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IMPACT OF FORMULATED FEED ON GROWTH PERFORMANCE OF THE FISH *TOR TOR*

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ABSTRACT

The fry of the fish *Tor tor* weighing 0.347 to 0.398 g and having a length of 20 to 25 mm were collected from the Narmada river at Dhangarwada village near Hoshangabad, brought to the laboratory and acclimatized in the glass fibre tanks of 1000 litre capacity. The experiment was carried out for 270 days to evaluate the effects of different formulated feeds with different protein levels on growth and survival of fish *Tor tor*. In the formulated feeds fish meal was the main ingredient used along with soybean cake, ground nut oil cake, soya oil and mineral mixture.

The experiment was conducted in the glass aquaria. The fish were fed twice daily (morning and evening) at the rate of 5% of their total body weight. In control conditions, the fish was fed on commercial feed along with mosquito larvae, zooplankton and phytoplankton. About 50% of the water of each aquarium was exchanged on alternate days. Observations on fish survival, body weight and length were recorded fortnightly in each tank. Faecal material was collected and weighed after drying in a hot oven to compute the feed intake and faecal matter release. The feed and faecal samples were then analysed for proximate composition following the methods of AOAC (1980) to estimate the different nutrient contents and energy. On the basis of dry matter it was found that the moisture content of feed-I, feed-II and feed-III was 8.18%, 7.8% and 7.56% respectively and 9.14% in case of control feed. The crude protein content of feed-I, feed-II, feed-III and feed-IV was 26.25%, 32.38, 36.75 and 14.36% respectively.

Weight gain by the fry of *Tor tor,* fed on different diets of 35%, 45% and 50% protein levels, records an average gain in the body weight by 1.00 g, 1.165 g and 1.584 g respectively, while body length increased by 34.22 mm, 37.11 mm and 46.22 mm respectively. Significantly higher growth was observed in the diet with 50% protein than in the diets with less than 45% of protein.

INTRODUCTION

The development of *Tor-tor* species is on account of non-availability of quality seed and feed responsible for its total growth. The changing environment conditions have been found to be responsible for altering its feeding habit at different stages of its growth.

Since growth of the fish is directly related to its feeding behaviour and the type of feed yet very few attempts have been made to determine the feed intake and its affect on growth of the fish (Grayton & Beamish 1977, Patra et al. 2000).

Apart from other nutrient sources fish meal is the major protein source for super intensive fish farming. During the last few years, research work has been done on partial or complete substitution of dietary fish meal using other plant protein sources as alternative cheaper protein source (Twibell & Brown 2000). The quality of a dietary protein source depends on its digestibility and amino acid profile (Kaushik & Cawey 1991). In most animal diets, protein is the most expensive constituent and is usually the first nutrient which is assessed in diet formulation. The energy level of the diet is adjusted to the desired value by addition of high energy supplements.

Present investigation evaluates the role of variously formulated feeds having different protein levels on the growth of the fish *Tor tor*.

MATERIALS AND METHODS

The fry (20 to 25mm) of length and (0.347 to 0.398g) weight of *Tor tor* were collected from the Narmada river, brought to the laboratory and acclimatized in the glass fibre tanks of 1000 litres capacity. The experiment was carried out for 270 days to evaluate the effect of different formulated feeds with different protein levels on growth and survival of *Tor tor*. Four glass aquaria of 30" × 12" ×18" were installed with 10 frys in each aquarium. One among the four aquaria was kept in controlled condition. In the formulated feeds fish meal was the main ingredient used along with soybean cake, ground nut oil cake, soya oil and mineral mixture. The details of the different feed ingredients used for feed formulation are given in Table 1. The proximate composition of feed is given in Table 2, and the proximate composition of faecal matter in the Table 3.

The fish were fed twice daily at the rate of 5% of this total body weight. They were given the feed two times daily i.e., morning and evening. In control conditions, the fish were fed with commercial feed along with mosquito larvae zooplankton and phytoplankton. About 50% of the water of each

Table 1: Formulation of three different diets for *Tor tor* having definite protein levels.

Ingredients	Experimental Diets (%)		
	Feed I (35%)	Feed II (45%)	Feed III (50%)
Ground nut oil cake	20	05	Nil
Soya cake	50	50	50
Fish meal	20	35	40
Molasses	06	06	06
Soya oil	02	02	02
Mineral mixture	02	02	02

Table 2: Proximate composition of different formulated feeds and commercial feed for *Tor tor*.

