Shobuj Bangladesh Publications House
International Journal of Natural and Social Sciences
ISSN: 2313-4461

Evaluation of nutritive value of three commercial fish feed and their effect on the growth and survival of tilapia (Gift Strain, *Oreochromis niloticus*) fry

Debashis Kumar Mondal[1], MNS Mamun Siddiky[2], Mritunjoy Paul[3]

[1]Bangladesh Fisheries Research Institute, Freshwater Sub-station, Jessore, Bangladesh
[2]Bangladesh Fisheries Research Institute, Brackishwater Station, Khulna, Bangladesh
[3]Bangladesh Fisheries Research Institute, Freshwater Station, Mymensingh, Bangladesh

ABSTRACT

An 8 week feeding trial was conducted in synthetic hapa in pond to asses and compare the nutritive value of three commercial fish feed through chemical analysis and their effect on the growth and survival of tilapia (GIFT strain, *Oreochromis niloticus)* fry (0.008±0.00g). In the rearing pond, overall water quality parameters were at the acceptable level. Three commercial fish feed, were collected from market and proximate composition such as moisture, crude protein, crude lipid, ash and fiber were analyzed in the laboratory. This experiment was designed with three treatments each having two replications. Three different feed *viz*, National feed (T_1), Quality feed (T_2), Mega feed (T_3) were supplied four times a day. Growth of tilapia fry under treatment T_3 in terms of weight was significantly ($p<0.01$) higher (7.23±0.3866 g) than those of other treatments. Treatment T_1 showed the significantly ($p<0.01$) lowest (4.097±0.1745 g) growth performance among the three treatments. The highest survival rate (90.275±0.460%) was obtained with treatment T_3. Comparatively better growth and survival rate of fry was obtained with Mega feed. From the result of both nutritive value and growth performance Mega feed can be the recommended feed for the growth and production of tilapia fry.

Keywords: Tilapia fry, fish feeds, growth performance, Bangladesh.

*Corresponding author.
E-mail address: debbfri@gmail.com (DK Mondal)

INTRODUCTION

Tilapia is widely recognized as one of the most important species for farming in a wide range of aquaculture systems (Pullin, 1985). The Nile tilapia (*O.niloticus*) contributes about 55% to the global production of about 450,000 Mt (Pullin et al., 1994). Nile Tilapia has been introduced in our country because of its high market demand and growth performance. It can be cultured in almost any type of water bodies. It grows to marketable size within short period of time and its survivability is also very high. Tilapia reproduces easily, accepts wide variety of food and can tolerate poor water quality with low dissolved oxygen levels and is also disease-resistant. But the ultimate tilapia booming was done with the introduction of improved strain of nile tilapia called GIFT (Genetically Improved Farmed Tilapia). In response to the expansion of tilapia aquaculture, considerable attention has also been given to ensure a continuous supply of high quality tilapia seed. At present, to meet the demand for tilapia fingerlings more than 250 tilapia hatcheries has been established and are producing 3000 million fry every year in Bangladesh (Hussain et. al., 2011).

The nutritional requirements of tilapia are very similar to other warm water fishes (Popma and Lovshin, 1995). The diet of fishes must be balanced and should contain the primary or basic food components such as proteins, carbohydrates and lipids. Protein is the most expensive macronutrient in fish diet. The dietary protein

How to cite this article: DK Mondal, MNSM Siddiky and M Paul (2016). Evaluation of nutritive value of three commercial fish feed and their effect on the growth and survival of tilapia (Gift Strain, *Oreochromis niloticus*) fry. International Journal of Natural and Social Sciences, 3(1): 67-72.

requirement for fish fry is high and ranges from 35% to 56% (Jauncy and Ross, 1982).

In Tilapia culture, fry feed is very important because the quality of Tilapia fry depends on the quality of fry feed. Fry feeds generally contain higher level of protein because it is believed that the protein and energy requirements on a unit mass basis are much higher in the early stages of life. The highest relative weight gain is achieved in the fry stages and it is important to ensure that full growth potential is realized during this stage of development. The protein content of fry feed in our tilapia farms have not yet been standardized although some farms use feed having 40% protein. The survival of fry in the farm is also low by feeding feeds of differential protein levels in different farms. So it is essential to recommend the appropriate protein level of fry feed for economic production of healthy fry and to maximize survivability as well.

