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A comparative study on the effect of commercial fish feeds on the growth of Thai pangas, *Pangasius hypophthalmus*

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Abstract
A 70 day long experiment was carried out to evaluate three commercial pangas feeds available in Bangladesh *viz.* Quality Feeds Ltd. (QF), Aftab Bohumukhi Farm Ltd. (ABF) and Saudi-Bangla Fish Feed Ltd. (SBFF) (designated as treatment T_1, T_2 and T_3) on the growth of Pangas, *Pangasius hypophthalmus*. Each treatment had two replicates using six experimental ponds of each 80m^2 size. The stocking density was 250 fish/80 m^2. At the beginning, the fish were fed twice daily at 15% of their body weight which was gradually reduced to 10 and 6%, respectively for the rest of the period. The ranges of water quality parameters observed were: temperature 29.0^{0}C - 35.1^{0}C, pH 6.85 - 8.52, DO 1.71 - 7.65 mg/l and transparency or Secchi depth 14.5 - 30.0 cm. The mean weight gain of fish was significantly ($P<0.05$) higher in T_3 followed by T_2 and T_1. The specific growth rate (SGR) ranged between 4.09 and 5.06, feed conversion ratio (FCR) values between 1.54 and 1.61 with treatment T_1 showing the lowest FCR. Protein efficiency ratio (PER) values ranged between 2.03 and 2.11. The survival of fish varied between 90.4 and 91.6%. The significantly ($P<0.05$) highest production of fish (kg/ha/70 days) and profit (Tk/ha/70 days) was observe in T_3 (SBFF) followed by T_2 (ABF) and T_1 (QF), respectively. The result of the study showed that on the basis of nutritive value and growth performance of pangas, feed from Saudi-Bangla Fish Feed Ltd. is the best.

Key words: *P. hypophthalmus*, Commercial fish feed

Introduction

With the increasing demand for food fish and the decline in capture fisheries production, aquaculture in Bangladesh is heading towards intensification. This shift from low density to high density culture i.e. traditional to semi-intensive or intensive culture is consequently leading to an unprecedented rise in the demand for feeds. Farmers shift gradually from no feed, through the use of farm-made feeds, to factory-made feeds. The success of intensive and semi-intensive fish culture depends to a large extent on the application of suitable feeds. Fish feeds provide nutrients for optimum fish growth and bring higher economic return to farmers. Fish production as high as 3,700-4,500 kg/ha could be obtained by using semi-intensive polycultue in ponds with supplementary feeding. This demonstrates a real possibility of increasing production

and reveals the potential importance of aquafeeds in Bangladesh (Zaher and Mazid 1993). At present, there are about 25 commercial fish feed industries in Bangladesh. Saudi-Bangla Fish Feed Ltd., Aftab Bohumukhi Farm Ltd., Quality Feeds Ltd. are among the pioneers whose feeds available throughout the country (Pers. Comm. Manager, SBFF).

Feed costs generally constitute the highest single operation cost of semi-intensive or intensive grow-out farming operation (Shang and Costa-pierce 1983). It is essential that the feed provides maximum production efficiency at a minimum cost. The relative importance of growth rate and feed conversion efficiency will depend upon the quality and cost of feed in relation to the market value of the farmed product. The unit cost of various types of feed and cost of fish production using each of this feed as well as the unit profitability of each system of fish production must be compared before one type of feed is selected. It is therefore of great importance to the fish farmers to utilize their investments in feed as optimal as possible.

Thai pangas (*P. hypophthalmus*) is an indigenous fish species of Thailand (Roberts and Vidthayanon 1991). It was introduced in Bangladesh from Thailand in 1989 is particularly important for their fast growth, lucrative size, good taste and high market demand. The species can also be stocked at a much higher density in ponds compared to other culturable species. Tavarutmanegul *et al.* (1979) reported that *Pangasius sutchi* is one of the most suitable catfishes for rearing in ponds and cages (floating ponds).

Only few years back *P. hypophthalmus* was a popular table fish in our country and farmers were economically benefited from pangas farming. But recent years, pangas culture is being depleted because of decreasing market value, increasing feed cost, decreasing feed quality, unavailability of low cost supplementary feeds, lack of proper management and related socio-economic constraints. As government has no legislation over control of feed quality and cost, there is a great possibility that the farmers may be deceived by using the commercial feeds without knowing their nutritive values. Therefore, the present study was undertaken to observe the growth and feed utilization of *P. hypophthalmus* using three different commercial fish feeds available in the market so that the best commercial feed for pangas will be known.

