Egyptian Journal of Aquatic Biology & Fisheries
Zoology Department, Faculty of Science,
Ain Shams University, Cairo, Egypt.
ISSN 1110 – 6131
Vol. 24(7): 349 – 362 (2020)
www.ejabf.journals.ekb.eg

Food Intake, Conversion Efficiency and Growth of Hamilton's Pethia Ticto (*Ticto Barb*) from a Himalayan Stream

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ARTICLE INFO

Article History:
Received: May 2, 2020
Accepted: Oct. 22, 2020
Online: Nov. 15, 2020

Keywords:
Pethia ticto;
management;
Conversion efficiency;
Himalayan stream;
Garhwal Himalaya

ABSTRACT

Garhwal Himalaya has a wide network of aquatic bodies in the form of rivers, lakes, tributaries, reservoirs, wetlands and ponds. These water bodies harbor very good fish diversity hence can be used for intensive fish culture. *Pethia ticto* was collected with the help of casting net and other local fishing methods from the Khanda Gad, a tributary of Alaknanda River that is also an important tributary of River Ganga. The study on food consumption was made by offering the food items of known weight and number to fishes and careful observations were made. The initial and the final weights of the fishes were taken and the growth was calculated. Among artificial feed, soya meal fed groups showed the highest conversion ratio (7.21:1) and semolina (*suji*) fed groups showed the lowest (6.95:1) conversion ratio. The present work is to develop a scientific approach for the management and conservation of the important fish (*Pethia ticto)* of Garhwal Himalaya.

INTRODUCTION

Fish provides an outstanding food source of animal protein for human consumption **(Pal *et al*., 2018)**. This protein is comparatively having high digestibility and a growth-promoting value in the human diet. It is estimated that 23% of the people in the developing countries are malnourished, because of the high intake of calorie-deficient diet in the form of cereals rather than a calorie-rich diet of meat, fish and egg **(Muller and Krawinkel, 2005; FAO, 2015)**. This also applies to Garhwal Himalaya where there is an acute problem of malnutrition among the rural masses of the hilly region. Although agriculture is the major shareholder in feeding the population on Earth **(FAO, 2017)**, the aquaculture production has become a considerable companion in this regard **(FAO, 2014; FAO, 2016)**. Aquaculture has recently made a great stride forward, new areas of fish culture have been developed, and old culture systems have been rejuvenated and intensified **(IARI, 1993)**.

The nutrition components and gross energy made available for cell maintenance, growth, locomotion and determined by the amount of food consumed, the fraction that is assimilated, and the nutrient contents of the food **(Talbot, 1985)**. The relationship between fish and their food is affected by a complex interaction between a number of factors, which include temperature, light, salinity, fish size, activity and behavior, appetite, feeding regime, starvation, stress and type of food **(Volkoff and Peter, 2006; Jobling, 2006; Moberg, 2011; Martins *et al*., 2012)**. The quantitative requirement of any food depends largely on its composition. The most efficient level of feeding is attained only when the correct supply of energy and essential nutrients are available in the proportions required by the fish for maintenance and growth. The basic principle of bioenergetics is relatively simple to grasp and can be stated as all energy acquired through the ingestion of food is ultimately lost as wastes in feces or by new body tissue (growth and energy gain). Thus, bioenergetics is concerned with the study of rates of energy intake and transformations within the organism and provides the physiological framework for the study of the relationship between feeding rates and growth rates of fish subjected to environmental conditions. Considerable research efforts have been directed towards the study of fish bioenergetics and growth. Measurements have been made of the different components of the energy budget for fish that have been used in fisheries research for a variety of purposes. A major benefit of energy budget is that they can be 'instantaneous' i.e. carried out relatively in a short time period comparable in duration to biological and cultural cycles (e.g. one feeding cycle, one day) **(Kooijman, 2008; Lee *et al*., 2018)**. This is of particular benefit in making a rapid prediction of effects on the growth of certain diet formulation or feed regime or acute culture stress. Suitable indigenous feed formulations may be prescribed to substitute fish protein, which is in short supply. Other major raw materials for fish food such as rice bran, oil cake, groundnut cakes, sesame cake, or soya bean cake could be available. Thus, the study of bioenergetics enables the investigation of problems related to fisheries management and production and has a central place within aquaculture research **(Tuene and Nortvedt, 1995)**.

