AN ECONOMIC ARTIFICIAL LABORATORY FEED FOR FRESHWATER FISHES AND IT’S IMPACT ON GROWTH RATE OF CHANNA PUNCTATUS (ADULT & FRY)

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INTRODUCTION
Nutrient essentials to the freshwater fish are same as those required by most other animals. These include water, proteins, lipids (fat, oils, and fatty acid), carbohydrate (sugar, starch), vitamins and minerals. Study of food and feeding habits of fish have manifold importance in fishery biology (Hertrampf and Piedad-Pascual, 2000). The food consumption of fish varies with season, different age and their adaptation (Dewan and Saha, 1979; Moyle and Cech, 2000). Seasonal change in temperature influence food consumption and rate of digestion. Various studies on the food and feeding habits of different fish have been made by different workers time to time (Cho, 1980; Mustafa et al., 1981; DeKoven et al., 1992; Bengston, 1993; Bhuiyan et al., 1994 and 2006; Jhingran, 1997; Ali et al., 2003; Kumar et al., 2005). Feed acceptability, palatability and digestibility vary with ingredients and feed quality. Optimum feeding rates can be calculated on the basis of average size in length or weight and the number of fish in the tank or pond (Andrews and Stickney,1972).

In captivity fish have become adapted to a variety of food. In nature fish have different feeding habit some of them feed exclusively on plants other feed on animals while large number of species are omnivores deriving their requirement from both animals and plants. The carnivores’ fish feed on live foods that introduced parasites and bacteria into their place after decomposition of the remaining food material in the water body. This risk can be eliminated by adopting artificial food with complete balanced nutrition diet. Artificial diets may be either complete or supplementary type. Complete diet supply all the ingredients (protein, carbohydrate, fat, vitamins and minerals) necessary for the optimal growth and health of the fish. Those containing all the required proteins (15.0 – 18.0%), carbohydrate (15.0 – 20.0 %), ash (8.5%), phosphorous (1.5 %), water (10.0 %) and trace amount of vitamin and minerals (Saxena, 2003). The nutritional value of dietary ingredients is in part dependent on its ability to supply energy.

Artificial fish food should be like that which can prepare easily and their all the ingredients should be available locally and that should not be very costly. Current article presents a recipe on the preparation of a feasible and economic dietary food that can be edible for most of the fresh water fish in spite of their feeding habit (carnivorous or herbivorous and their age viz. adult and fry) and its impact on growth of body weight on different age (adult and fry) of fish Channa punctatus.

MATERIALS AND METHODS
Feasible and economic dietary food was prepared with the ingredients those were obtained easily from local market, home and laboratory. Ingredients and their quantity are listed below:

<table>
<thead>
<tr>
<th>Key Word</th>
<th>Description</th>
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<tbody>
<tr>
<td>Freshwater fish</td>
<td>Artificial fish feed</td>
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</table>

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The cheesewas grinded and simmers in the water until dissolved, in it the meshed goat liver was added and stirred, the mixture become sticky, now it was removed from heat. Mixture was cooled and in it CaCO₃ and grinded spinach was mixed. Egg white and yellow portion of two eggs were mixed properly and added to wheat flour until the mixture became very thick and doughy. The gelatin crystals were dissolved into the half cup of hot water. Now all mixed properly in dough and kneaded. The same dough was used for pelleting in very small pieces measuring about 2 mm - 4mm. Pellets were kept in oven at temperature 60 °C to make it dry for two to four hours and after cooling were kept in a air tight container. At the time of feeding the pellets can be crushed again to make small size according to fish to make easily gulping level. This artificial food consumption was checked for different fresh water fish species and different age group. Further it was evaluated the efficiency of artificial prepared feed in the adult and fry of C. punctatus as compared with single diet as boiled egg (crushed) at the initial period and after one month of consumption.

Statistical analysis
The statistical analysis of the alterations in body weight growth was done subjected to one way analysis of variance (ANOVA) followed by Student’s t-tests to resolve the statistical significance of differences between the boiled egg feed and artificial laboratory feed. The data of this work were presented as mean ± SEM (standard error of mean).

RESULTS AND DISCUSSION
This artificial food consumption was checked for different carnivorous (Clarias batrachus, Channa punctatus), herbivorous (Oreochromis mossambica, Labeo rohita), omnivorous (Heteropneustes fossilis) and different age group (adult and fry) fish. Different species and different age groups of fish show variation in eating behaviour for the same artificial fish. As H. fossilis eat this feed in more frequent manner followed by Tilapia (Oreochromis mossambica) and rest of other carnivorous fish (Table 2). This is widely accepted fish feed for carnivorous fish also. Current study showed the body weight of adult and fry fish Channa punctatus were significantly \( P<0.05 \) increased when compared with fish taken single diet as crushed boiled egg (Table 3). In the case of fish fry the percentage of body weight growth was decreased after one month consumption of boiled egg because of they were not eat with proper interest. The prepared artificial feed was equally palatable to fry of fish species. The artificial feed can be stored for months without any change in its composition in room temperature.

Table represents significant alteration of body weight of fry \((p<0.05)\) and adult \((p<0.05)\) fish after consumption of boiled egg and artificial feed, which were analysed by one way ANOVA followed by student’s t-test. All values expressed as mean ± SEM \((n = 5)\). The parenthesis shows percentage of increased/decreased body weight.