Materials and methods

Three most commonly used Pangas feeds from Quality Feeds Ltd. (QF), Aftab Bohumukhi Farm Ltd. (ABF) and Saudi-Bangla Fish Feed Ltd. (SBFF) were collected from local Mymensingh market. Three categories of feeds e.*g.* nursery, starter and grower/finisher for QF and ABF Feed and starter-I, starter-II, starter-III and grower-I were used for SBFF.

The experiment was carried out over a period of 70 days in six experimental ponds located in the Hatchery and Field Laboratory Complex of the Faculty of Fisheries, Bangladesh Agricultural University (BAU), Mymensingh. The size of each pond was 80 m^2 and average depth was about 1.5 m. There were three treatments *viz* T_1, T_2 and T_3 assigned to QF, ABF and SBFF feed respectively each having two replicates.

The proximate composition of the commercial feeds were analysed and the resuts are shown in Table 1. The fingerlings of Thai pangas, *P. hypophthalmus* were collected from a local fish vendor. All the fish were of same age group having mean length and weight of 8.44±0.04 cm and 6.60±0.04 g respectively. Each pond was stocked with 250 fingerlings. Nursery feeds were applied at the beginning of the trial followed by starter and grower/finisher feeds. The feeds were supplied twice daily morning (9.00 hr) and afternoon (16:00 hr). At the beginning, fish were fed at a rate of 15% of the body weight which was reduced to 10 and 6% for the rest of the period. The feeds were dispersed by hand broadcasting over the ponds. Fortnightly sampling was done to adjust the feeding rate and to observe the health condition of fish. Water quality parameters such as temperature, pH, dissolved oxygen and transparency were measured and recorded weekly throughout the experimental period.

Table 1. Proximate composition (% dry matter basis) of different commercial fish feeds used

Treatments	Type of feed	Dry matter	Crude protein	Crude lipid	Ash	Crude Fibre	NFE*
T_1	Rupali (N)[a]	88.71	31.96	6.06	13.2	11.06	33.47
(Quality	Rupali (S)[b]	90.35	27.21	6.61	14.81	10.37	32.05
Feeds Ltd.)	Rupali (G)[c]	89.50	27.98	6.28	14.07	11.01	36.39
T_2	(S)	90.41	30.82	9.97	11.27	9.61	34.65
(Aftab	(G)	89.47	27.91	9.92	11.27	9.45	37.08
Bohumukhi	(F)	90.32	27.07	9.98	11.99	8.54	38.31
Farm Ltd.)							
T_3	(S-I)	90.06	31.53	7.06	18.84	9.86	29.46
(Saudi-	(S-II)	90.22	32.47	7.90	18.42	10.28	27.90
Bangla Fish	(S-III)	89.53	28.97	7.11	17.29	9.24	33.47
Feed Ltd.)	(G-I)	89.99	28.38	7.83	18.37	9.55	32.27

*Nitrogen free extract (NFE) calculated as: 100- %(moisture + crude protein + crude lipid + ash + crude fibre).
[a]N= Nursery; [b]S= Starter & [c]G= Grower

At the beginning of the experiment ten fish from the stock and at the end of the experiment four fish from each treatment were collected randomly for carcass analysis. The proximate composition of fish carcass and feed were determined in triplicates according to AOAC (1980). Growth performances and feed efficiency were calculated according to Castell and Tiew (1980). One way analysis of variance (ANOVA) followed by Duncan's multiple range test (DMRT) was done to determine the significance of variation among the treatment means.

Results

The crude protein content of the various diets differed slightly. However, all the nursery feeds contained higher protein (27.07-32.47%) than the starter (27.21-28.97%) and grower (27.07-28.38%) feeds. The crude lipid content of ABF were much higher (9.92-9.98%) than those of SBFF (7.06-7.90%) and QF (6.06-6.61%).

The ranges of water quality parameters recorded in different experimental pond did not vary considerably during the experimental period and the values were: temperature 29.0-35.1°C, pH 6.8-8.5, dissolved oxygen 5.71-7.65 mg/l) and transparency 14.5-30.0 cm.

The results of growth performance and food utilization are shown in Table 2. The mean initial weight of 6.63g, 6.62g and 6.55g reached to a mean final weight of 116.3g, 158.68g and 226.83g in treatment T_1, T_2 and T_3 respectively. The significantly ($P<0.05$) highest growth was achieved in treatment T_3 followed by T_2 and T_1. The weight increment of *P. hypophthalmus* in different treatments during the experimental period is graphically shown in Fig. 1.