The nutritive balance of feed influences feed utilization and growth of fish. It is very essential to know the nutritional requirements particularly for protein, carbohydrate and lipid for optimum growth of a fish species as well as in formulating a balanced diet. But farmers are facing problems with the high price and low quality of the commercial pelleted feeds for which the profit margins of the farmers are being decreased day by day. Therefore, efforts are needed to assess the actual nutritive value of the commercial fish feeds available in the market and their effect on fish growth.

MATERIALS AND METHODS

A comparative outdoor growth trial was conducted in 6 (six) nylon net hapas with a mesh size of 1.00 mm for 56 days to determine the effects of commercial feeds on growth and survival of tilapia (GIFT strain. *O. niloticus)* fry. The hapas were arranged in two columns (3 hapas per columns). Size of each hapa was 16 m^3. 7 days old fry of initial average length 0.8 cm and weight 0.008 gm were released in each hapa. Fish were stocked into groups of 20000 fry per hapa. Three experimental diets *viz*, National feed, Quality feed and Mega feed were used in treatment 1, treatment 2 and treatment 3 respectively. Each of three dietary treatments had two replications and the experiment was conducted for eight weeks. Proximate composition of three commercial feed was analyzed in the fish nutrition laboratory in Bangladesh Fisheries Research Institute, Mymensingh. Initially the fry were individually weighed and the growth rate was measured at weekly interval. The fry were offered the test diet four times daily and the feeds were supplied to fry up to satiation level.

The water quality parameters of different hapas were measured at weekly interval throughout the experimental period. The parameters like dissolved oxygen, pH, total alkalinity, carbon dioxide were measured by respective test kits and temperature by Celsius / centigrade thermometer.

Proximate composition of three diets was analyzed following AOAC (1990) methods:

Moisture:

$$Moisture = \frac{Original\ sample\ wt - dried\ sample\ wt}{Original\ sample\ wt} x100$$

Crude protein:

$$Nitrogen = \frac{Miliequivalent\ of\ nitrogen\ (0.014)\ x\ titrant\ \ value\ (ml)\ x\ strengtsh\ of\ HCL\ strent}{Sample\ wt}$$

Crude protein = 6.25 × % Nitrogen

Crude lipid:

$$Total\ lipid\ (\%) = \frac{wt\ of\ lipid\ (g)}{Wt\ of\ sample} x\ 100$$

Crude fiber (%) = [Wt. of sample after air drying (g) - Wt. of sample after ashing (g)/sample weight] x100

$$\text{Ash content (\%)} = \frac{\text{Weight of ash (g)}}{\text{Weight of sample (g)}} \times 100$$

Weight gain, specific growth rate (SGR) and Survival rates, were calculated as follows:

Weight gain (g) = Mean final weight – Mean initial weight

$(SGR) = [(\ln W_2 - \ln W_1)/ (T_2 - T_1)] \times 100$

Where, W_2 = Final live body weight (g) at time T_2

W_1 = Initial live body weight (g) at time T_1.

Survival rate (%) = (Total number of harvest/ Total number of stock) x 100

The data obtained during experiment were statistically analyzed to see whether the effect of different commercial feeds on the growth and survival of fish fry were significant or not. One way analysis of variance (ANOVA) was performed to test the significance of variation among the treatment means. Statistical tests were performed by computer based statistical software SPSS (Statistical Package for Science).

RESULTS AND DISCUSSION

The water temperature monitored during the study period in the experimental hapas was 26 to 33°C i.e. within the suitable range. Similar findings were reported by Boyd (1982), Hossain et al. (2004). The dissolved oxygen content in the present experiment ranged from 5.5 to 8 mg/l that is suitable for tilapia culture as described by Rahman (1992) and DoF (1996). During the study period the pH, Free CO_2, and total alkalinity value were 7.8 - 8.8, 0.0-8.2 mg/l and 105-170 mg/l which were also within the suitable range (DoF, 1996). The water quality parameters are presented in Table 1.

Table1. Water quality parameters observed during the experimental period

Parameters	Treatments		
	T_1	T_2	T_3
Temperature(^{0}C)	26.0-32.5	26.0-33	26-32.5
DO (mg/l)	5.5-7	6.5-7.5	6.0-8.0
pH	7.8-8.5	7.9-8.8	7.8-8.6
Free CO_2 (mg/l)	0.0-8.2	0.0-7.5	0.0-8.0
Total alkalinity (mg/l)	105-170	115-165	110-160

Quality feed, Mega feed and National feed were used for the study. During the study period, Proximate Composition such as moisture, Lipid, Protein, ash, fiber and carbohydrate of three feeds were analyzed in the laboratory and the results are presented in the Table 2.