Many studies have shown that multiple feeding resulted in more efficient utilization of the food than a single feeding. The number of feedings per day and the time of feeding vary with species, size of fish, and environmental conditions. Two inter-related ways of expressing the efficiency of conversion of food to body weight gain are important. The one, usually expressed as a percentage, is the 'food utilization ratio' or 'food conversion efficiency', which is the ratio between the gain in weight and the ingested food. The reciprocal of this expression is 'food conversion ratio' which designates the amount of food required to obtain a unit weight of body gained. The study of food intake, conversion efficiency and growth rate in fish has created an immense interest among fish biologists, because of its application in resource management. A lot of work has been done on various aspects including the food intake, conversion efficiency and growth that include the work of **Suresh (2003)** on fish nutrition and feed research; **Jobling *et al*. (2006)** on the monitoring feeding behavior and food intake; **Volkoff and Peter (2006)** on feeding behavior of fish and its control; **Priestley *et al*. (2006)** on the influence of feeding frequency on growth and body condition of the common Goldfish; **Lall and Tibbetts, (2009)** on nutrition, feeding, and behavior of fish; **Kawarazuka (2010)** contributed on fish intake, aquaculture, and small-scale fisheries to improving nutrition; **Eriegha (2017)** on factors affecting feed intake in cultured fish species; **Bogard (2017)** on higher fish but lower micronutrient intakes: Temporal changes in fish consumption from capture fisheries and aquaculture in Bangladesh and **Marinda (2018)** on dietary diversity determinants and contribution of fish to maternal and under five nutritional status in Zambia; but, not a single attempt has been made on the food intake, conversion efficiency and growth of *Pethia ticto (Ticto barb)* in the Uttarakhand. The present work was carried out to develop a scientific approach for the management and conservation of *Pethia ticto* of Garhwal Himalaya.

MATERIALS AND METHODS

The Study Area

The stream Khanda Gad is a spring-fed tributary of the Alaknanda River in the lower Himalaya. The stream Khanda Gad flows from an elevation of 2,143 m above m.s.l. southeast to the northeast direction and meets the Alaknanda at Bilkedar 520 above m.s.l. (Figure 1). The Khanda basin lies between latitude 30°6’42” N to 30°13’23” N and longitude 78°41’48” E to 79°5’4” E covering an area of 96.7 Km^2. The stream has been named as Khanda Gad (720 m above m.s.l.) after the confluence of two-parent streams named, Kathalsyun (Nayal) Gad and Nanda Gad, 1 Km upstream of Khanda Chatti. The stream has been channelized at some places for irrigation purposes. Human settlements exist in the lower and middle stretch of both the stream banks. On both sides of the stream, the mountain slopes have been extensively used for agriculture purposes, especially for paddy crops. Horticulture is also being practiced along the bank of the stream at some places.

