RESEARCH REVIEW JOURNALS
Volume-04
Issue-01
January -2019

ISSN: 2455-3085 (Online)
RESEARCH REVIEW International Journal of Multidisciplinary
www.rrjournals.com [UGC Listed Journal]

Study of Diet Conditions of Fish Under Kanwar Lake in Special References of Catla

[1]Dr. Aradhana Singh and [2]Dr. Akhilesh Kumar

[1]*Assistant Professor of Zoology, Simtech College, Patna*
[2]*Associate Professor of Zoology, A N College Patna*

ARTICLE DETAILS

Article History
Published Online: 20 January 2019

Keywords
Variation, Quantity, Bioenergetic, Feed, Parameters.

ABSTRACT

In general, growth of a fish is influenced by the quality and quantity of food materials available and consumed. Thus, any variation in quality and quantity of food materials will affect growth rate of the fish. Feeding experiments were carried out in 100 L tanks for 40 days. Fish fry fed with the mixed diet showed significantly better survival rate (54.80 ± 2.43%) than those fed with other food types (P < 0.001). Fish fry fed with Cyclopoid had significantly (P < 0.001) better growth (26.03 ± 1.88 mm, weight 61.07 ± 3.53 mg) than those fed with other food types. The fish were fed with the formulated feed at a rate of 4% of their body weight for a period of 60 days. It was observed that the fish fed with formulated feed containing 40% protein content showed better growth results and improvement in bioenergetic parameters, compared to the other three feeds.

1. Introduction

Inland fish production mainly consists of capture based fishing activities and is mainly dependent on exotic species such as Tilapia spp, Indian carps and Chinese carps. However, sustainability of aquaculture production depends on proper feeding and farm management. Feeding of fish has become one of the critical management practices today, as it occupies 50- 60% from the total cost of production. Therefore, it is important to produce low cost feeds for small scale farmers in order to reduce the cost of farm operation. In Sri Lanka, there is no recommended low cost feed available from fry to fingerling stage of Indian carps. Some farmers have been using their own ingredients in formulating fish feed, without considering availability of nutrient in the raw materials and the nutritional requirement of the fish. Thus, those feeds do not contain required amount of nutrients and it is impossible to achieve higher growth rate of fry under local conditions. Of the feed ingredients, protein source is one of the expensive ingredients in the formulated feed. Fish meal is still an essential ingredient in the diets and it is also an expensive feed ingredient compared to other protein sources and thus represents a significant cost element in feed and production cost. This has necessitated the search of alternative sources available locally in the country. In this context, use of certain potential aquatic weeds offer excellent scope as the nutrient laden materials are naturally grown in the entire country without much agronomic care. Many aquatic plants such as Eichornia crassipas, Hydrilla verticillata, Salvinia aculata, Ipomea aquatica, Pistia spp. etc. contain fairly high amount of protein. Aquatic plants also contain high amount of vitamin E, vitamin C and mineral elements required for normal growth and development of fish. Ipomea aquatica and Hydrilla verticilata are currently used in many South East Asian countries as the alternative feed ingredients. Those two aquatic plants have fairly high feeding value, with moderately high protein content. The intensive growth of aquatic weeds in culture ponds and reservoirs are one of the prevailing problems in fish production. If aquatic weeds are used effectively in feed formulation, it will be a solution for management of aquatic weeds. Thus, present study was undertaken to formulate cost effective feeds for the fry to fingerling stage of Catla catla, using locally available feed ingredients including aquatic plants under a semi intensive culture system.

Food and feeding habits of carps have been a field of interest to fisheries researchers since very long. Natarajan and Jhingran (1961) studied the food habits of Catla catla and reported a zooplankton dominated food preference for the fish. Hora and Pillay (1962) reported the feeding habits of Catla catla. Khan and Jhingran (1975) have given a report on the food and feeding habits of an Indian major carp Labeo rohita (Ham). Rajgopal (1978) described the foods and feeding habits of some commercial fishes from the Tungabhadra reservoir. Sunder et al.(1990) studied the food and feeding habit of the Cyprinus carpio var. specularisfrom Dal Lake (Kashmir) in relation to gastrosomatic index, condition factor and length-weight of fish and reported that the monthly fluctuations in feeding activity and gastrosomatic index (GaSI) is in agreement with each other.

