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RESEARCH ARTICLE

NUTRITIONAL EFFECT OF LIVEFEED ON GROWTH AND BIOENERGETICS IN CIRRHINUS MRIGALA FINGERLINGS

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ABSTRACT

Feeding habit of the fish is very difference in the form of carnivorous, herbivorous and omnivorous and also there is a large diversity in their feeding patterns. Very young fish prefer to have eat from live feed due to their mouth size and the immaturity of the digestive system, otherwise they do not take the food will have starvation. The nutritional status of feed in fishes is important in determining the ability of fish to resist various diseases. Therefore, there is a clear need for a proper diet to improve the health and to prevent the outbreaks of disease. Presentstudy consisted of five dietary treatments in triplicate groups. The mrigal fingerlings fed with 100% of Pelleted feed (T1), 50% of Pelleted feed and 50% of Chironomous (T2), 100% of Chironomous (T3), 100% of Tubifex (T4), 50% of Pelleted feed and 50% of Tubifex (T5).Growth measurement such as weight and length of *cirrhinusmrigala* fingerlings were recorded indivually. At the end of 30 days experimental period specific growth rate, food conversion ratio, food conversion efficiency, Average daily weight of fingerlings fed with different experimental diets were calculated. *Cirrhinusmrigala* fingerlings attained significantly higher body weight (1.47&1.39) in T4 and T5 fed groups. The highest length gain was found to be 0.8mm in treatment T4 fed with mixed experimental diet. This was significantly higher than the rest of the treatments. The highest percent length gain was 70 in the fish fed with live feed diets. The positive effect of feeding of *Cirrhinusmrigala* fingerlings with live food was found in this present work.

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INTRODUCTION

Live foods are highly nutritious sources of micro and macro nutrients, vitamins, fats, proteins and carbohydrates. The use of live foods stimulates the natural eating environment for captive aquatic life, making the stock more vibrant and colourful. Furthermore, live food is an excellent conditioning agent for brood stock. Its high nutrient concentration encourages spawning activities; hence increasing breeding success rates. The most important live foods include: Artemia, rotifer, daphnia, copepods, tubifex, blood worms, infusoria, mosquito larvae and phytoplankton. Artificial larval feeds are no match to live food organisms in terms of acceptance, nutritional and other factors. Feeding habit of fishes in natural water bodies is different among the species but all the fishes require protein rich live food for their better growth efficient breeding and survival (Mandal *et al.,* 2009). Advances in live food enrichment technique have helped to boost the importance and potential of live food organisms in the raising of larval aquatic species. The success in the hatchery production of fish fingerlings for stocking is largely dependent on the availability of suitable live food for feeding fish larvae, fry and fingerlings.

Live food organisms contain all the nutrients such as essential proteins, lipids, carbohydrates, vitamins, minerals, amino acids and fatty acids (New, 1998) and hence are commonly known as "living capsules of nutrition''. Providing appropriate live food at proper time play a major role in achieving maximum growth and survival of the young ones of finfish and shellfish. To achieve maximum production and profitability, the nutritional components of natural foods must be identified and quantified. The chironomid larvae are recognized as an important food for many fishes and cultured invertebrate. These live foods are very popular in aquarium fish trade. Chironomid larvae are excellent source of protein, lipid, vitamins and minerals (Mclarney *et al.,* 1974). Tubifex worms are often used as a live

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food for fish, especially tropical fish and certain other freshwater species. They have been a popular food for the aquarium trade. Tubifex worms act as feed ingredient and appetite stimulant in fishes. The present investigation was attempted to study the efficacy of commercially available live feed for better growth and to determine the appropriate feed of Indian major carp species *cirrhinusmrigala.*

MATERIALS AND METHODS

Experimental procedure and feeding trails

In the present study three different feeds such pelleted artificial feed, livefeed such as chironomous and freeze dried tubifex were evaluated for their suitability as feeds for the mrigal fish fingerlings. For the experimental feeding fishes were fed under five treatments viz (T1,T2,T3,T4&T5). Freeze dried tubifex feed was obtained from the commercial aquafarm. Chironomous larvae were obtained from the culture systems in the fishfarm and were kept under mild flow of running water for 2h for removal of feces and mud from the body before feeding fish.