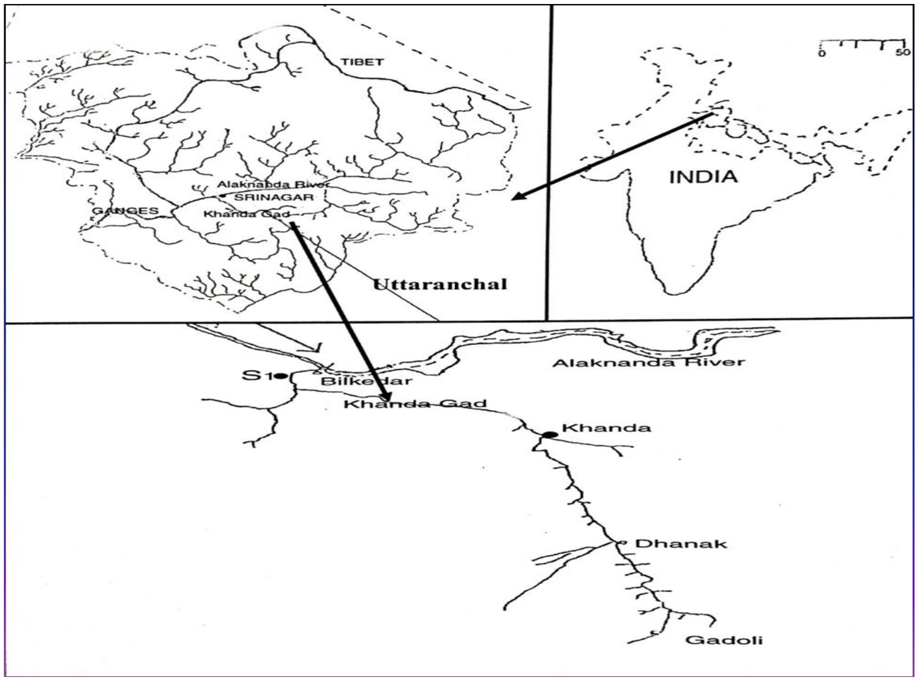

Figure 1. Location Map of the Study Area

Fish sampling

The fishes were collected from the Khanda Gad, a tributary of Alaknanda River near Bilkedar. The fishes were sampled with the help of casting net and other local fishing methods. These fishes were put in a bucket and brought to the laboratory in the Department of Environmental Sciences. All the fishes were divided into small groups and ten fishes in each group were reared on different food items in different aquaria. Four replicates were taken for each food item. The study on food consumption was made by offering items of foods of known weight and number to fishes and observed them carefully.

Fish feeding

This measurement was made by direct visual observation **(Grove *et al*., 1978)**. When food consumption was measured by observation, the food was usually dispensed by hand. Fish may require a conditioning period before feeding regularly, and precautions were taken to avoid starving the fish during the feeding period. Observation of food items eaten may be facilitated using floating food. An alternative to observing the amount eaten is to measure the difference between the quantity offered and that remaining at the end of the feeding period **(Wallace, 1973; Tytler and Calow, 1985)**. For this type of experiment, aquaria require a mesh to collect uneaten food in the effluent water.

Growth determination

Fishes were weighted to the nearest milligrams (mg) and divided into four groups of ten individuals in each for all the natural and artificial foods. For this study, the fishes were reared on these food items for 30 days. A weighted food was given to the entire Adlibitum group, so that food was always available. Fishes were fed on the respective food combinations for 30 days. The uneaten food was removed from the aquaria through a fine sieve (diameter 160µ) on the next day and was dried and weighed. After completion of the experiment, again the weights of the fish were measured for determining the growth and specific growth rate of each fish, using standard methods:

(i) Specific growth rate (% day^{-1}) = $$\frac{\text{In } W_2 - \text{In } W_1 \times 100}{t_2 - t_1}$$

Where, W_1 and W_2 are fish weight, at time t_1 and t_2, respectively, and t_2 - t_1 is the time, between weighing.

(ii) Feeding rate (mg gm fish^{-1} day^{-1}) = $$\frac{\text{Food consumed}}{\text{Initial biomass} \times \text{days}}$$

The conversion efficiency (K_1) was expressed as a percentage and calculated following the methods outlined in **Reddy *et al*. (1977)**:

Conversion efficiency (K_1) = $$\frac{\text{Growth} \times 100}{\text{Food intake}}$$

Estimated food required and flesh production was calculated by the method details by **Krishnan and Reddy (1984)**:

Estimated food required (kg) = feeding rate × No. of days

Estimated flesh production (kg) = estimated food required ×specific growth rate × No. of individuals

Food conversion ratio (kg) denotes the amount of dry food necessary to produce 1 kg of fish biomass:

Food conversion ratio = $$\frac{\text{Total dry weight of food (kg)}}{\text{Total wet weight (t) gain (Kg)} \times \text{Biomass}}$$

Statistical Treatment of Data

The data was statistically treated with the help of standard statistical software (MS Excel, 2013) available.

