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EVALUATIONS OF BODY COMPOSITION AND GROWTH PERFORMANCE BY APPLYING DIFFERENT DIETARY VITAMIN C LEVELS IN STINGING CATFISH, *HETEROPNEUSTES FOSSILIS* (BLOCH, 1792)

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ABSTRACT

An experiment was conducted for sixty days to evaluate the effects of Vitamin C of formulated feed on growth performance and body composition of stringing fish, Heteropneustes fossilis (Bloch, 1792). During experimental trial in the laboratory condition, the change in growth and feed utilization by the stringing fish fed on three different Vitamin C level have been assessed by the determination of condition factor (K), survival rate (SR), specific growth rate (SGR%), feed conversion ratio (FCR) and average daily gain (ADG) and protein efficiency ratio(PER). All the water quality parameters specifically- Temperature (°C), Dissolved oxygen (DO), Carbon dioxide (CO_2) and pH in the plastic tanks were highly monitored and maintained. The highest food conversion ratio (FCR) was found in the treatment 1 while the lowest was measured in treatment 3. The values of protein efficiency ratio (PER), condition factor, average daily gain (ADG) and specific growth rate(SGR) were highest in treatment 3 and lowest in treatment 2 and treatment 1 respectively. Result of the current study showed that supplementation of Vitamin C at 1200 mg/kg feed had significant positive effects on the FCR, SGR, ADG, PER while no such differences were observed in condition factor variables. The fish Diet C containing 1200 mg/ kg of Vitamin C level has been found to be more effective for better growth of the stringing fish.

KEYWORDS

Stinging Cat fish, Vitamin C, Body Composition, Growth Performance

1. INTRODUCTION

Heteropneustes fossilis (common name is Singhi), the fish that we are studying, is the most economically important freshwater food fish species. It is highly valued as an excellent Indian aquaculture species for intensive culture because of its ability to resist diseases, tolerance to crowding and wide range of environmental conditions. It thrives well on artificial diets at high temperature and has superior nutritive and medicinal values, all factors contributing to its increasing market demand. For high nutritious value, taste and flavor *H. fossilis* has a high market value and consumer preference. In commercial catfish feeds the energy ratio ranges from 66-74 k.cal / kg for each 0.05% of Vitamin [Lovell, R.T. 1972]. Proper food selection is important both from nutritional and economical point of view. Food quality, food type and foods cost should be of primary consideration in terms of selecting the best food. Any fish cultured with artificial feeds needs a suitable percentage of vitamins in the diet for fast growth and better reproductive performance. However requirement of vitamin C by a particular species of fish varies from others. Vitamin C is considered to be a very important component in the diet for body maintenance, growth and other biological performance for the air breathing fish [Delong *et al.,* 1958, Lovell, 1972]. Therefore the present study attempts to investigate the requirement of optimum vitamin C level in formulated fish feed for *H. fossilis*. The overall objective of this

study was to improve the feed quality and their effects on the seed quality. The specific objectives are to study the effects of dietary vitamin C on growth and (b) the impact of dietary vitamin C on the body composition of *H. fossilis.*

2. MATERIALS AND METHODS

The set up for the experiment was situated in Badkulla, a village of West Bengal, India and it was organized sequentially in various steps. These steps included collection of feed ingredients, preparation of fish feed, collection of experimental fish (*H. fossilis*) specimen, acclimatization of the fishes in the laboratory's experimental conditions followed by feeding trials of the fish using the formulated feed in nine different tanks located in the said place.

2.1 Experimental design:

The experiment was designed for nurturing stinging cat fish (H. *fossilis)* in nine plastic tanks in total, each containing 700L of tap water. 25 fishes were placed in each tank. Tanks were filled with fresh water from Laboratory water tap through PVC pipes. Water flow rate in the tank maintained as 1 L/ m. Water aerators were fitted in the tanks for proper aeration. To ensure water quality and safety of the fish *H. fossilis,* the water of the tanks were changed once a day during the experimental period (60 days).

Water quality parameters of the experimental tanks were recorded throughout the study period (60 days) Physico-chemical parameters, such as water temperature (0C), dissolved oxygen (mg/L), pH, nitrate-nitrogen (mg\L), nitrate-nitrogen (mg\L), ammonium nitrogen (mg\L) etc were closely monitored.

The formulated feeds were given twice a day at different time intervals and every week they were measured for their biological parameters. The collection and analysis of these information gathered using the experimental design mentioned above helped evaluate the growth performance, FCR, PER etc of the specimen.