Table 2: Proximate composition analysis of three commercial fish feed

Name of item	% moisture	% Lipid (oil)	% Crude Protein	% Ash	% Crude fiber	% Carbohydrate
Quality feed	14.95	7.5	34.00	16.99	6.40	20.16
Mega feed	12.00	7.39	35.23	17.28	6.85	21.25
National feed	13.45	10.80	24.14	16.17	6.31	29.13

Growth, health and reproduction of fish and other aquatic animals are primarily dependent upon an adequate supply of nutrient, both in terms of quantity and quality, irrespective of the culture system in which they are grown. Therefore, supply of inputs (feeds, fertilizers etc) has to be ensured so that the nutrients and energy requirements of the species under cultivation are met and the production goals of the system are achieved (Hasan, 2001).

The analyzed moisture value of Quality, Mega, and National feed was 14.95%, 12.00%, 13.45% respectively. Roy (2002) reported that a diet containing 9.8% moisture appear to be more suitable for GIFT tilapia. Therefore, variation of moisture content in aqua feed among different industries and places are due to lack of knowledge about fish feed quality.

The analyzed crude protein value of Quality, Mega feed, National feed were 34.00%, 35.23% and 24.14% respectively. The analyzed carbohydrate value of Quality, Mega, and National feed were 20.16%, 21.25%, 29.13% respectively. Roy (2002) reported that a diet containing 29.18% CHO appears to be more suitable for GIFT tilapia.

The analyzed lipid value of Quality, Mega, and National feed were 7.5%. 7.39 %, 10.80 % respectively. The lipid value are lower in quality and Mega feed than that of Cowey and Sargent (1979) who reported that in general , 10-20% of lipid in most fresh water fish diets gives optimal

growth rates. Luquet (2000) also stated that dietary lipid levels of 5-6% are often used in tilapia diet.

The analyzed crude fiber value of Quality, Mega, and National feed were 6.40%, 6.84%, 6.31 % respectively. It is not desirable to have a fiber content exceeding 8-1.2% in diets for fish, as the increase in fiber content would consequently result in the decrease of the quality of an unusable nutrient in the diet (De Silva and Anderson, 1995). The analyzed ash content of Quality, Mega and National feed were 16.99%, 17.28% and 16.17% respectively.

Effects of three artificial feed on the growth of tilapia (GIFT strain, *Oreochromis niloticus)* fry in synthetic hapa in pond were investigated in the experiment. The initial average weight of fry was 0.008g in all different treatments. There were no significant ($P>0.01$) difference among treatments.

In the experimental period, mean final weight of tilapia fry were 4.097± 0.1745g in T_1, 5.186±0.2177gm in T_2, 7.230±0.3866g in T_3. The maximum and minimum final weights were 7.230±0.3866g in T_3 and 4.097± 0.1745g in T_1. The final weight of tilapia fry under treatment T_3 were significantly ($P<0.01$) higher than those of treatment T_1 and T_2. The final weight (g) of fry under different treatment showed a linear trend of growth during the experimental period (Figure 1).

