield of Tilapia (*Oreochromis mossambicus*) fed on *Spirulina* mixed with the ground nut cake was found to be 4 – 5 times higher than that of fish fed on ground nut cake alone (Vonshak, 1997). *Spirulina* was shown to be an excellent substitute for fish meal in Silver Sea Bream (*Rhabdosargus sarba*) diets (EI- Sayed *et al.*, 1994) and in Common Carp, Catla and Rohu (Nandeeshha *et al.*, 2001). This study evaluates effect of the *Spirulina platensis* as a feed additive on the growth performance and survival of Kissing Gourami (*Helostoma temminckii*).

### MATERIALS AND METHODS

#### Experimental fish

The Gourami fish were obtained from commercial hatchery, Thoothukudi, Tamilnadu, India. A total of 240 fish was randomly placed in 12 aquaria for one control (group A) and three replicates. The fish were acclimatized for about one week. Twenty fish were reared in one aquarium and the experiment was conducted for 35 days.

All fish were fed daily at 9.00 am, 14.00 pm and 18.00 pm at 3% of the body weight of fish. Everyday remaining diets were collected by siphoning before feeding. Quantity of feed was adjusted weekly according to the weight of fish in each aquarium. Every third day, water in each aquarium was partially changed (about 50%).

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### Experimental Diets

The components of basal diet presented in Table 1 provided adequate nutrient supply to fish. Table 2 shows the proximate composition of experimental diets on dry weight basis. Fish diets consisted of the basal diet (control group A) and three doses of supplementation with *Spirulina platensis* i.e., 1%, 2% and 3%, (Group B, Group C and Group D) respectively. All the ingredients were made as pellet feed forms and stored in dry sterilized containers at - 20°C.

**Table 1:** Ingredients of basal and experimental diets on dry weight basis.

Ingredients %	Diets			
	Group A	Group B	Group C	Group D
Spirulina Powder	0.00	1.00	2.00	3.00
Fish meal	27.70	25.50	23.00	20.00
Rice bran	34.00	34.00	34.00	34.00
Soybean meal	21.00	21.00	21.00	21.00
Rice flour	16.80	18.00	19.50	21.50
Vitamin C	0.50	0.50	0.50	0.50

**Table 2.** Proximate composition of basal and experimental diets on dry weight basis.

Proximate composition(%)	Diets			
	Group A	Group B	Group C	Group D
Crude protein	30.16 ± 0.16	30.08 ± 0.3	30.12 ± 0.2	30.17 ± 0.8
Crude lipid	7.74 ± 0.17	7.80 ± 0.2	7.56 ± 0.5	7.81 ± 0.7
Ash	11.24 ± 0.03	11.30 ± 0.02	11.26 ± 0.01	10.96 ± 0.02
Crude fiber	6.87 ± 0.7	6.53 ± 0.2	6.93 ± 0.07	6.42 ± 0.2

Values are mean ± SD. No significant difference was detected within each row (p >0.05)

### Statistical analysis

One way analysis of variance (ANOVA) was used to find out whether there were any significant differences in various parameters among the treatment and the control groups. Statistical significant i.e., at p<0.05 level was used for interpretations.

### RESULTS

Table 3 shows that *S. platensis* supplemented to the diet could increase the growth, SGR and survival of *Helostoma temminckii*. No significant difference was observed with regard to weight among the treatment groups (Group B, Group C and Group D) and the control (Group A). After 35 days, there was a significant difference seen between the weight gain of control and experimental groups. The weight gain in each group increased with increasing concentration of *Spirulina*.

But there was no significant difference (p< 0.05) between group C and group D. Maximum weight gain was seen in group D (3.61 ± 0.07g). Dry weight gain (DWG) was significantly higher in both groups C and D (0.102± 0.006g and 0.103±0.06g respectively) than group B and control.