2. Literature Review

B. A. Dars (2010) To study the effect of different protein levels on growth and survival of Catla catla (Hamilton) reared in glass aquaria during May to August 2009. Three iso-caloric feeds were formulated with locally available ingredients (rice protein, rice bran and wheat bran) of different protein levels such as 30%, 35% and 40% (dietary protein levels) of 2 mm dia were prepared with the help of manually operated pellet machine. The feed ingredients were tested for proximate (bio-chemical composition) analysis according to the methods given in AOAC (1980) and found 13%, 12% and 40% protein respectively. Each feed was supplied at a rate of 8% of the body weight of fish twice a day. The results of the various growth parameters like suitability of protein level requirement, specific growth rate, mean total weight gain, percentage weight gain, feed conversion ratio, survival rate and production of the experimental fish showed significantly ($p<0.05$) highest growth and production was observed in feed B followed by feed C while significantly ($p<0.05$) lowest growth and production was recorded from feed A. It is therefore concluded that the feed with 35% protein found to be suitable for the better growth and production of Catla catla.

AMAN Adikari (2017) There is no recommended low cost feed available from fry to fingerling stage of Indian carps in Sri Lanka. Hence, this study was aimed on utilizing locally available aquatic plants Ipomea aquatica and Hydrilla vercillata and discarded dry fishmeal in feeds of Catla catla fry to cut down the feed cost. The experiment was conducted in a complete randomized design. Three experimental feeds were formulated using different protein sources while keeping other ingredients constant (T1= 1:1 discarded dried fish meal: Hydrilla vercillata, T2= 1:1 discarded dried fish meal: Ipomea aquatica, T3 = discarded dried fishmeal) and a commercial feed was used as the control. Catla catla fry were stocked at a density of 75 fry per m 2 in 12 pond units. Fry were fed at the rate of 5% of the body weight. Growth and water quality parameters were measured weekly and feeding behavior was

also observed. Data were analyzed using the one way Analysis of Variance (ANOVA) procedure in SAS. All treatment feeds were accepted by fish and palatability was same. Hydrilla vercillata incorporated feed was moderately stable in water whereas, T2, T3 and commercial feeds were comparatively stable. Total body length, wet body weight and specific growth rate (SGR) of the fry were significantly different (p0.05). The lowest feed costs were recorded in T1 and T2 feeds and it was 60% less compared to commercial feed. In conclusion, there is a potential benefits of using discarded dried fishmeal, Ipomea aquatica and Hydrilla vercillata in aqua feeds for fry stage of Catla catla.

Abdul Kadhar, (2014) Effect of live feed on the survival and growth of fry of Catla catla using three different live feeds namely, Cyclopoid (Thermocyclops decipiens), Cladoceran (Moina micrura), and mixed diet (Cyclopoid and Cladoceran) were studied. Commercial feed (Sunder's feed) was used as control. Feeding experiments were carried out in 100 L tanks for 40 days. Fish fry fed with the mixed diet showed significantly better survival rate (54.80 ± 2.43%) than those fed with other food types (P < 0.001). Fish fry fed with Cyclopoid had significantly (P < 0.001) better growth (26.03 ± 1.88 mm, weight 61.07 ± 3.53 mg) than those fed with other food types. Biochemical studies showed higher level of protein, carbohydrate, and lipid content in Catla fry fed with Cyclopoid diet.The results are discussed in the light of the literature available. It could be suggested that the Cyclopoid diet can be used as live feed for effective production of Catla fry.

Kumar Lalit, (2015) In the present study, an attempt has been made to investigate the food and feeding habits of an Indian major carp Catla catla from Udai Sagar, Udaipur. On the basis of qualitative and quantitative analysis of gut contents, Catla catla has been categorised as planktivorous (zooplankton feeder). Gastrosomatic index (GaSI) of Catla catla species of this lake was calculated and found to be higher during study period.