The quantity of live and artificial feed supplied daily to the treatment troughs was equivalent 4% of the total fish fingerlings biomass. Both live and artificial feed were given one time per day during the experimental period (30days). The unfed and fecal matters were siphoned out. The water was exchanged daily with freshwater before the feed ration was given.

The experiment consisted of five dietary treatments in triplicate groups. The mrigal fingerlings fed with 100% of Pelleted feed (T1), 50% of Pelleted feed and 50% of Chironomous (T2), 100% of Chironomous (T3), 100% of Tubifex (T4), 50% of Pelleted feed and 50% of Tubifex (T5). At the end of the experiment, the test animals were weighed to estimate the growth of animals. All weighing were made in an electrical digital balance too an accurancy of 0.01g. Before beginning the experiment, total body length (mm) and weight (gm) of the fish fingerlings in each trough were measured. Mean body weight (g) was calculated by wet weight of test animals divided by total number ofanimals in the trough at that time.

Bio energetic studies

Food utilization

The scheme of energy budget followed in the present work is that of the IBP formula of petrusewicz and macfadyen (1970) usually represented as

C = P + R + F + U

Where
C = Food consumption
P = Production (growth)
R = Respiration (mettabolism)
F = Faeces
U = Nitrogenous excretory products (urine)

Food consumption (C)

Food consumption was estimated gravimetrically in terms of dry weight by subtracting the dry weight of the unfed from the dry weight of the food supplied.

Food absorbed (A)

Food absorbed was estimated by subtracting the dry weight of faeces from that of food consumed.

$$A = C – F$$

Food convered (P)

Food converted was determined by subtracting the dry weight of fish at the commencement of the experiment from the dry weight of the fish at the termination of the experiment. To determine their initial dry weight, control samples consisting two testing individuals of *Cirrhinusmrigala* were separately weighed and dried at 60^0C.

Food metabolized (R)

Food metabolized was estimated by subtracting the sum of tissue production from the food absorbed

$$R = A – P + U$$

Energy budget

Rates of feeding, absorption, conversion and metabolism were calculated by dividing the respective quantities of the products of initial weight of the fish (mg) and duration day of the experiment. The rate was expressed as mg dry wt/gm live fish / day.

Consumption rate (Cr) = Food consumed (mg) / Live wt. of fish (mg) x No. of days
Absorption rate (Ar) = Food absorbed (mg) / Live wt. of fish (mg) x No. of days
Conversion rate (Pr) = Food converted (mg) / Live wt. of fish (mg) x No. of days
Metabolic rate (Mr) = Food metabolized (mg) / Live wt. of fish (mg) x No. of days
Food conversion Ratio (FCR) = Dry food intake / Wet body weight gain
Food conversion efficiency = Growth (live) / Consumption
Where
W_o= Final live weight
W_1 = Initial live weight
T = Experimental duration
Average daily gain (ADG) = Growth (live weight) / Experimental duration
Food conversion efficiency (FCG) = Growth (live weight) / Consumption
Length gain of fish = Average final length – Average initial length of fish
Weight gain of fish = Average final weight of fish – Average initial weight of fish

Percent gain in length = Average final length-Average initial length/Average initial length x 100

Statistical analysis

The data obtained in the present study were expressed as mean ISD. Further, a multiple comparison test was conducted to compare the significant differences among the treatments. Growth parameters were estimated using standard methods suggested by Annet (1985), Desilva (1995).

RESULTS AND DISCUSSION

In the present work, the 30 days experiment was conducted with a view to observing the effect of different types of diets (formulated pelletted feed and livefeeds) on the growth of *Cirrhinusmrigala*fingerlings (Table 1).