Table 2. Growth and feed utilization of *P. hypophthalmus* in different treatments during the experimental period

Parameters	Treatments			±SE[1]
	T_1	T_2	T_3	
Mean initial weight (g)	6.63[a2]	6.62[a]	6.55[a]	0.039
Mean final weight (g)	116.3[c]	158.68[b]	226.83[a]	3.706
Weight gain (g)	109.67[c]	152.07[b]	220.28[a]	3.996
% Weight gain (g)	1654.29[c]	2298.56[b]	3362.86[a]	48.349
Specific Growth Rate (SGR % day)	4.09[c]	4.54[b]	5.06[a]	0.032
Food Conversion Ratio (FCR)	1.54[a]	1.61[a]	1.57[a]	0.055
Protein Efficiency Ratio (PER)	2.11[a]	2.03[a]	2.03[a]	0.071
Apparent Net Protein Utilization (ANPU %)	35.14[a]	30.66[c]	32.07[b]	1.490
Survival (%)	90.4[a]	91.2[a]	91.6[a]	1.200
Production (kg/ha/70 days)	3062.01[c]	4282.99[b]	6231.66[a]	-
Net profit (Tk/ha/70 days)	31,004[c]	31,801[b]	34,950[a]	-

[1]Standard error of treatment means calculated from the residual mean square in the analysis of variance.
[2]Figure in the same row with the same superscripts are not significantly different ($P>0.05$).

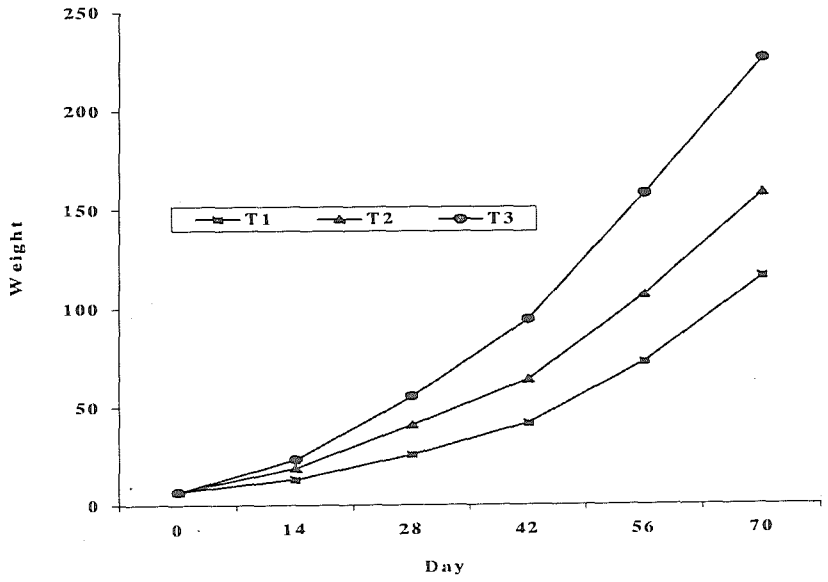

Fig. 1: Weight increment of P. hypophthalmus in different treatments during the experimental period.

The specific growth rate (SGR % day) of fish in different treatments varied from 4.09 to 5.06 with fish in T_3 showing significantly the highest SGR. The survival of fish in different treatments ranged between 90.4 and 91.6%. There was no significant difference in survival rates of fish among the treatments (Table 2).

The mean food conversion ratio (FCR) in different treatments ranged between 1.54 and 1.61 (Table 2). The highest FCR was found in treatment T_2 (1.61) and the lowest in treatment T_1 (1.54). However, there was no significant difference between the FCR values in different treatments. The PER values ranged between 2.03 and 2.11. There was no significant ($P>0.05$) difference in PER values among the treatments. The ANPU% values were 35.14, 30.66 and 32.07% in treatments T_1, T_2 and T_3 respectively. The values significantly ($P>0.05$) differed from each other.

Significantly ($P>0.05$) highest fish production was achieved in treatment T_3 (6231.66 kg) followed by T_2 (4282.99 kg) and T_1 (3062.01 kg) for a period of 70 days. Consequently, significantly ($P<0.05$) highest net profit (Tk.) was also obtained in treatment T_3 followed by T_2 and T_1 respectively (Table 2).