Aasia Karim (2018) A feeding experiment was conducted for one year with six formulated diets containing all parts chicken meal in three different inclusion levels (25%, 35% and 45%) as APCM I, APCM II, APCM III and Fish meal as Control I, Control II and Control III, to examine the potential of all parts chicken meal as a substitute of fish meal in the diet of Indian major carps in intensive polyculture system. Fingerlings of Catla catla, Labeo rohita and Cirhinus mrigala were fed on experimental diets. It is evident by the results that growth is highly affected by dietary ingredients and its level of inclusion in diet. With increasing level of fishmeal, a noticeable decrease in growth was observed, as Control I, II and III produced 67.3 g, 50.5 g and 39.6 g mean weight gain respectively. While opposite trend of growth was observed with APCM based diet i.e., APCM III (45% inclusion of APCM) produced significantly higher growth with a decreased FCR. The two-way analysis of variance for weight, DFA, SGR and FCR against months showed highly significant relationship in all diets. Except moisture and ash, fish carcass composition was significantly affected by protein source and its inclusion level.

3. Material and Methods

Six experimental diets were formulated by using fishmeal and all parts chicken meal in three different inclusions i.e. 25%, 35% and 45%. Fishmeal based diets were named as control I, II, III for 25%, 35% and 45% inclusion level respectively, while diets with all parts chicken meal were labeled as APCM I, II and III for three inclusion levels in that order. All experimental diets were formulated by mixing of fish meal (only in controls) or all parts chicken meal with corn gluten meal, rice polish, and starch and canola oil. Ingredients were pulverized, mixed and then pelletized with the help of a pellet maker. Pellets were then dehydrated at room temperature for 24 hours and followed by storing in freezer.

Table 1: Percentages of ingredients for Diet

	Control I	*APCM I	Control II	APCM II	Control III	APCM III
Ingredients (%)						
Fish meal	25	-	35	-	45	-
All Parts Chicken meal		25	-	35	-	45
Corn gluten meal	1.16	1.74	16.69	16.90	30.98	32.06
Rice polish	63.83	63.24	38.30	38.08	14.00	12.93
Starch	5	5	5	5	5	5
Canola oil	4.5	4.5	4.5	4.5	4.5	4.5
Vitamins and mineral mixture	0.5	0.5	0.5	0.5	0.5	0.5
Proximate composition (%)						
Crude protein	24.99	24.98	35.2	34.98	44.98	44.99
Crude fat	15.19	16.85	12.74	15.12	10.42	13.39
Crude fiber	2.56	2.95	2.48	3.02	2.38	3.07
Ash	13.7	12.02	13.42	11.13	13.25	10.24
Nitrogen –free extract	42.99	42.63	35.6	35.17	28.39	27.74
DE (K cal/Kg)	3109.90	3231.26	3186.43	3356.82	3263.44	3482.67
GE (K cal/Kg)	4520.48	4655.95	4554.32	4824.17	4587.67	4832.79

Each experiment was performed in triplicates for the accuracy of data and thus eighteen re-circulatory concrete raceways of the dimension 22′×50′) W×L) were designed. The juveniles of Catla catla, were reared in each raceway at a ratio of 33:33:34 respectively by following Wahab, Rahman and Milstein (2002) for a period of one year.

Experimental design and feeding trial

Fingerlings (15.1-15.3 g) of Catla catla were procured from Kanvar Lake, Bihar, India. Ninety fingerlings were randomly distributed in six experimental groups with three replicates each. Fishes were stocked in plastic tubs (100 L capacity) with continuous aeration. It was a static system where at least 75% of water was exchanged every day with fresh water by siphoning out water with uneaten feeds and faecal matters. Before the experiment, the fishes were acclimatized to the experimental condition for 30 d and fed a 30% crude protein diet. The water quality parameters, i.e. temperature, pH, dissolved oxygen (DO), carbon dioxide (CO2), ammonia-nitrogen and nitrite- nitrogen were recorded every week following standard methods (APHA 1985). Dissolved oxygen (DO) and pH ranged from 6.17 to 7.9 ppm and 7.5 to 8.49, respectively. The ammonia and nitrite levels varied between 0.27-0.67 ppm and 0.04-0.17 ppm, respectively. Water temperature varied from 25 to 27°C and CO2 was not detected in any of the tubs. The fingerlings were fed to satiation twice daily (0800 and 2000 h) and daily feed intake was monitored. The feeding trial lasted for 60 d.