Table 1. Composition of different types experimental feeding trails

S.No	Experimental diets	Composition	Percentage ratio of diets
1	Feed-T1	Control	100
2	Feed-T2	Control +Chironomous	50 : 50
3	Feed-T3	Chironomous	100
4	Feed-T4	Tubifex	100
5	Feed-T5	Control + Tubifex	50 : 50

Cirrhinusmrigala fingerlings of different experimental diets were fed at the rate of 4% of the body weight. The feeding rate was adjusted accordingly with respect to the biomass gain over a period of 7 days. The amount of feed required was determined by calculating the weight of all the fish's indivually in a group. The composition of ingredients used in formulated feed is given in Table 2. Control feed had soyabean meal, ground nut oil cake, Rice bran, Wheat flour, Vitamins and minerals. The Tapioco Powder was used as binder.

Table 2. Ingredients and proximate composition of formulated control diets

S.No	Ingredients	Weight/ Percentage (gm/%)
1	Soyabean meal	25.0
2	Ground nut oil cake	25.0
3	Rice bran	25.0
4	Wheat flour	10.0
5	Tapiaco	10.0
6	Fish oil	3.0
7	Vitamins and Minarals	2.0

The overall energy budget of C*irrhinusmrigala*fed on different feed types (T1, T2, T3, T4 , & T5) were recorded in Table 3 and table-4. In the present work, the amount of dry substance gained or loosed by the fish after 30 days of feeding was calculated and expressed as gm dry substance gained / lost/ fish /day. The feeds given were adjusted at 7 days intervals after the fishes were weighed. The consumption rate, Absorption rate, Conversion rate and food metabolic rate was tabulated in Table 3. The consumption rate was highest (38.85g) in feed T4 whereas the lowest consumption (16.94g) was recorded in T1type of feed. Same trend was also noticed in absorption rate. The maximum absorption rate (30.43g) and minimum (9.68g) was noticed in feed type T4and T1respectively. The conversion rate of T1, T2, T3, T4and T5 feed type was 2.17, 8.62, 11.45, 26.43and 9.63 respectively. The maximum conversion rate was recorded in T4feed type. The food metabolic rate was 14.94, 22.01, 23.51, 20.64, and 25.98 in T1, T2, T3, T4and T5experimental diets. Among the all test feeds, control (14.94g) had lower values than other diets. Maximum metabolic rate (25.98g) was noted in T5 feed type (Table 3).

Table 3. Overall energy budget of different live feed and formulated control feed. Each value (gm) represents the mean of three observations

S.No	Types of Feed trail	Consumption rate	Absorption rate	Conversion rate	Food Metabolic rate
1	T1	16.94±0.40	9.68±0.19	2.17±0.28	14.94±0.41
2	T2	30.28±0.38	26.16±0.17	8.62±0.11	22.01±0.04
3	T3	35.10±0.26	25.97±0.11	11.45±0.41	23.51±0.55
4	T4	38.85±0.31	30.43±0.47	26.43±0.52	20.64±0.55
5	T5	32.22±0.32	28.96±0.50	9.63±0.12	25.98±0.13

Growth measurement such as weight and length of *cirrhinusmrigala* fingerlings were recorded indivually. At the end of the experimental period, specific growth rate, food conversion ratio, food conversion efficiency, Average daily weight of fingerlings fed with different experimental diets were calculated. The specific growth rate was high (1.01) in fingerlings fed with T5diet followed by (0.49) T3 feed type. The low specific growth rate (0.10) was noted in control formulated pelleted feed. The feed conversion ratio was significantly increased (7.82) in T1and decreased (3.29, 2.93) in T4and T5fed groups (Table 4). The food conversion efficiency of experimental diets ranged between 0.13 and 0.77. The maximum (0.77) and minimum (0.13) was noticed in T4 and T1feeds (Table 4). This study also substantiates many other earlier reports on benefits of using live feed as a part of aquaculture diet for various commercially important food fishes. In the present study, enhanced growth increment and feed absorption in terms of SGR and FCR was significant in *Cirrhinusmrigala* fed with T5feed. This is an agreement with work of common carp on Ramakrishnan *et al.,* 2008 and Tongsiri *et al.,* 2010.