2.2 Feed preparation:

Feed ingredients were collected from the fish feed market and also prepared feed specifically for experimental fish was collected directly from the feed manufacturing company. The collected feed ingredients were mixed thoroughly with a measured amount of hot distilled water to make the mixer moist. Then it was passed through a fish feed pellet-making machine. The fish feed pellets were dried in the sun and then further dried in an oven. After drying of the pellet they were stored properly.

2.3 Proximate composition of the feed and Fish:

Three types of food pellets were prepared for the *H. fossilis* fish and they were distinguished as Diet A, B & C depend on Vitamin C Level-0 as treatment 1; Vitamin C Level-800 mg/kg and Vitamin C Level-1200 mg/kg as treatment 2 and treatment 3 respectively. The proximate compositions of each of the feed were carried out in accordance with A.O.A.C method (1990).

2.4 Collection and Feeding trial of fish:

The experimental fish (*H. fossils*) fingerlings were obtained from local fish merchants, Badkulla, West Bengal, India. The fish fingerlings were treated with potassium permanganate solution (1 mg L^{-1}) to remove any external parasites and were acclimatized in a tank for two days. Each group of fingerlings also were initially weighed to record the initial biomass. According to the size and weight of the fishes an appropriate amount of fish feed were provided two times a day in the experimental tanks. The fish fingerlings were divided in three groups and each batch was given a specific category of fish feed at different time intervals with different Vitamin C level. Fish bodies were analyzed at the initial and final period of the experiment for assessment of their biochemical composition.

3. RESULTS AND DISCUSSIONS

The Study had two aspects: body composition and growth performances of stinging cat fish (*Heteropneustes fossilis*). Detailed result of the study on the proximate composition of fish, survival rate, growth performance and water quality parameters reared in nine tanks fed on three formulated diet (Diet A; without Vitamin C, Diet B; 800 mg of Vitamin C per kg of feed and Diet C; 1200 mg of Vitamin C per kg of feed) as recorded during the period of investigation were presented below-

3.1 Proximate composition of fish

During the rearing and feeding trial, investigations were carried out on the proximate composition of *H. fossilis* for several times. According to the size and age of the fish, proximate composition showed variations for giving different Vitamin C level in the formulated feed. After using the formulated feed with different Vitamin C level, protein, fat, ash and moisture contents of the fish showed differences. Fish kept at nine tanks which are treated 15 days with control feed for being them adapt. Moisture, protein, fat, and ash contents at various rearing time are discussed in **Table 1**. From that result it is clearly revealed that the protein content increased; moisture contents decreased and fat and ash contents fluctuated at the time of rearing and feeding trial.

	Day 1	Day- 30	Day- 60
Moisture	79.21%	78.99-79.21%	78.28-78.98
Protein	16.53%,	16.03-17.05%,	16.77-17.12%
Fat	2.47%,	2.37- 2.47%	2.44-2.60%,
Ash	2.25%	2.05-2.49%	2.18-2.40%

Table: 1 Moisture, protein, fat, and ash contents of stinging cat fish (*Heteropneustes fossilis*) at different time of rearing.

3.2 Survival rate

The survival rate of this experimental fish is high in comparison with other fishes as the fish has accessory respiratory organ. At the time of experiment (rearing fish in the plastic tank which having tap water) the survival rate is comparatively lower than the natural water body as the tap water contained a little bit higher iron (Fe) amount than need. The survival rate of the fish was determined at every 15 days of experimental period. Among nine tanks the survival rate of fish was almost same. At the end of 60 days survival rate of fish was ranging from 81.00-85.00%, 81.00-85.00% and 82.00% in tank A, B & C.

3.3 Feed conversion ratio (FCR, %)

The Feed conversion ratio of *H. fossilis* kept in different tanks and fed on three different types of feed have been calculated in every 15, 30 and 60 days study period . The highest FCR (4.02±0.11 %) was found in the treatment (Diet A) while the lowest (FCR 2.37±0.10 %) was measured in treatment 3 (Diet C). In treatment 2 (Diet B) the value of FCR was 3.31±0.85 % which is significantly higher than treatment 3 but lower than treatment 1. From this point of view the formulated feed C gives the best result in comparison with the formulated feed A & B.

Parameters	Treatments	15th Day	30th Day	60th Day	Mean ± SD
Temperature (°C)	I	28.3	27.95	28.60	28.28± 0.27
	II	29.1	28.3	27.98	28.46± 0.47
	III	28.5	28.8	29.20	28.83± 0.29
pH	I	6.8	7.4	7.1	7.10± 0.24
	II	6.9	7.1	7.2	7.07± 0.21
	III	6.9	6.8	7.1	6.93± 0.12
Dissolved oxygen (DO) (mg L^{-1})	I	9.1	8.9	8.1	8.70± 0.43
	II	8.4	9.1	7.9	8.46± 0.49
	III	9.5	9.1	7.8	8.80± 0.72

Table: 2 Temperature , pH, DO levels various treatment of stinging cat fish (Heteropneustes fossilis) at different time of rearing.