RESULTS AND DISCUSSION

The data on the initial biomass, yield total food consumption, food intake, feeding rate, growth, specific growth rate and conversion efficiency for *Pethia ticto* fed on four different types of natural food (macrozoobenthos, soya meal, semolina and oil cake) have been presented in Table 1-8. Different fish species may vary in their growth rates. Some species are capable of growing faster than others. A number of traits are affecting the growth, such as the capability of the fish to search for and utilize food, its ability to compete for food with other fish, and the physiological utilization attribute. All these are ultimately expressed in the growth rate of fish.

Growth in Pethia ticto fed on macrozoobenthos

Initially, the average weight of *Pethia ticto* fed on macrozoobenthos was recorded to be 3.469±0.1 gm and the average final weight (yield) of the fishes was recorded to be 6.975±0.16 gm by consuming 21.098±5.54 gm of food (Table 1). The experimental fish consumed 79.49±0.13 mg fish^{-1} day^{-1} of natural food and the feeding rate was observed to be 229.35±8.27 mg gm fish^{-1} day^{-1}. The growth was observed to be 11.086±0.53, while the specific growth rate was computed to be 2.242±0.115% day^{-1}. However, the average conversion efficiency for natural food was calculated to be 13.947±0.141 kg and the food conversion ratio was computed to be 6.93:1±0.351 (Table 9). Observations on the present study revealed that the growth of *Pethia ticto* fed on natural food is higher than fish fed on artificial food like soya meal, semolina and oil cake. The feeding of natural food is higher (229.34 mg gm fish^{-1} day^{-1}) in comparison with the *Channa gachua* (213.70 mg gm fish^{-1} day^{-1} (**Krishan and Reddy, 1983-84**). The feeding rate of *Pethia ticto* was higher for the macrozoobenthos fed group and lower for the semolina fed group. However, the feeding rate of *Pethia ticto* under the present study was higher (171.16 mg gm per fish per day) than *Barilius bendelisis* (159.99 mg gm fish^{-1} day^{-1}). Under the present study, a linear relationship was found to occur between total food consumption and the specific growth rate of juveniles of *Pethia ticto* (Figure. 2). It is often possible to achieve a high rate of growth at the expense of excessive food and low utilization to make gain economical.