Discussion

The water quality parameters such as temperature, pH, dissolved oxygen, transparency measured in different treatments throughout the experimental period were found to be more or less similar and were within the suitable range for fish culture (Jhingran 1991).

In the present study, the highest weight gain of fish was observed in treatment T_3 receiving SBFF followed by T_2 fed with ABF and T_1 fed with QF. The significantly highest growth of fish in T_3 may be attributed to the better quality of the SBFF which contained average 29% protein. On the other hand, ABF feed contained 28% and QF contained 27% protein. Protein and feed quality as well as mineral contents of SBFF was better than other feeds. Another possible cause for better growth performance of fish in SBFF might be that the quality of protein or the amino acid balance might have been better in SBFF. 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 pelleted feed having 22% crude protein compared to those having 32% crude protein. Growth rate of *P. pangasius* increased with the increment of protein concentration and the highest growth of fish was obtained at 40% protein level in feed as reported by Rahman (1989). However, Chuapoehuk and Pothisoong (1983) stated that 25% protein containing diet was best for optimum growth of *P. sutchi.*

The SGR values observed in the present study is much higher than the values (3.09 to 3.51) obtained with pangas reared in net cages (Azimuddin *et al.* 1999) and the value (3.34) observed in outdoor concrete tank for *P. sutch.* (Hung *et al.* 1998).

A low FCR value is an indicator of better food utilization efficiency of formulated feed. The high energy diet produced the lowest feed conversion ratio (FCR) and the highest nutrient retention (Hillestad 2001). In the present study, there was no significant

(P> 0.05) difference in FCR values among the treatments. However, comparatively lower FCR (1.54) obtained in T_1 where fish were fed with QF. The FCR values were higher than the values (1.40) reported by Hung *et al.* (1998) but lower than the values (1.73 to 2.04) stated by Azimuddin *et al.* (1999) for *P. sutchi.* Rashid (1997) reported higher FCR values of 4.45 and 4.67 for *P. sutchi* in cage fed diet containing 29.98% and 29.63% protein respectively. The PER values in the present study is higher than the values reported by Kamrudin *et al.* (1987) for *P. sutchi.* Survivals (%) of fishes in the present study were similar to the values reported by Azimuddin *et al.* (1999).

The total fish production in T_3 reached almost two times higher than T_1 during the same experimental period (70 days) due to higher weight gain of individual fish. The production obtained in this study is much higher than the findings of Ahmed *et al.* (1996) who reported a production of 339.39 kg/ha for *P. pangasius* fed with SBFF for a three months experimental period. This might be due to the fact that *P. hypophthalmus* is a culturable species whereas *P. pangasius* is a riverine fish species. A simple economic analysis showed that treatment T_3 generated maximum net profit of Tk. 34,950/ha/70 days which is due to the higher production of fish in T_3.

The carcass proximate composition of fish was influenced by the feeds from different company (Seikai *et al.* 1997, Austreng and Storebakken 1985). There was a marked increase in lipid content of fish compared to the initial content of fish (Table 3). The carcass lipid content was directly influenced by the dietary lipid content. ABF which contained the highest crude lipid (9.95%) resulted in the highest carcass lipid. An inverse relationship between lipid and moisture contents could be observed as reported earlier (Andrews and Stickney 1972, Garling and Wilson 1976).

Table 3. Carcass composition of the experimental fish at the start and end of the experiment (% dry matter basis)

Parameters	Initial (all fish)	Treatments		
		T_1	T_2	T_3
Moisture	78.83	69.81±1.82	67.4±1.98	67.88±1.44
Crude protein	56.43	49.27±1.94	42.02±2.87	43.98±0.95
	(11.94)*	(14.88±0.59)	(13.70±0.94)	(14.39±0.37)
Crude lipid	18.86	41.91±3.63	48.19±4.3	43.43±4.9
	(3.99)	(12.66±1.10)	(15.71±1.4)	(14.17±1.5)
Ash	18.67	8.54±1.10	8.96±0.60	9.28±1.62
	(3.96)	(2.58±0.33)	(3.03±0.53)	(2.92±0.20)

*Figures in the parentheses indicates the values expressed in % fresh matter basis

In the present study, growth performance, survival (%) and overall production in terms of kg/ha was highest in T_3 receiving SBFF. Therefore, the result of the study suggests that Saudi-Bangla Fish Feed is the best commercial fish feed for mono culture of *P. hypophthalmus* in ponds at a higher stocking density as used in the present study.

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