Effect of feed supplement on growth of *Labeo rohita*

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**ABSTRACT**
Fish require adequate nutrition in order to grow and survive. The role of artificial feed in intensive fish farming cannot be ignored as nutritional requirements of fish depend upon the feed supplied. The study of effect of spirulina as a feed supplement on survival and growth of *Labeo rohita* has been conducted in the departmental ponds for a period of 90 days. Highest value for survival and growth gain in the fishes was observed in feed impregnated with 5% Spirulina.

**Keywords:** Rohu, pond, growth, Survival.

**1. INTRODUCTION**
Nature offers a great diversity of food to fish including plants and animals. Artificial feed plays an important role in semi intensive fish culture where it is required to maintain a high density of fish than the natural fertility of the water can support (Jhingran, 1991). The quantity and quality of feed consumed have a pronounced effect on growth rate,
efficiency of feed conversion and chemical composition of fish (Hassan et al., 1996; Jena et al., 1998; Erfanullah and Jafri, 1998).

Spirulina has been used as a complementary dietary ingredient of feed for fish. China is using this micro-alga as a partial substitute of imported forage to promote the growth, immunity and viability of shrimp. There has also been comprehensive research on the use of Spirulina as aquaculture feed additives in Japan and other major countries of the world. One of the most essential and major operational inputs in successful aquaculture is the fish feed. Up to 60% of the operational expenditure may be required as feed costs in these culture systems. Therefore, considering the specific nutritional requirements of the particular cultivated species, the artificial feed need to be formulated and prepared by scientifically applying proper processing techniques. The protein and amino acid requirements of fish have been reviewed by Tacon et al. (1985). In general the dietary protein requirement of fish ranges between 35 and 55% or an equivalent of 45 – 75% of the gross energy content of the diet should be in the form of protein (Tacon et al. (1985)).

2. MATERIALS AND METHOD

Procurement of Spawn

For the purpose of present study, healthy, disease free fry of Labeo rohita were collected from Central Institute of Fisheries Education (CIFE) centre, Powarkheda, Madhya Pradesh. Fry were brought to the Department of Zoology and Applied Aquaculture, Barkatullah University under oxygen packing and were introduced in the Pond-1 and Pond-2 of the Department of 20 x 20 m size.

Formulation of basal diet

Basal diet with 35 - 40% protein content was formulated following the Pearson square method. Proportionately selected ingredients were quantified and presented in Table 1.

Preparation of control diet

Artificial diet was prepared to feed the fishes with various feed ingredients. Fish meal, wheat flour were finally ground and proximate analysis was performed using standard methods given in AOAC, 1995. Based on this analysis, one practical diet was formulated containing 40% protein. The finely ground ingredients were thoroughly blended with cod liver oil using a food mixer for 15 minutes. Vitamin and mineral mixes were then added by continuous mixing. Distilled water (27°C) was slowly added to the feed to get desired consistency for pelleting. This was then extruded in hand pelletizer using a 1mm die and dried for 4 - 6 hours below 45°C and subsequently air-dried overnight to reduce moisture content less than 10%. Dried feed was chopped into pellets in a blender passed through sieves to ensure a homogenous particle size (0.5 - 1.0 mm). The feed was further stored at room temperature in air tight jars. In every feed, same amount of fish-meal was removed as different amount of Spirulina was added. This was done due to the close range of protein level in both the additives (60-65%).

Preparation of experimental diet

Three experimental diets impregnated with Spirulina were prepared by replacing fishmeal in the basal diet by Spirulina powder at the rate of 5%. Different percentages of fish meal were used for feed formulation while wheat flour, cod liver oil and vitamin-mineral mixture contents were the same as in all the four formulated feeds. The feed was pelleted with hand pelletizer, dried in hot air oven at 50°C and stocked in air tight jars (Table 2).

Table 1
% age composition of Basal diet

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>% Diet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish Meal</td>
<td>51.25</td>
</tr>
<tr>
<td>Wheat flour</td>
<td>36.75</td>
</tr>
<tr>
<td>Vitamin Premix (Tablets)</td>
<td>2.00</td>
</tr>
<tr>
<td>Cod liver oil</td>
<td>10.00</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

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Table 2
Percentage composition of various ingredients in experimental diets/100 g

<table>
<thead>
<tr>
<th>Diets</th>
<th>Fish meal</th>
<th>Wheat flour</th>
<th>Cod- liver oil</th>
<th>Vitamin premix</th>
<th>Spirulina</th>
<th>Protein content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>51.25%</td>
<td>36.75%</td>
<td>10.00%</td>
<td>2.00%</td>
<td>0%</td>
<td>34.79%</td>
</tr>
<tr>
<td>Experimental (5%Spirulina)</td>
<td>46.25%</td>
<td>36.75%</td>
<td>10.00%</td>
<td>2.00%</td>
<td>5.00%</td>
<td>35.04%</td>
</tr>
</tbody>
</table>