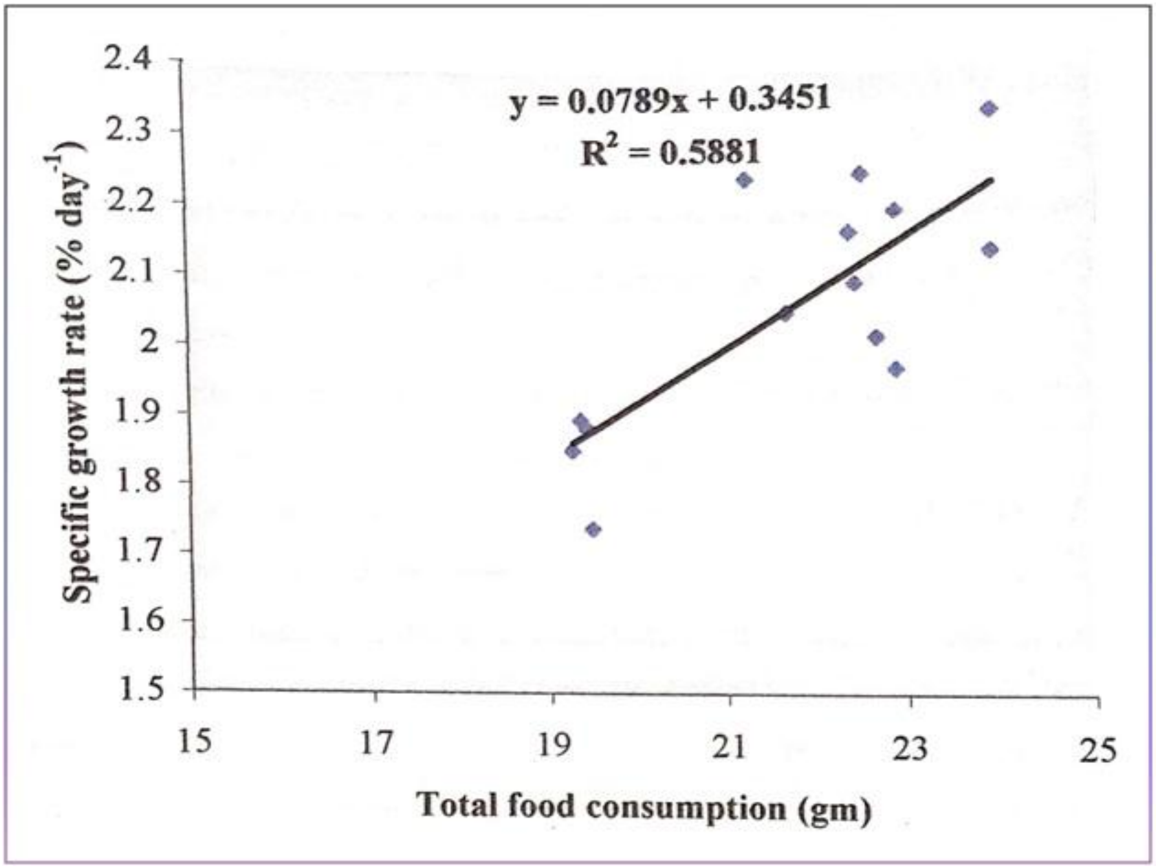

Figure 2. Average relationship between total consumption and specific growth rate

Growth of Pethia ticto fed on Soya meal

The average initial weight of the fishes reared on the soya meal was found to be 3.66±0.08 gm and the yield was recorded to be 6.785±0.05 gm after consuming 22.507±0.49 gm of soya meal (Table 2). Food intake in *Pethia ticto* fed on soya meal was recorded to be 75.025±1.6481 mg $fish^{-1}$ day^{-1}, while the feeding rate was found to be 205.08±7.12 mg gm $fish^{-1}$ day^{-1}. The growth was calculated to be 10.41±0.352 mg $fish^{-1}$ day^{-1}; however, the specific growth rate of the fish was computed to be 2.056±0.084% day^{-1}. The conversion efficiency was found to be 13.88±0.580% (Table 6) and the average flesh production was computed to be 1.266±0.01 kg and the food conversion ratio was found to be 13.88:1 (Table 10). The artificial diet soya meal contains about 38% crude protein, 18% fat and 5% crude fiber. As with energy, the amount of protein required for maintenance can be measured by feeding fish a diet containing just enough protein to balance the loss due to the recycling of tissues, enzymes, etc, so that the protein content of the body will remain unchanged. Soya meal has a number of toxic stimulatory and inhibitory substances. It also contains genistein, a plant estrogen, which may account in some cases for part of its high growth-inducing properties.

Growth of Pethia ticto fed on Semolina

The average biomass of *Pethia ticto* fed on semolina was recorded to be 3.776±0.07 gm which resulted in a yield of 6.569±0.08 gm by consuming 19.38±0.09 gm of food (Table 3). The food intake by *Pethia ticto* fed on semolina was found to be 65.621±0.272 mg fish^{-1} day^{-1}, while the feeding rate was recorded to be 171.16±2.201 mg gm fish^{-1} day^{-1}. The growth was recorded to be 9.3.9±0.312 mg fish^{-1} day^{-1} and the specific growth rate was computed to be 1.845±0.063% day^{-1}. However, the conversion efficiency was found to be 14.407±0.506% (Table 7). The average flesh production was recorded to be 0.948±0.049 kg and the food conversion ratio was noted to be 6.95:1 (Table 1). On average, the conversion efficiency (K_1) of *Pethia ticto* was recorded highest in semolina fed groups than other artificial food fed group. The food conversion ratio for *Tor putitora* fed on natural food was higher in respect to the soya meal, semolina and oil cake fed groups.