Table 2: Ingredient and proximate composition of experimental diets (%)

Ingredients	Rice		Corn		Tapioca	
	40	50	40	50	40	50
Casein[1]	32.7	17.5	35.2	20.6	38.6	24.9
Gelatin[2]	5.0	5.0	5.0	5.0	5.0	5.0
Carbohydrate sources[3]	46.9	58.7	42.4	53.0	41.4	51.7
Carboxymethylcellulose[4]	1.0	1.0	1.0	1.0	1.0	1.0
Cellulose[4]	5.3	8.8	7.4	11.4	5.0	8.4
Sunflower oil:cod liver oil[3] (2:1)	6.0	6.0	6.0	6.0	6.0	6.0
Vitamin-mineral mix[5]	2.6	2.6	2.6	2.6	2.6	2.6
Vitamin B complex[6]	0.1	0.1	0.1	0.1	0.1	0.1
Vitamin C[7]	0.1	0.1	0.1	0.1	0.1	0.1
Glycine[8]	0.2	0.2	0.2	0.2	0.2	0.2
Proximate composition % (Mean±SD; n = 3)						
Crude protein	34.6±0.0	25.5±0.2	33.3±0.2	25.0±0.2	33.3±0.2	25.0±1.0
Lipid	5.5±1.6	5.6±0.2	6.2±0.3	6.2±0.3	6.4±0.2	6.3±0.2
Ash	3.1±0.0	4.8±0.2	3.4±0.2	3.2±0.2	3.6±0.0	3.5±0.0
Total carbohydrate	56.3±0.7	64.1±0.3	57.1±0.3	65.7±0.2	56.7±0.3	65.2±1.4
Calculated digestible energy (KJ g^{-1} diet)	17.3±6.4	17.1±2.3	17.4±2.6	17.5±1.9	17.5±1.7	17.5±6.4
Degree of gelatinization (%)	85.2±2.4	85.2±2.4	94.3±2.3	94.3±2.3	96.5±0.7	96.5±2.4
GC%*	40	50	40	50	40	50

Feeding and Sampling

The experimental feeds were supplied twice daily morning at 9.00 AM and evening at 5.00 PM at a rate of 8% of the body weight. Sampling was done at an interval of one month to adjust the feeding rate, by measuring the weight of fish and to observe the health condition of fish. The length of experimental fish was measured to the nearest mm with an ordinary scale graduated with tenth of centimeters. Weight was measured to the nearest g by a portable electronic balance (Model AK-3000H AFD). The 50% water of the aquaria was replaced every alternate day, to prevent growth inhabitant ammonia.

Data Analysis

Statistical Analysis One-way analysis of variance (ANOVA) was used to determine the effects of feed on the growth of carps. This was followed by Duncan's New Multiple Range Test (DNMRT), Duncan (1995) at 5% level of significance to observe any difference among treatment means.

4. Result

Growth, feed conversion efficiency, HSI and GSI data are given in Table 2. The specific growth rate (SGR) was significantly different (p<0.05) with respect to the different carbohydrate sources at both levels of GC. Corn fed groups showed highest SGR at 50% tapioca fed groups and lowest in rice fed groups. Within the source at different levels, only the tapioca source had significantly (p0.05) at 40%. A general trend of higher FCR was observed at 50% GC level than its lower counterpart (40%), though it was not significantly different (p>0.05) in corn fed groups. In the rice and tapioca fed groups, protein efficiency ratio (PER) and apparent net protein utilization (ANPU) were not significantly different (p>0.05) between two GC levels, but in the corn fed group, 50% level showed higher value than the 40% level. At 50%, both PER and ANPU were highest in corn fed group followed by tapioca and lowest in rice fed group.

The initial and final body composition of the tissues of Catla catla fingerlings are given in Table 3. The moisture, total carbohydrate and ash content decreased at the end of the experiment compared to the initial values, while the crude protein (CP) and lipid content increased. The moisture, CP and ash contents were not significantly different (p>0.05) among the different sources of carbohydrate. At 50% GC level, the lipid content was higher in corn fed group. Between two GC levels, not much difference in body composition was observed except for moisture and lipid contents of corn fed group where 50% GC had significantly higher (p<0.05) lipid content and lower moisture content.