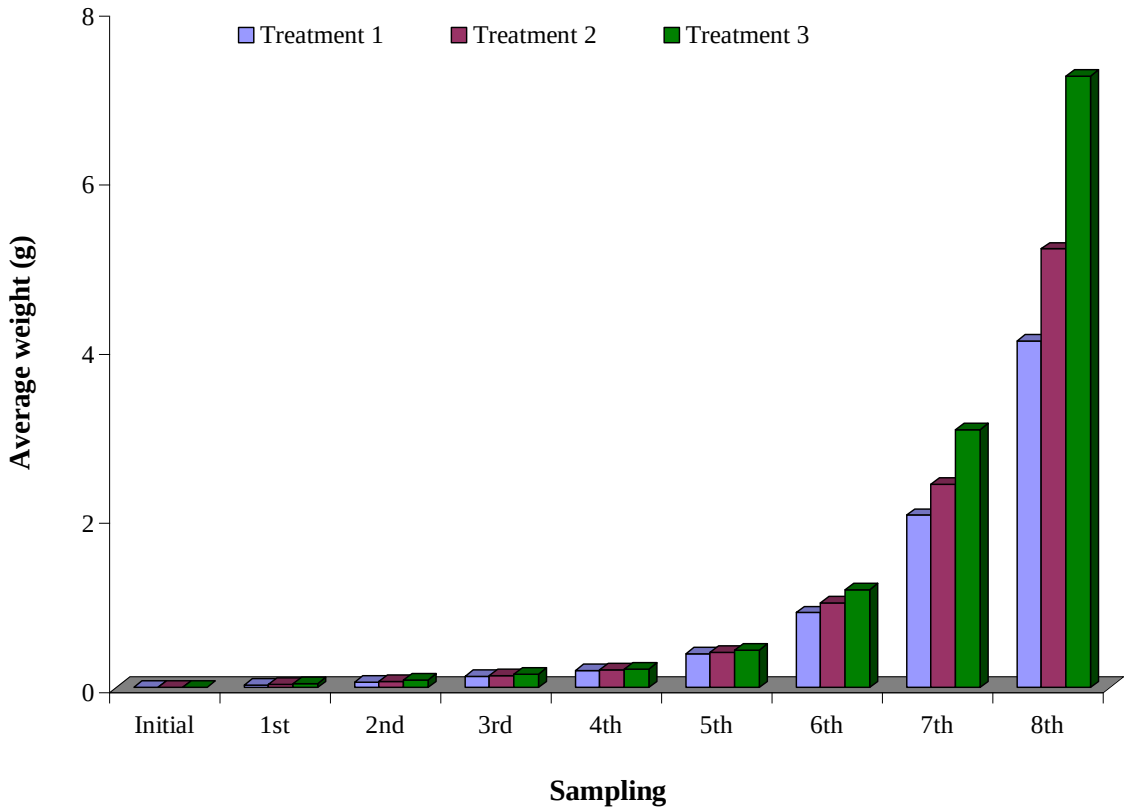

Figure1
Growth trend of final weight (g) of tilapia (GIFT strain) fry during the experimental period of 8 weeks under three different treatments.

Table 3
Statistics of growth parameters of tilapia fry under different treatments.

Parameters	Treatment (T_1)	Treatment (T_2)	Treatment (T_3)	LSD	Level of significance
Initial weight	0.008±0.000	0.008±0.000	0.008±0.000	0.000	ND
Final weight (g)	4.097±0.174[b]	5.186±0.160[b]	7.230±0.289[a]	0.433	**
Weight gain (g)	4.089±0.212[c]	5.178±0.387[b]	7.222±0.111[a]	0.525	**
Specific growth rate (SGR)	11.342±0.240[b]	11.771±0.434[b]	12.375±0.109[a]	0.586	**
Survival (%)	86.415±0.827[b]	89.795±1.690[a]	91.275±0.460[a]	2.02	**

** Significant at 1% level of probability ND - Not significantly different at P>0.01

During the experiment, the mean weight gain of tilapia fry were 4.089±0.212 g in T_1, 5.178±0.387 g in T_2 and 7.222±0.111 g in T_3 (Table 3). The maximum weight gain was 7.222±0.111 g which was obtained in T_3 where Mega feed was supplied. Whereas, the minimum weight gain was 4.089±0.212 g which was obtained in the T_1 where National feed was supplied. Significantly maximum growth rate of fish in T_3 may be attributed due to quality of the Mega feed which contained average 35.23% protein. On the other hand, National feed contained 24.14 % protein. Level of crude protein and other necessary elements in the diets and mode of feed presentation influence the growth rate of the fish (Khan, 1997). Pathmasothy and Jin (1987) reported that the growth rate of fish was lower when fed with pellet having 22% crude protein compared to those having 32% crude protein.

Specific growth rate (% /day) in three treatments ranged from 11.342±0.240 %/day to 12.375±0.109 %/day (Table 3). The significantly highest specific growth rate obtained in T_3 (12.375±0.109 %/day) and lowest growth rate obtain in T_1 (11.342±0.240 %/day). Diana and Lin (1996) obtained SGR value of 3.10 %/day in *O. niloticus* in Thailand using feed and fertilizer. On the other hand, Green (1992) obtained a slightly lower SGR value 2.03 %/day with tilapia in Honduras using feed and fertilizer.