Growth of Pethia ticto fed on Oil cake

The average initial biomass of the fish reared on oil cake was found to be 3.352±0.10 gm and the yield was noted to be 6.455±0.08 gm by consuming 22.11±0.52 gm of oil cake (Table 4). Food intake by *Pethia ticto* fed on oil cake was recorded to be 73.70±10.089 mg fish^{-1} day^{-1} and the average feeding rate was found to be 219.92±5.229 mg gm fish^{-1} day^{-1}. The growth of *Pethia ticto* fed on oil cake was recorded to be 10.34±0.127 mg fish^{-1} day^{-1}and the specific growth rate was found to be 2.185±0.063% day^{-1}. However, the average conversion efficiency was computed to be 14.033±0.364% (Table 8). The average flesh production by *Pethia ticto* fed on oil cake was recorded to be 1.442± 0.082 gm and the food conversion ratio was computed to be 7.13:1 (Table 12). Oil cakes are in general a very good source of protein, about 95% of the nitrogen is present as true protein. It usually has a digestibility of 75% to 95%. Certainly, they are of poorer quality than the better animal protein. The meals usually have high phosphorus content. Most fishes require 35-45% protein in their diet. Natural food (macrozoobenthos) however contains 50-60% protein (dry matter basis). When the fish live on natural food alone, this excessive food of protein is utilized for energy. This may be advantageous from a biological point of view since protein has a higher calorific value than supplementary carbohydrate, but it is wasteful from an economic point of view since protein is much more expensive than carbohydrate. Supplementary food must fill energy deficit first. At this stage, high energy-low protein diet can be used. If the fish have no difficulty in digesting and utilizing starch, as in the case with common carp, a starchy diet is usually the most economical. Where difficulties in digesting the starch exist, lipid can be a good source of energy.

A few studies have been made on the actual efficiency of food utilization for growth by actively feeding fish and on the effect of the diet composition, feeding level, and environmental conditions. It was also found that the utilization of carbohydrates by common carp for production of body fat to be 30% of the gross energy ingested, or if metabolizable energy is considered to be about 75% of the gross energy, this amounts to 40% of the metabolizable energy. This efficiency of utilization of dietary energy for growth is affected by the amount of food consumed. The cost of food amounts to a large proportion of the production costs of animals on culture, and the food conversion efficiency should be maximized. The food conversion efficiency was however better explained by growth than by consumption. This probably reflects the individual variation in the allocation of food to grow. This variation could have been caused by differences in energy losses in metabolism, feces and excretory products. A positive correlation was found between the feeding rate and specific growth rate for all the four types of food (Table 13). The feeding rate is not the only factor responsible for better growth but stress, food choice, quality and quantity of food, temperature and other favorable environmental conditions contribute to effect.

Table 1. Balance sheet of *Ticto barb* (Hamilton, 1822) reared on Natural food for 30 days

Group/Food Type	Initial Biomass (gm)	Yield (gm)	Total Food Consumption (gm)
A	3.6468	6.9565	23.855
B	3.4020	6.8946	12.790
C	3.3529	6.7404	23.870
D	3.4758	6.5890	23.875
$\bar{X}$±SD	3.4694±0.1	6.7951±0.16	21.098±5.54

Table 2. Balance sheet of *Ticto barb* (Hamilton, 1822) reared on Soyameal for 30 days

Group/Food Type	Initial Biomass (gm)	Yield (gm)	Total Food Consumption (gm)
A	3.7131	6.7026	22.870
B	3.7189	6.8049	22.656
C	3.6833	6.8258	21.662
D	3.5266	6.8078	22.841
$\bar{X}$±SD	3.6605±0.08	6.7853±0.05	22.507±0.49

Table 3. Balance sheet of *Ticto barb* (Hamilton, 1822) reared on *Suji* for 30 days

Group/Food Type	Initial Biomass (gm)	Yield (gm)	Total Food Consumption (gm)
A	3.7275	6.5013	19.265
B	3.7821	6.6870	19.365
C	3.7264	6.5669	19.432
D	3.8688	6.5211	19.484
$\bar{X}$±SD	3.7762±0.07	6.5691±0.08	19.387±0.09

Table 4. Balance sheet of *Ticto barb* (Hamilton, 1822) reared on Oil cake for 30 days