In their natural environment fish have developed a wide variety of feeding specialization (behavioural, morphological and physiological) to acquire essential nutrients and utilize variety of food sources. Based on primary diets fish are classified as carnivores, herbivores or omnivores. However regardless of their feeding classification in captivity fish can be taught to readily accept various prepared foods which contain the necessary nutrients (Tacon, 1988). Feeding a single type of food is neither complete nor balanced and does not supply all the nutrients to a fish might need in its diet. Therefore the fish must be fed with artificial food to supplement natural food. The rate of growth (body weight) as in current study and survival of African catfish, Clarias gariepinus fingerlings was increased due to the application of different feed formulation (Marimuthu et al., 2011). The prepared artificial feed is good in quality having majority of required nutrients. Among the components of the prepared artificial feed, gelatin acts as primary binder which reduces leaching of the nutrients in the water. Gelatin based diet are popular in the aquarium fish industry and useful for the preparing medicated feeds at home (Meyers and Brand, 1975; Lovell, 1989; DeKoven et al., 1992).

Protein ingredients are the most expensive as well as important components of artificial diets. Protein used for fish growth as the crude protein level in feed increased, weight gain percentage increased (Desilva et al., 1991; Desilva and Anderson, 1995; Kumar et al., 2005). Protein requirement usually lower for herbivores fish and followed by omnivores fish than of carnivores fish. This also vary with rearing environment, water temperature and water quality as well as genetic composition and feeding rate of fish (Moyle and Cech, 2000). In the formulated diet cheese, egg and goat liver were used as protein source as goat liver was very palatable to carnivores fish and cooked liver was eaten by both herbivores as well as carnivores fish.

A recent trend in fish feeds is to use higher levels of lipid in the diet. Because lipid supply about twice the energy as compare to protein and carbohydrate. Lipids typically comprise about

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of Ingredients</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>1.</td>
<td>Wheat flour</td>
<td>250 g</td>
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<tr>
<td>2.</td>
<td>Calcium carbonate</td>
<td>11 g</td>
</tr>
<tr>
<td>3.</td>
<td>Pure gelatin crystal</td>
<td>9 g</td>
</tr>
<tr>
<td>4.</td>
<td>Cheese</td>
<td>100 g</td>
</tr>
<tr>
<td>5.</td>
<td>Goat liver</td>
<td>100 g</td>
</tr>
<tr>
<td>6.</td>
<td>Green vegetables (Spinach)</td>
<td>15 g</td>
</tr>
<tr>
<td>7.</td>
<td>Eggs</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>Water</td>
<td>As required</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Consumption rate</th>
<th>Fish species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>10g / day</td>
<td>Omnivorous</td>
</tr>
<tr>
<td>2.</td>
<td>8g / day</td>
<td>Herbivorous</td>
</tr>
<tr>
<td>3.</td>
<td>6g / day</td>
<td>Carnivorous</td>
</tr>
<tr>
<td>4.</td>
<td>2g / day (meshed)</td>
<td>Carnivorous</td>
</tr>
</tbody>
</table>

Table 1: Composition of artificial fish feed, as prepared in laboratory for fresh water fish

Table 2: Evaluation of food consumption in different fish species
15% of fish diets supply essential fatty acid and serve as transporters for fat soluble vitamins (Winfree, 1992). In the present fish feed egg yolk was used as lipid source. Fresh water fish under natural feeding condition have low body fat. Higher deposition of total lipid and total glycerides were found in carnivorous followed by omnivorous and least in plankton feeders (Kumar et al., 2005).

Carbohydrates are the most economical and inexpensive source of energy for fish diets to reduced feeds cost and for their building activity during feed manufacturing. Wheat flour is commonly found and economic carbohydrate source. In fish carbohydrate are stored as glycogen that can be utilized to satisfy energy demands (Bhuiyan et al., 1999).

Vitamins and minerals are necessary in the diets for complete fish health. Deficiency of each vitamin has certain specific symptoms, but reduce growth is the most common symptom of any vitamin deficiency (Francis-Floyd and Reed, 1994; Hardy and Burrows, 2002). In present artificial feed green vegetables mainly spinach was used to fulfil this requirement. Since several artificial diets are available in the market that have a well-defined composition but are expensive in terms of their prize and consumption. On the other hand the present artificial fish food is very economic and easy to prepare in large amount to fulfil the daily diet requirement of the cultured fish. The growth performance of fish can be readily determined after modifications of a control diet, this required extra attention for the given artificial feed. Current manufactured artificial feed overcome the feed substitute problem for a pond having different feeding habit fish (mixed-culture), and of different age (hetero-culture) but their impact on growth are remain to be studied.

In conclusion the prepared food was taken by most of the fresh water fish and also by the fish fry of both herbivorous and the carnivorous fish, but the study on effect of the feed on their growth and on their reproductive efficiency is left and required extra attention.

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REFERENCES


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Table 3: Impact of feed on growth rate of fish C. punctatus - adult and fry

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Fish (C. punctatus) Growth rate</th>
<th>Initial body weight</th>
<th>After one month body weight Boiled egg (crushed)</th>
<th>Artificial laboratory feed</th>
<th>F – value(P value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Adult (mg / month)</td>
<td>35.84 ± 0.73</td>
<td>38.20 ± 0.32 (+6.91%)</td>
<td>44.24 ± 0.97 (+23.43%)</td>
<td>69.56(P&lt;0.05)</td>
</tr>
<tr>
<td>2.</td>
<td>Fry (mg / month)</td>
<td>18.09 ± 0.92</td>
<td>16.66 ± 0.47(-7.90%)</td>
<td>21.19 ± 1.49(+14.13%)</td>
<td>42.81(P&lt;0.05)</td>
</tr>
</tbody>
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REMOVAL OF HEAVY METALS