3.4 Protein efficiency ratio (PER, %)

The values of protein efficiency ratio of the experimental fish *H. fossilis* rearing in nine tanks fed on three different types of fish feed have been estimated at the end of 15, 30 and 60 days study period. The values of PER for treatment 3 was 1.41±0.10 which is higher than treatment 1 and treatment 2. PER of treatment 2(1.01±0.12) was significantly higher than treatment 1 (0.84±0.06). From this point of view Diet C (1200mg/kg Vitamin C) have shown better protein efficiency ratio than Diet B (800mg/kg Vitamin C) and Diet A (treatment 1 feed).

3.5 Condition factor (K)

The values of condition factor were calculated during the study period specifically at the end of 15, 30 and 60 days. The condition factor was highest in treatment 3 (1.10± 0.10 %). However the condition factor (1.02±0.02 %) in the treatment 2 was more or less similar with treatment 3 and Treatment 1(0.94±0.02 %).

3.6 Average daily gain (ADG, g/d)

The values of Average daily gain (ADG) was highest in treatment 3 (0.23±.011 g/d) and lowest in treatment1 (0.09±0.004 g/d). The values of Average daily gain (ADG) of the experimental fish *H. fossilis* for treatment 2 (0.17±0.002 g/d) is higher than the treatment 1.

3.7 Specific growth rate (SGR, %/d)

The values of Specific growth rate (SGR%) of the experimental fish *H. fossilis* rearing in nine tanks fed on three different types of fish feed were estimated and the findings were different. The values of SGR% highest for treatment 3 (1.88±0.10 %) and lowest for treatment 1 (0.96±0.02 %) but SGR% value of treatment 2 (1.55±0.01) is higher than treatment 1.

4. Statistical result

SGR, PER, FCR, ADG, Feed efficiency (FE) and Condition factor (K) data were transformed into square root transformations before analysis. Differences between treatments were compared by using one-way ANOVA. Statistical software SPSS version 12 was used to analyze data with the level of significance $p< 0.05$. According to the result we may concluded that formulated Diet C is the effective feed for the experimental fish *H. fossilis*.

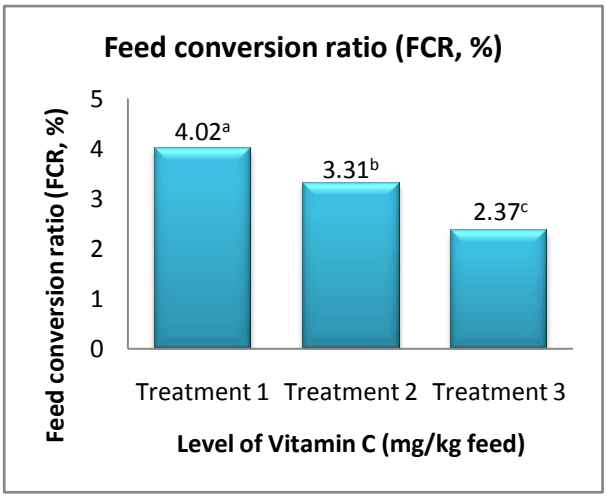

Fig 1: Food conversion ratio (FCR) of pellet feed supplemented with and without Vitamin C fed by *H. fossilis* measured in a laboratory experiment. Bars (mean ±SEM) different letters indicate significant difference.

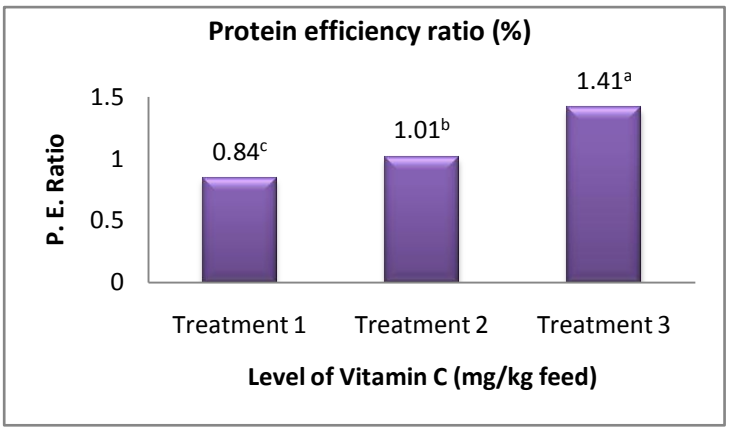

Fig 2: Protein efficiency ratio (PER) of pellet feed supplemented with and without Vitamin C fed by *H. fossilis* observed in a laboratory trail. Bars (mean ±SEM) different letters(a,b,c) indicate significant difference.