Composition	*Formulated Feed			**Commercial Feed
	Feed I 35%	Feed II 45%	Feed III 50%	Feed I V 35% control
Moisture (%)	8.18	7.8	7.56	9.14
Ash content (%)	11.6	13.5	13.4	17.8
Crude protein %	26.25	32.38	36.75	14.36
Crude lipid ether extract (%)	17.79	15.11	19.14	17.23
Carbohydrate including fibre (%)	58.12	51.04	38.78	55.07
P/E (mg crude protein/KJ energy)	14.40	19.14	25.67	21.69
Gross energy (KJ/g)	16.48	15.82	17.28	13.51

*On dry matter basis; ** A commercial feed procured from the local market.

Table 3: Proximate composition of faecal matter ejected by *Tor tor* fish from different feed treatment aquaria.

Composition (% dry matter)	Feed I	Feed II	Feed III	Feed IV
Crude protein	2.63	4.36	5.25	2.14
Crude lipid	5.37	4.14	3.16	1.14
Ash content	22.43	13.16	18.64	15.22
Moisture	12.46	14.12	13.68	18.52
Gross energy (KJ/g)	7.61	7.23	6.57	5.90

aquarium was exchanged on alternate days. Change in body weight and length was measured fortnightly. The data for growth and survival were statistically tested by Student's '*t*' test (Snedecor & Cochran 1967).

Faecal material was collected and weighed after drying in a hot air oven to compute the feed intake and faecal matter release. The samples of 1 g each were weighed and analysed for proximate composition following the methods AOAC (1990) to estimate the different nutrient contents and energy. The crude fibre content was determined following the Pearson (1976) method. Total ash content was obtained by incinerating the samples at 550°C in a muffle furnace for 6 hours. Hastings (1976) method was employed to find out the carbohydrate content (nitrogen free extract NFE). The gross energy of the samples was calculated by using kilocaloric values (Smith 1975, Viola 1977).

$$\text{kcal/g} = \frac{(\text{Rise in temperature} \times 3147) - 23.0}{\text{Sample wt. (g)} \times 1000}$$

Water quality parameters like temperature, pH, phenolphthalein alkalinity, total alkalinity, dissolved oxygen, Ca-hardness, total hardness, Mg-hardness and chloride were analysed following the methods given in APHA (1995).

RESULTS AND DISCUSSION

The physico-chemical parameters measured in the experimental aquaria are given in Table 4. No significant variation has been revealed among different aquaria, however, the variation in various parameters is on account of the addition of feed of different protein levels.

The weight gain and rate of survival of fry of *Tor tor*, fed on different diets of 35%, 45% and 50% protein levels and of control group up to 270 days of rearing, are given in Table 5. The average gain in the body weight was 1.00g, 1.165g, 1.584g and 0.473g fed on the diet with 35%, 45% and 50% of protein level and of control group respectively. The average gain in the body length was found to be 34.22mm, 37.11mm, 46.22mm and 28.05mm fed on the diet having 35%, 45% and 50% of protein level and of control group respectively. Significantly higher growth was observed in the diet with 50% than in the diets with 45%, 35% and of control group. The survival of fry during rearing for 270 days revealed 20-35% mortality under control conditions and only 2-8% mortality under formulated diets as shown in Table 6.

The proximate composition of feed and faecal matter has revealed decrease in moisture content on enhancing the protein value. Thus, feed having 50% protein content recorded low moisture

Table 4: Average value of physico-chemical parameters of aquaria I, II, III and IV during the study period from October 2005 to June 2006.

Parameters	Tank I	Tank II	Tank III	Tank IV
Atmospheric Temperature, °C	28.98	28.98	28.98	28.98
Water Temperature, °C	25.49	25.76	25.67	25.0
pH	7.7	7.7	7.6	7.3
Total alkalinity, mg/L	184.8	182.4	186.1	179.5
Dissolved Oxygen, mg/L	11.20	11.4	10.7	6.4
Calcium Hardness, mg/L	69.1	71.91	71.92	65.43
Total Hardness, mg/L	213.3	220.4	211.2	202.8
Magnesium Hardness, mg/L	52.15	50.10	50.85	49.46
Chloride, mg/L	67.78	66.95	68.97	64.01

Table 5: Growth (weight and length) of *Tor tor* in relation to various formulated feeds.