Table 3: Body composition of Catla catla fingerlings

Source	GC level	Moisture	CP[1]	Lipid	TC[2]	Ash
Initial		78.0±0.0	13.27±0.1	2.32±0.1	2.50±0.2	3.92±0.1
Rice	40	74.2±1.0	14.95±1.3	5.56±0.4	1.77±0.5	3.86±0.7
	50	73.6±0.8	14.41±0.8	6.82^{X}±0.2	1.57^{XY}±0.2	3.58±0.04
Corn	40	74.3^{b}±1.0	15.10±0.4	5.24^{a}±0.3	2.21±0.5	3.55±0.1
	50	71.7^{a}±0.9	14.49±0.3	8.85^{by}±1.1	1.74^{Y}±0.1	3.48±0.3
Tapioca	40	74.7±0.7	14.32±0.1	6.03±1.0	1.65±0.05	3.34±0.2
	50	74.6±1.4	14.74±0.8	6.30^{X}±1.2	1.35^{X}±0.08	3.33±0.2
ANOVA		p value				
Among sources at 40 GC		0.825^{ns}	0.481^{ns}	0.374^{ns}	0.242^{ns}	0.359^{ns}
Among sources at 50 GC		0.051^{ns}	0.819^{ns}	0.033	0.019	0.419^{ns}

Glycogen content of muscle was much lower in rice fed groups, which was significantly different (p<0.05) than the corn and tapioca fed groups at both GC levels. However, no difference was found in tapioca and corn fed groups irrespective of their levels in the diets. Among the carbohydrate sources, muscle glycogen level was much lower in rice fed group than corn and tapioca fed groups at both GC levels. Glycogen content of liver was significantly (p<0.05) different among different sources at 40% GC level and between two levels of GC within the same source. Higher inclusion level of GC in the diet induced more glycogen deposition in liver in all the sources. At 40% GC level, liver glycogen level of rice fed group was lower than in corn and tapioca fed groups.

The growth responses of the indigenous carp, C. catla fed with three different protein levels diets (iso-caloric) in terms of initial and final mean weight gain, percentage weight gain,

specific growth rate (SGR), Food Conversion Rate (FCR), survival rate and production of the experimental fish are presented in the Table 4. The fish with an initial average weight of 6.4 ± 1.6 g reached to a final weight of 135.50 ± 2.66, 110. 30 ± 1.44 and 120.50 ± 2.11 g in feed B with 35% gross protein. Results of these parameters indicated that the feed B containing 35% gross protein shows significantly ($p<0.05$) highest growth in terms all parameters like (weight gain, percentage weight gain, specific growth rate, food conversion and production followed by feed C while significantly ($p<0.05$) lowest growth and production was recorded in feed A (Table 5). No mortality was recorded (100% survival rate) in the experimental fish throughout the study period.

Table 4: Effects of various feeds on growth parameters of Catla catla

Parameters	Feed A (30%)	Feed B (35%)	Feed C (40%)	Control* With natural feed
Rearing Period (days)	120	120	120	120
Mean Initial Weight (g)	6.4[a1] ± 1.6	6.4 [a1] ± 1.6	6.4 [a1] ± 1.6	6.4 [a1] ± 1.6
Mean final weight (g)	80.25[b] ± 1.55	110.30 ± 1.44	91.75 ± 1.99	33.55 ± 1.66
Weight gain (g)	73.85[b]	103.90	85.11	27.15
(%) Weight gain	1253[b]	1723	1433	524
SGR (% per day)	1.40[b]	1.58	1.47	0.92
FCR	4.40[b]	3.90	4.20	----
Survival (%)	100[a]	100 [a]	100 [a]	100 [a]
Production Kg/m^2/120 days	5.350[b]	7.353	6.116	2.236