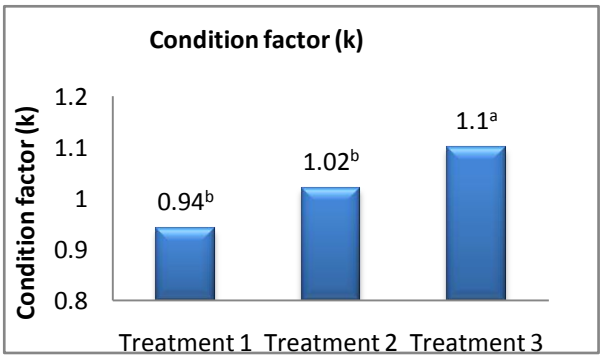

Fig 3: Condition factor (k) in *H. fossilis* determined after 60 days trail feed with different Vitamin C level diet. Bars (mean ±SEM) different letters indicate significant difference.

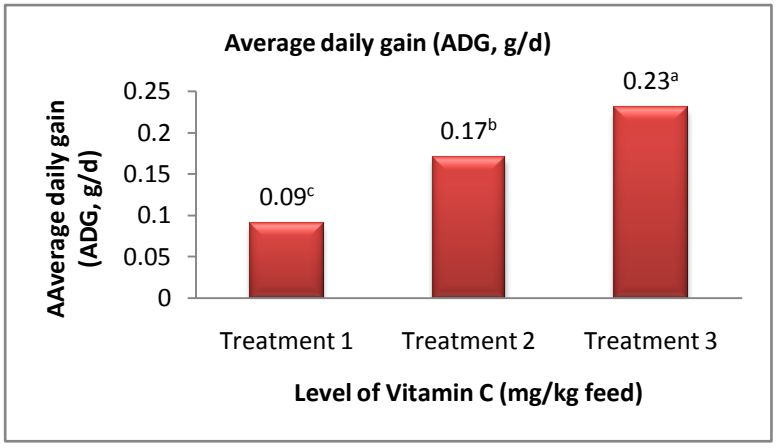

Fig 4: Average daily gain of pellet feed supplemented with and without Vitamin C fed by *H. fossilis* observed in a laboratory test. Bars (mean ±SEM) different letters indicate significant difference.

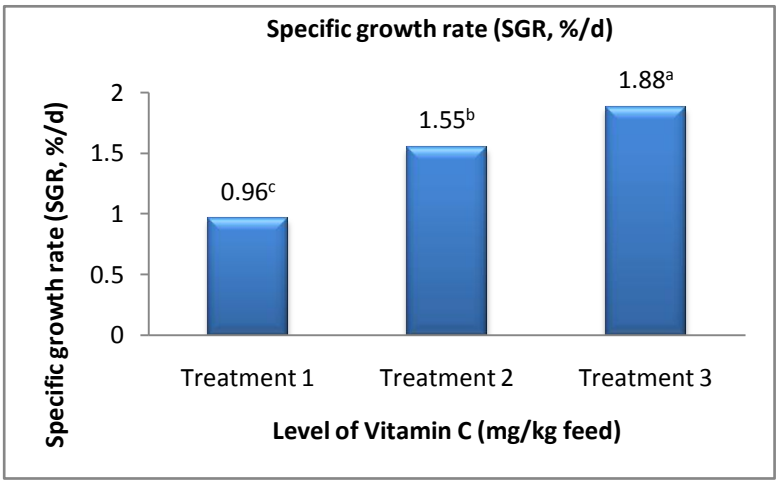

Fig 5: Specific growth rate of pellet feed supplemented with and without Vitamin C fed by *H. fossilis* observed in a laboratoryexperiment. Bars (mean ±SEM) different letters indicate significant difference.

5. CONCLUSION

From the above study we find dietary effect of Vitamin C of formulated fish feed on the body composition and growth performance of *H. fossilis*. During the study period FCR, PER of the rearing *H. fossilis* showed results in favor of the use of prepared fish feed specifically diet with Vitamin C at 1200 mg/kg feed (Diet C). So, there is a significantly positive effect of the highest Vitamin C level (Diet C - 1200 mg/ kg of feed) on the growth, feed utilization & body composition. So Vitamin C @ 1200 mg/ kg mix with formulated feed should be used for better enhancement of growth of these type of air breathing fishes. Also it is suggested that the feed be prepared and sold to farmers for better tomorrow in aquaculture industry.

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