Table 4. Feed utilization parameters selected for assessment of different types of feeding trails

S.No	Types of Feed	SGR	FCR	FCE
1	T1	0.10	7.82	0.13
2	T2	0.20	2.96	0.14
3	T3	0.49	2.93	0.34
4	T4	0.44	3.29	0.77
5	T5	1.01	3.04	0.33

Cirrhinusmrigala fingerlings attained significantly higher body weight (1.47&1.39) in T4 and T5 fed groups while the same was minimum (0.27g) in treatment T1feed, which clearly indicates that replacement of formulated feed with live feed for *Cirrhinusmrigala* has effective role in growth.

The value of average daily weight gain was found in the order feed T4> feed T5> feed T3,T2 > feed T1. There was no mortality of fish during the period of experiment (Table 5).

Table 5. The growth parameters of *Chirrihinusmirigala* fingerlings fed with different ratio of live feeds. Values (gm) were expressed as mean of 3 observations

S.No	Types of Feed trail	Final weight (gm)	Initial weight (gm)	Wet weight gain(gm)	Average daily weight gain(gm)
1	T1	1.69±0.12	1.42±0.06	0.27±0.16	0.09±0.01
2	T2	4.45±0.07	3.72±0.08	0.73±0.15	0.03±0.01
3	T3	1.98±0.05	1.34±0.04	0.64±0.08	0.02±0.003
4	T4	2.54±0.05	1.30±0.02	1.47±0.35	0.49±0.001
5	T5	5.18±0.04	3.79±0.05	1.39±0.02	0.46±0.001

Live feed has been most-useful feed for rearing carp fingerlings (Mahmoudzadeh, 2009). Among the different feeds, live foods exhibited better growth and survival rate of fingerlings were observed in T4 and T5over formulated feed in treatments. A superior growth performance was noted in fish fed with feed T4and T5as compared to those feed T1, T2and $_{T3}$ feeds.

Table 6. The morphometric parameters of *Chirrhinusmrigala* fingerlings fed with different feeds. Values (gm) were expressed as mean of 3 observations

S.No	Types of Feed trail	Final fish length (cm)	Initial fish length (cm)	Length gain (cm)	Percentage of length gain
1	T1	6.10±0.10	5.67±0.15	0.43±0.05	40.00±1.00
2	T2	7.63±0.15	7.23±0.15	0.40±0.01	40.00±0.33
3	T3	5.60±0.20	5.23±0.15	0.37±0.06	20.00±3.00
4	T4	6.30±0.30	5.50±0.10	0.80±0.36	70.00±1.33
5	T5	8.20±0.20	7.86±0.25	0.47±0.06	40.00±2.00

The positive effect of feeding of *Cirrhinusmrigala* fingerlings with livefood was found in the present study. Feeding of fingerlings with livefood (T4) and mixed food (T5) results into higher average wet weight gain compared to the fingerlings fed with pelleted control feed. The lower growth of fish fed with artificial pelleted feed may also be related to the poor digestibility. The present investigation correlated with several studies (Sharma *et al.,* 2000; 2009).

It has been suggested that the livefood assist in digestion process by contributing their digestive enzymes either by autolysis or as zymogens that activate the endogenous enzymes. Kumar *et al.* (2005) showed the presence of various digestive enzymes and nutritional growth factors of live food also enhance digestion, it may leads to enhance growth. The overall growth performance of grow out fish in T1 experimental trails feed remained poor. A possible reason of poor fish growth might be due to low appetite and low feed utlilization (Islam, 2002).

The initial average length was 5.7, 7.2, 5.2, 5.5 and 7.8 mm respectively for all treatments (T1,T2,T3, T4 and T5). The final average length gain was found to be 6.1, 7.6, 5.6, 6.3and 8.2 mm (Table 6). The highest length gain was found to be 0.8mm in treatment T4 fed with mixed experimental diet. This was significantly higher than the rest of the treatments. The highest percent length gain was 70 in the fish fed with livefeed diets (Table 6). The results of present studies revealed there *Cirrhinusmrigala* was a significant difference among treatments in growth of fingerlings. In conclusion, the present study indicate that experimental feed T4 and T5 (tubifex., control & tubifex) showed satisfactory results interns of gain in weight and length as compared to control.

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