Table 3
Showing observed average weight (gm) of Labeo rohita using different feeds

<table>
<thead>
<tr>
<th>Ponds</th>
<th>Feeds</th>
<th>Initial average Weight</th>
<th>15\textsuperscript{th} Day</th>
<th>30\textsuperscript{th} Day</th>
<th>45\textsuperscript{th} Day</th>
<th>60\textsuperscript{th} Day</th>
<th>75\textsuperscript{th} Day</th>
<th>90\textsuperscript{th} Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1\textsuperscript{st}</td>
<td>Control Feed</td>
<td>3.1</td>
<td>10.1</td>
<td>17.6</td>
<td>25.9</td>
<td>33.9</td>
<td>40.6</td>
<td>47.1</td>
</tr>
<tr>
<td>2\textsuperscript{nd}</td>
<td>5% Spirulina</td>
<td>3.3</td>
<td>11.2</td>
<td>19.6</td>
<td>27.6</td>
<td>35.6</td>
<td>43.4</td>
<td>51.2</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Ponds</th>
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<th>15\textsuperscript{th} Day</th>
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<th>45\textsuperscript{th} Day</th>
<th>60\textsuperscript{th} Day</th>
<th>75\textsuperscript{th} Day</th>
<th>90\textsuperscript{th} Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1\textsuperscript{st}</td>
<td>Control Feed</td>
<td>1.8</td>
<td>3.1</td>
<td>5.8</td>
<td>7.8</td>
<td>9.1</td>
<td>12.6</td>
<td>15.5</td>
</tr>
<tr>
<td>2\textsuperscript{nd}</td>
<td>5% Spirulina</td>
<td>1.9</td>
<td>3.9</td>
<td>6.0</td>
<td>9.2</td>
<td>11.3</td>
<td>15.2</td>
<td>18.0</td>
</tr>
</tbody>
</table>

**Physico-chemical parameters of water**
The physico-chemical parameters of water like temperature, pH, DO, free CO\textsubscript{2}, alkalinity and total hardness were analysed by using methods given by APHA (1995) from the month of September to November, 2013.

**Detail of the experiment**
The average length and weight of individual fry was recorded before transferring them into experimental ponds. 150 fry were randomly selected and transferred to individual experimental ponds. Pond-1 was considered as control in which feed devoid of Spirulina was given. Pond-2 was supplied with feed impregnated with Spirulina at the rate of 5% of the biomass, twice a day, morning (8.00 am) and evening (5:00 pm).

After every 15 days, mean average length and weight of the fishes was recorded separately for each pond for 90 days. Accordingly, feed ration was adjusted to 10% of the biomass, every time (Figure 1).

**3. RESULTS**
**Physico-chemical observations**
The physico-chemical analysis for the parameters like, temperature, pH, free CO\textsubscript{2}, alkalinity and total hardness was carried out for Pond 1 and Pond 2 separately.

**Growth and Survival rate analysis**
Highest value for average length and weight gain in the fishes was observed in feed impregnated with 5% Spirulina which came out to be 18.0 cm and 51.2gm, respectively and lowest value for average length and weight gain in the fish was observed in feed without Spirulina as as15.5 cm. and 47.1 gm, respectively (Table 3). 98% survival rate was observed in the feed impregnated with Spirulina at all the percentage levels respectively. Whereas, 89% survival rate was observed in fishes fed without Spirulina.

**4. DISCUSSION**
Fish fed diets containing Spirulina (5 g/kg) had significantly better growth and feed utilization as compared to fish fed with the control diet. The present study proved that dietary supplementation of Spirulina enhanced fish growth. These results may possibly be due to the improved feed intake and nutrient digestibility. Moreover, Spirulina contains several nutrients especially vitamins and minerals that may help in fish growth promotion. These results agree with those found by Belay et al. (1996), Hayashi et al. (1998), Hirahashi et al. (2002) who reported that feeding Spirulina to...
fish and poultry improved survival and growth rates. Nandeesha et al., (2001) studied the influence of *Spirulina platensis* meal on the growth of two Indian major carps, *catla* (*Catla catla*) and *rohu* (*Labeo rohita*). The specific growth rate and protein efficiency ratio recorded in *rohu* improved with higher levels of *Spirulina* inclusion, while in *catla* they did not differ significantly from the control treatment. But in our study, it was observed that length, weight gain, and survival of *Labeo rohita* was significantly best with the addition in *Spirulina* content in the feed.

5. CONCLUSION

From the present investigation, it is clear that *Spirulina* impregnated feed enhanced length, weight gain and survival. With the addition of *Spirulina* in moderate amount (5%) in fish feed the quality of the feed is improved in the experiment. As the cost of the formulated feed is also of utmost importance for aquaculture industries the input cost is also not significantly affected with the addition of *Spirulina* to a moderate level (5%). So, addition of *Spirulina* in the fish feed may be used to enhance the growth of the fish.

REFERENCE