5. Discussion

Growth was not increased significantly in rice fed groups with increase in GC level, but FCR significantly increased. Same trend was also observed with tapioca fed groups. However, in corn fed groups higher SGR at higher GC level and non-significant change in FCR indicates better nutrient utilization from gelatinized corn than rice and tapioca at higher inclusion level. Schwarz and Kirchgessner (1991) reported better growth in carps fed corn and wheat diets than those fed with tapioca. Best FCR was reported at 35% CP level in the diet of L. rohita fry when fed with 40% GC (Mohapatra et al., 2003). This is in agreement with the present study, where lower FCR was recorded in the 40% GC (with 35% protein) fed groups, though it was not significantly different in the corn fed groups. Feeding higher levels of carbohydrate in the diets resulted in an increased deposition of glycogen in the liver. High hepatic amylase activity was found due to feeding of higher GC (50%) from rice and tapioca. This value corroborates the glycogen content in liver indicating the storage of excess glucose as glycogen in the liver. However, in the corn fed groups, no significant difference was found in amylase activity between the two levels of GC. Higher amylase activity was also found in higher GC fed groups in the intestine. But there was no difference ($p>0.05$) in intestinal amylase activity among the different sources of carbohydrate at same level of GC. In general, higher amylase activity was observed in liver than the intestine, which is in agreement with findings in carps (Hidalgo et al., 1999). A positive correlation ($Y = 0.0204X-0.3275$; $r2 = 0.77$) was found between intestinal amylase activities and the liver glycogen deposition. Higher amylase activity in intestine increases carbohydrate digestion and consequently absorption of glucose, which was deposited as glycogen in the liver. Hidalgo et al. (1999) reported higher protease activity in the intestine than the liver. Same trend was observed in the present study. Chymotrypsin and trypsin are two important enzymes in digestion and breaking down protein and their activities do not vary with the change of dietary protein and crude protein digestibility in rabbits.

6. Conclusion

The results suggest that 50% gelatinized corn in the diet of Catla catla fingerlings improved PER and APU, whereas both GC levels of corn had good FCR and SGR. But in case of tapioca and rice, FCR was higher at higher GC level indicating poor nutrient utilization. Rice was poorly utilized by fingerlings and the order of nutrient utilization at 50% GC level was corn>tapioca>rice. At 40% GC level, corn and tapioca were comparable and more efficiently utilized than rice. Though nutrient digestibility of tapioca fed groups was higher, but overall nutrient utilization was higher in corn fed groups. However, high GC in the diet induced more liver-glycogen. More deposition of body lipid was due to more feeding of gelatinized corn. Moreover, species specificity for carbohydrate utilization from different carbohydrate sources remains as suggestive rather than conclusive and need to be elucidated.

References

1. Raj Kumar, FOOD AND FEEDING HABITS OF CATLA CATLA (HAMILTON - BUCHANAN) FROM DAYA RESERVOIR, UDAIPUR, RAJASTHAN, Indian J. Anim. Res., 41 (4) : 266-269, 2007
2. Kumar Lalit, Food and Feeding Habits of Catla Catla (Hamilton) From Lake Udai Sagar, Udaipur, International Journal of Fauna and Biological Studies 2015; 2(5): 06-08

3. Abdul Kadhar, Studies on the Survival and Growth of Fry of Catla catla (Hamilton, 1922) Using Live Feed, Hindawi Publishing Corporation Journal of Marine Biology Volume 2014, Article ID 842381, 7 pages
4. AMAN Adikari, Formulation of artificial feeds for Indian Carp (Catla catla) fry using aquatic plants, International Journal of Scientific and Research Publications, Volume 7, Issue 7, July 2017
5. Madhyastha, Harishkumar & Gajaria, S & K S, Radha. (2004). Growth and development of catla (Catla catla) fed with different levels of diet containing Spirogyra sp. Bioresource technology. 95. 73-6.
6. Dars, B.A. & Narejo, Naeem & Dayo, Abdullah & Punhal, Lashari & Laghari, Dr. Muhammad & Waryani, Baradi. (2010). Effect of different protein on growth and survival of Catla catla (Hamilton). Reared in glass aquaria. Sindh Univ Res Jour (Sci Ser). 42. 65-68.
7. Sona Yengkokpam, Gelatinized Carbohydrates in the Diet of Catla catla Fingerlings: Effect of Levels and Sources on Nutrient Utilization, Body Composition and Tissue Enzyme Activities, Asian-Aust. J. Anim. Sci. Vol. 20, No. 1 : 89 - 99 January 2007
8. S. Murugesan, V. Sivasubramanian, and K. Altaff, “Nutritional evaluation and culture of freshwater live food organisms on Catla catla,” Journal of Algal Biomass Utilization, vol. 1, no. 3, pp. 82–103, 2010.
9. MFARD. Fisheries Statistics, Ministry of Fisheries and Aquatic Resources Development. Colombo, Sri Lanka: 2015.
10. Maqbool A. Effects of dietary protein levels on the growth, feed utilization and biochemical parameters of freshwater fish Cyprinus carpio specularis. Faculty of Biological Science, University of Kashmir, Hazratbal, Srinagar, J&K , India: University of Kashmir; 2013.