Group/Food Type	Initial Biomass (gm)	Yield (gm)	Total Food Consumption (gm)
A	3.4048	6.5140	22.343
B	3.2350	6.3353	22.213
C	3.2807	6.4344	21.476
D	3.4904	6.5365	22.410
$\bar{X}$±SD	3.3527±0.10	6.4551±0.08	22.111±0.52

Table 5. Food intake, feeding rate and specific growth rate of *Ticto barb* (Hamilton, 1822) reared on natural food (Algae and Macrozoobenthos) for 30 days in the laboratory

Group	Body weight (mg)	Food intake (mg gm fish^{-1}day^{-1})	Feeding Rate (mg gm fish^{-1}day^{-1})	Growth rate (mg fish^{-1}day^{-1})	Specific growth rate (% day^{-1})	Conversion efficiency K_1 (%)
A	364.68	79.52	218.045	11.032	2.153	13.874
B	340.20	79.30	233.098	11.642	2.355	14.681
C	335.29	79.57	237.307	11.292	2.328	14.192
D	347.58	79.58	228.964	10.378	2.132	13.040
$\bar{X}$±SD	346.94±12.86	79.49±0.13	229.354±8.273	11.086±0.535	2.242±0.116	13.947±0.689

Table 6. Food intake, feeding rate and specific growth rate of *Ticto barb* (Hamilton, 1822) reared on Soyameal for 30 days in the laboratory

Group	Body weight (mg)	Food intake (mg gm fish^{-1}day^{-1})	Feeding Rate (mg gm fish^{-1}day^{-1})	Growth rate (mg fish^{-1}day^{-1})	Specific growth rate (% day^{-1})	Conversion efficiency K_1 (%)
A	371.31	76.23	205.309	9.965	1.968	13.072
B	371.89	75.52	203.071	10.280	2.014	13.612
C	368.33	72.21	196.038	10.457	2.050	14.506
D	352.66	76.14	215.890	10.937	2.192	14.360
$\bar{X}$±SD	366.05±7.85	75.03±1.65	205.080±7.118	10.410±0.352	2.056±0.084	13.888±0.580

Table 7. Food intake, feeding rate and specific growth rate of *Ticto barb* (Hamilton, 1822) reared on *Suji* for 30 days in the laboratory

Group	Body weight (mg)	Food intake (mg gm fish^{-1}day^{-1})	Feeding Rate (mg gm fish^{-1}day^{-1})	Growth rate (mg fish^{-1}day^{-1})	Specific growth rate (% day^{-1})	Conversion efficiency K_1 (%)
A	372.75	64.216	172.278	9.246	1.854	14.398
B	378.21	64.550	170.672	9.683	1.899	15.001
C	372.64	64.773	173.822	9.468	1.888	14.617
D	386.88	64.946	167.873	8.841	1.470	13.613
$\bar{X}$±SD	377.62±5.80	64.621±0.273	171.160±2.201	9.309±0.311	1.845±0.063	14.407±0.507

Table 8. Food intake, feeding rate and specific growth rate of *Ticto barb* (Hamilton, 1822) reared on Oil cake for 30 days in the laboratory

Group	Body weight (mg)	Food intake (mg gm fish^{-1}day^{-1})	Feeding Rate (mg gm fish^{-1}day^{-1})	Growth rate (mg fish^{-1}day^{-1})	Specific growth rate (% day^{-1})	Conversion efficiency K_1 (%)
A	340.48	74.48	218.740	10.364	2.163	13.910
B	323.50	70.71	218.578	10.330	2.240	14.600
C	328.07	74.92	228.366	10.512	2.245	14.031
D	349.04	74.70	214.015	10.153	2.091	13.592
$\bar{X}$±SD	335.27±10.09	73.70±1.73	219.920±5.229	10.340±0.128	2.185±0.063	14.033±0.364

Table 9. Estimated food required, new flesh production (kg) and conversion ratio of *Ticto barb* (Hamilton, 1822) fed on natural food (macrozoobenthos)