The survival rate in the treatments T_1, T_2 and T_3 were 86.415%, 89.795% and 91.275 % respectively. Highest survival rate was obtained in treatment T_3 where Mega feed was supplied. More or less similar type of survival rates were observed by Mostaque (1995), who recorded the survival rates of 86 to 95% in polyculture system in BAU ponds. Kohinoor *el al.* (1993) obtain survival rate of 86 to 94 % in monoculture of Thai Sharpunti. The major growth parameters including final weight, weight gain, specific growth rate, survival rate of tilapia fry were varied significantly (P<0.01) between the treatments in the Table 3.

REFERENCES

AOAC (Association of Official Analytical Chemists) (1990). Official Methods of Analysis. Kenneth, H. (ed.). Arlington, Virginia, USA. 1298p.

Boyd CE (1982). Water Quality Management for Pond Fish Culture. Elsevier Scientific Publishing Company, Amsterdam, Oxford, New York, 318 pp.

Cowey CB and Sargent JR (1979). Nutrition *In*: Fish physiology. (ed. by W. S. Hoar, D. J. Randall and J. R. Breet), New York, Academic Press. Vol. 8, pp. 1-69.

De Silva SS and Anderson, TA (1995). Fish Nutrition in Aquaculture. Chapman & Hall, 208p.

Diana JS and Lin. CK (1996). Timing of supplemental feeding for tilapia production. Journal of. World Aquaculture Society, 27(4): 410-419.

DoF. (1996). Matsha Pakkah Shankalan. Directorate of Fisheries, Ministry of Fisheries and Livestock, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh. 81 pp.

Green BW (1992). Substitution of organic manure for pelleted feed in tilapia production. Aquaculture, 101 (3-4): 213-222.

Hasan MR (2001). Nutritional and feeding for sustainable aquaculture development in the third millennium. In*:* Aquaculture in the third Millennium. (ed.by R.P. Subasinhghe; P. Bueno,M.J. Phillips, C. Hough, S.E. McGladdery and J.R. Arthur), Bangkok, Thailand, 20-25 February 2000. pp. 193-219.

Hossain MA, Roy R, Rahmatullah SM and Kohinoor AHM (2004). Effect of stocking density on the growth and survival of GIFT tilapia, (*Oreochromis niloticus*) fed on formulated diet. Journal of Agriculture and Rural Development, 2(1): 127-133.

Hussain MG, Kohinoor AHM and Islam MS (2011). BFRI evolved improved fish variety and their dissemination strategy. In Jatiya Matsha Shaptaha Shankalan. Department of Fisheries, Ministry of Fisheries and Livestock, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh. pp. 21-23.

Jauncey K and Ross B (1982). A guide to tilapia feed and feeding. University of Stirling, Scotland, UK. 111 pp.

Khan MSR (1997). Culture of *Pangasius sutchi* (Flower) in ponds and cages. M.S. Thesis, Department of Aquaculture, Bangladesh Agricultural University, Mymensingh, 62pp.

Kohinoor AHM, Akhteruzzaman M and Sahah MS (1993). Production of *Puntius gonionotous* in ponds. Bangladesh Journal of Zoology, 21(2): 7-83.

Luquet P (2000). Tilapia, *Oreochromis* spp. In: Handbook of Nutrient Requirement of Fishes. (ed. by R. P. Wilson), CRC Press, Boca Ann Arbor, Boston, London. pp. 169-180.

Mostaque A (1995). Studies on the mixed culture of fishes in seasonal ponds through fertilization and feeding. M.S. dissertation, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. 38pp.

Pathmasothy S and Jin LT (1988). The response of Pangasius sutchi (Flower) fingerlings fed on isocaloric diets with variable protein levels. Journal of Malaysian Agriculture, 54: (2), 81-90.

Popma TJ and Lovshin LL (1995). Worldwide Prospects for Commercial Production of Tilapia. International Center for Aquaculture and Aquatic Environments Department of Fisheries and Allied Aquacultures, Auburn University, Alabama. pp. 26-27.

Pullin RSV, Bimbuo MAP and Bimbao GB (1994). World outlook on tilapia farming First International Symposium on Aquaculture. June 1994. Boca del Rio, Mexico.

Pullin RSV (1985). Tilapias: every man's fish. Biologist, 32 (2): 84-88.

Rahman MS (1992). Water quality management in aquaculture. BRAC Prokashana, Mohakhali, Dhaka, Bangladesh. 84 pp.

Roy R (2002). Effect of stocking density on the growth and survival of GIFT tilapia fed on formulated diet. MS Thesis. Department of Aquaculture, BAU, Mymensingh. 68 pp.