	Weight (g) Gained on Different Dates				Enhancement in Length (mm) on Different Dates			
Dates	Tank I	Tank II	Tank III	Tank IV	Tank I	Tank II	Tank III	Tank IV
Oct. 1, 05	0.352	0.361	0.382	0.350	21	21	22	20
Oct. 16, 05	0.360	0.394	0.457	0.358	22	23	24	21
Nov. 1, 05	0.425	0.451	0.536	0.362	23	24	27	21
Nov. 16, 05	0.498	0.536	0.621	0.369	25	27	30	22
Dec. 1, 05	0.535	0.598	0.732	0.374	26	28	33	23
Dec. 16, 05	0.589	0.673	0.847	0.378	27	29	35	24
Jan. 1, 06	0.634	0.712	0.956	0.382	28	30	37	25
Jan. 16, 06	0.679	0.789	1.126	0.384	30	32	40	25
Feb. 1, 06	0.751	0.868	1.264	0.390	32	33	43	26
Feb. 16, 06	0.835	0.952	1.351	0.398	33	35	45	27
Mar. 1, 06	0.932	1.036	1.468	0.418	34	36	47	28
Mar. 16, 06	1.013	10264	1.642	0.432	35	38	50	29
Apr. 1, 06	1.168	1.388	1.864	0.459	36	40	53	31
Apr. 16, 06	1.210	1.479	1.986	0.468	37	43	56	32
May 1, 06	1.349	1.742	2.346	0.538	41	49	60	35
May 16, 06	1.564	10936	2.689	0.621	48	53	67	37
Jun. 1, 06	2.267	2.568	3.472	0.862	57	62	79	39
Jun. 16, 06	2.986	3.217	4.781	0.968	61	65	84	40

Table 6: Survival rates of *Tor tor* fed against formulated feeds of different protein.

	Mortality Rate During the Experiment Period			
Dates	Tank I, 35%	Tank II, 45%	Tank III, 50%	Tank IV
Oct 1, 05	Nil	Nil	Nil	Nil
Oct. 16, 05	Nil	Nil	Nil	Nil
Nov. 1, 05	Nil	Nil	Nil	01
Nov. 16, 05	Nil	Nil	Nil	Nil
Dec. 1st 05	Nil	Nil	Nil	Nil
Dec. 16, 05	Nil	Nil	Nil	02
Jan. 1, 06	Nil	Nil	Nil	Nil
Jan 16, 05	Nil	Nil	Nil	Nil
Feb. 1, 06	01	Nil	Nil	Nil
Feb. 16, 06	Nil	Nil	01	Nil
Mar. 1, 06	Nil	Nil	Nil	01
Mar 16, 06	05	04	03	02
Apr. 1, 06	Nil	Nil	Nil	Nil
Apr. 16, 06	Nil	Nil	Nil	Nil
May 1, 06	Nil	Nil	Nil	02
May 16, 06	Nil	Nil	Nil	Nil
Jun. 1,t 06	Nil	Nil	Nil	Nil
Jun. 16, 06	Nil	Nil	Nil	Nil
Total mortality	06	04	04	08

Number of initial frys = 10

Table 7: Periodical increment in the growth of *Tor tor* fed on different formulated feeds during the experimental period.

Time interval	Periodical Increments in Weight and Length on Different Days							
	Weight (g)				Length (mm)			
Days	Tank I	Tank II	Tank III	Tank IV	Tank I	Tank II	Tank III	Tank IV
15	0.008	0.033	0.075	0.008	1	2	2	1
30	0.065	0.057	0.079	0.004	1	1	3	0
45	0.063	0.085	0.085	0.007	2	3	3	1
60	0.037	0.062	0.111	0.005	1	1	3	1
75	0.054	0.075	0.115	0.004	1	1	2	1
90	0.045	0.039	0.109	0.004	1	1	2	1
105	0.063	0.077	0.170	0.002	2	2	3	0
120	0.054	0.079	0.138	0.006	2	1	3	1
135	0.074	0.084	0.087	0.008	1	2	2	1
150	0.097	0.084	0.117	0.020	1	1	2	1
165	0.081	0.288	0.174	0.014	1	2	3	1
180	0.155	0.124	0.222	0.027	1	2	3	1
195	0.042	0.091	0.122	0.009	1	3	3	1
210	0.139	0.263	0.360	0.070	4	6	4	3
225	0.215	0.194	0.343	0.083	7	4	7	2
240	0.703	0.632	0.783	0.241	9	9	10	2
255	0.719	0.649	1.309	0.106	4	3	5	1

content in comparison to feed-I and commercial feed used in control group. The moisture content of faecal matter collected from aquaria I, II, III and IV also revealed near similar results as that of feed from respective aquaria.

An enhancement in gross energy level has been observed with the enhancement in protein content. The generally used commercial feed recorded low gross energy value in comparison to that of the formulated feeds.

During the early phases of experiment no significant change in weight as well as length of *Tor tor* has been recorded while a dramatic growth in both weight and length was recorded from 195 days up to 255 days, with significant results observed in aquaria III. Present observations clearly signify the role of protein enhanced feeds for the growth and development of *Tor tor*.

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