Group	Food Required (kg)	New Flesh Production	Conversion Ratio
A	6.5414	1.408	7.20:1
B	6.9929	1.649	6.53:1
C	7.1192	1.657	7.05:1
D	6.8689	1.464	7.66:1
$\bar{X}$±SD	6.8806±0.2481	1.5445±0.1273	7.11:1±0.4656

Table 10. Estimated food required, new flesh production (kg) and conversion ratio of *Ticto barb* (Hamilton, 1822) fed on Soya meal

Group	Food Required (kg)	New Flesh Production	Conversion Ratio
A	6.1593	1.212	7.65:1
B	6.0921	1.2277	7.34:1
C	5.8811	1.206	6.89:1
D	6.4767	1.419	6.96:1
$\bar{X}$±SD	6.1523±0.1452	1.266±0.0108	7.21:1±0.3821

Table 11: Estimated food required, new flesh production (kg) and conversion ratio of *Ticto barb* (Hamilton, 1822) fed on Semolina

Group	Food Required (kg)	New Flesh Production	Conversion Ratio
A	5.1683	0.958	6.95:1
B	5.1202	0.972	6.67:1
C	5.2146	0.985	6.84:1
D	5.0362	0.876	7.35:1
$\bar{X}$±SD	5.1348±0.0762	0.9478±0.0491	6.95:1±0.2889

Table 12. Estimated food required, new flesh production (kg) and conversion ratio of *Ticto barb* (Hamilton, 1822) fed on Oil cake

Group	Food Required (kg)	New Flesh Production	Conversion Ratio
A	6.5622	1.419	7.18:1
B	6.5573	1.469	6.84:1
C	6.8509	1.538	7.13:1
D	6.4205	1.343	7.36:1
$\bar{X}$±SD	6.5977±0.1811	1.4423±0.0822	7.13:1±0.2156

Table 13. Correlation between the feeding rate and specific growth rate of *Ticto barb* (Hamilton, 1822)

Food Type	Coefficient of Correlation (r)
Natural Food (Algae and Macrozoobenthos)	0.750774
Soyameal	0.66635
Suji	0.79937
Oil cake	0.76775

CONCLUSION

Pethia ticto reared on natural food (macrozoobenthos) showed the highest growth (11.086±0.535 mg fish^{-1} day^{-1}) and specific growth rate (2.242±0.116% day^{-1}). Oil cake and Soya meal showed a good growth rate to be 2.185±0.063% day^{-1} and 2.056±0.084% day^{-1} respectively. However, maximum conversion efficiency (14.407±0.507%) was found in semolina and the lowest conversion efficiency was noted in the case of soya meal fed group of *Pethia ticto.* The food intake was highest (79.49±0.13 mg fish^{-1} day^{-1}) in natural food fed groups and lowest in semolina fed groups (64.621±0.273 mg fish^{-1} day^{-1}). *Pethia ticto* required 6.885±0.30 kg of natural food and resulted in 1.571±0.141 kg of flesh. Among artificial feed, the fish required 6.152±0.15 kg of soya meal resulting in the flesh production of 1.266±0.011 kg. The fish required 5.134±0.076 kg of semolina and produced 0.9478±0.049 kg of flesh. The requirement of oil cake was noted to be 6.597±0.181 kg and the flesh production was computed to be 1.4423±0.082 kg. The food conversion ratio was the highest (7.21:1) for soya meal fed groups and the lowest for natural food fed groups of *Pethia ticto.* Among artificial feed, soya meal fed groups showed the highest conversion ratio (7.21:1) and semolina fed groups showed the lowest (6.95:1) conversion ratio. The present study reveals that soya meal, semolina and oil cake have a high nutritive value and conversion efficiency. So, these experimental foods may be tried in addition to the natural food, for improving the growth of fish which will be instrumental for fish culture and fisheries management in Garhwal Himalaya. Thus, the present study has an applied value.

ACKNOWLEDGEMENT

Three of the authors (Akash Deep, Chandi Prasad and Stanzin Namtak) are thankfully acknowledge for the fellowship given by the University Grant Commission, New Delhi through Hemvati Nandan Bahuguna Garhwal University (A Central University), Srinagar-Garhwal, Uttarakhand, India for undertaking the present work.

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