**Table 3.** Growth performance and survival rate of Gourami fed with experimental diets.

Parameters	Diets			
	Group A	Group B	Group C	Group D
Initial weight (g)	1.25 ± 0.05 <sup>a</sup>	1.25 ± 0.05 <sup>a</sup>	1.25 ± 0.05 <sup>a</sup>	1.25 ± 0.05 <sup>a</sup>
Final weight (g)	4.31 ± 0.06 <sup>a</sup>	4.51 ± 0.03 <sup>b</sup>	4.82 ± 0.04 <sup>c</sup>	4.86 ± 0.07 <sup>c</sup>
Weight gain(g)	3.06 ± 0.07 <sup>a</sup>	3.26 ± 0.04 <sup>b</sup>	3.57 ± 0.06 <sup>c</sup>	3.61 ± 0.07 <sup>c</sup>
DWG (g)	0.087 ± 0.007 <sup>a</sup>	0.091 ± 0.001 <sup>a</sup>	0.102 ± 0.006 <sup>b</sup>	0.103 ± 0.06 <sup>b</sup>
SGR (%)	3.53 ± 0.09 <sup>a</sup>	3.66 ± 0.03 <sup>a</sup>	3.85 ± 0.04 <sup>b</sup>	3.88 ± 0.06 <sup>b</sup>
FCR	2.05 ± 0.05 <sup>c</sup>	1.93 ± 0.03 <sup>b</sup>	1.76 ± 0.02 <sup>a</sup>	1.74 ± 0.04 <sup>a</sup>
Survival (%)	90	95	95	96

Values with different superscript letters are significantly different (p<0.05); value are mean ± SD.

The values of SGR and FCR in all groups treated with *Spirulina* at all concentrations were significantly better than those of control. Better survival was observed in fish which were fed with *Spirulina* when compared to the control. The maximum survival was seen in groups C and D with 96% survival rate.

### DISCUSSION

Using plant products as protein sources in fish feeds has been shown to have considerable application potential for aquaculture worldwide (Yagci *et al.*, 2009). Use of *Spirulina* in Guppy diet showed that increasing level of *Spirulina* diet provides better growth compared to other commercial feeds (Dernekbası *et al.*, 2010). Fish fed with 8% *Spirulina* diet showed better growth performance than those fed with lower levels (James *et al.*, 2006). Abalone (*Haliotis midae*) showed good growth, when fed with a diet containing *Spirulina* meal (Britz, 1996). The replacement of artificial diet for post-larvae of Abalone, *Haliotis discus* (Reeve) using *Spirulina* gave good growth performance (Stott *et al.*, 2004).

It was also reported that dried algae are used as feed additives, they improve growth, feed efficiency, carcass quality and physiological response to stress and disease in several species of fish (Mustafa and Nakagawa 1995). Ungsethaphand *et al.*, (2010) suggested that 20% *Spirulina* can be substituted for fish meal in a fish meal based diet for Hybrid Red Tilapia without any adverse effects on fish growth and proximate composition. The highest weight yield has been found among the Mekong Giant Cat fish (*Pangasianodon gigas*) that are fed with the feed that contains 5% *Spirulina* (Tongsiri *et al.*, 2010). Similar result was reported in Pla pho (*Pangasius bocourti*) fed with *Spirulina* supplementary pellet

(Meng-Umpham, 2009). The present study showed the maximum weight gain was in fish fed with 3% *Spirulina* (Group D).

Ramakrishnan *et al.*, (2008) reported the effects of two probiotics and *Spirulina* with rates of 1%, 2% and 3% on survival, growth and FCR in Common Carp (*Cyprinus carpio*). Fish fed with diets containing 3% *Spirulina maximus* showed the best survival, growth and FCR. Similar results were obtained in this study, *i.e.*, 3% *Spirulina platensis* (group D) treated fish showed better survival, growth, FCR and SGR.

## CONCLUSION

The results of the present study showed that 3% spirulina incorporated feed can be used for *Helostoma temminckii*, to improve growth performance, DWG, FCR, SGR and survival rate.

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