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EFFECT OF ARTIFICIAL FEED, RATION RATE AND TEMPERATURE ON THE SPECIFIC GROWTH OF MAJOR CARPS

S.Z.H.Naqvi*, A.N.Sheri, N.Ahmad**, M.Afzal**, & I.Aziz****
***Department of Zoology, Government College, Faisalabad and **Department of Zoology & Fisheries, University of Agriculture, Faisalabad**

The impact of different ration regimes having different metabolizable energy levels and two temperature ranges has been studied on the specific growth rate of major carps. The ***L. rohita*** *showed the maximum specific growth at maintenance temperature (12 – 23°C) while* ***C. catla*** *and* ***L. rohita*** *performed equally well at optimum temperature (24 – 35 °C) followed by* ***C. mrigala*** *under natural conditions.*

INTRODUCTION

Polyculture is one of the most productive aquacultural systems widely used for intensive fish farming. It can also become a major income generating element in integrated rural development programme. Pond culture is probably the most prevalent form of aquaculture in the world today to attain optimum production. A number of systems is used for establishing the quality and amount of feed required by fish, all of which are based upon total metabolism and net effect of various factors (Brett, 1979). The determination of ration rate based on wet body weight is the most common and useful method adopted by many workers (Halver, 1979; Sheri *et al.*, 1983).

A wide range of ration rate and feed formulae for Carp feeding were tried by Hepher and Pruginin (1981).In fertilized fish ponds under semiintensive herbivorous fish farming system, the plankton biomass is the major food source, so less balanced artificial feed proves equally effective in fish production. Keeping these facts in view, the impact of different feed formulae on the growth of major carps viz. C. Catla, L. rohita and C. mrigala was investigated in the present study.

MATERIALS AND METHODS

Six newly constructed earthen ponds of dimensions 15 x 7.5 x 1.5 meters (each) were selected at Fish Hatchery, Satiana Road, Faisalabad. The fish seed was collected from natural water sources of River Chenab at Trimmu Head Works, District Jhang. All the earthen ponds had similar physical and chemical conditions. One of them was kept as control and the remaining five as treatment ponds. The major carps seed was maintained on five feeding regimes (Table 1). Three of these regimes were fed on two percent of wet body weight while the two rations were fed at four percent of wet body weight of fish but all formulae had the same crude protein/metabolizable energy ratios (Table 2). They were offered at 8.30 a.m. by dusting method, once

in 24 hours. The specific growth rate (SGR) was measured by adopting the following formula worked out by Allen and Wootton (1982):

$G = (\ln W_2 - \ln W_1)/t \times 100$ (t is equal to day^{-1}, W in grams)

The data of specific growth rate were analysed statistically by applying two way analysis of variance and t–test by using microcomputer (IBM–PC/XT, MSTAT package) (Tables 1 & 2).

Table 1. Percentage composition of experimental rations fed to major carps under different regimes

Ingredients	Rations				
	1	2	3	4	5
Wheat	30	–	37	–	40
Cottonseed cake	25	–	5	38	20
Rice bran	40	45	30	30	20
Guar meal	–	25	5	–	2
Lucerne meal (alfalfa)	–	5	5	10	12
Fish meal	5	20	10	10	–
Molasses	–	5	–	–	–
Bone meal	–	–	5	8	–
Dicalcium phosphate	–	–	–	2	2
Sodium chloride	–	–	–	2	2
Vitamin (premix)	–	–	–	2	2
Level of feeding (%)	4	4	2	2	2

Table 2. Analysed chemical composition of experimental rations fed to major carps

Ration No.	Crude protein	Fat	Ash	Moisture	Crude fiber	NFE	Dry matter	Gross energy	ME(60%/GE)	CP/ME ratio
1	22.1	11.3	13.6	7.0	11.7	33.9	93.0	4626.83	2726.09	123.21
2	22.2	10.1	15.1	6.4	11.5	34.7	93.6	4492.80	2695.50	121.39
3	23.5	8.4	8.6	8.5	11.0	43.0	91.5	4565.85	2739.51	133.12
4	23.0	9.3	10.1	8.0	13.3	36.3	92.0	5041.60	3024.96	131.47
5	22.8	13.3	14.6	7.2	10.0	33.1	92.8	5168.00	3100.80	133.27

RESULTS AND DISCUSSION

To study the effect of temperature on specific growth rate of major carps, two ranges of temperature i.e., 12 to 23°C (maintenance temperature) and 24 to 35°C (optimum temperature) were considered (Table 3).

a. *Catla catla:* showed an average daily SGR of 0.34 to 0.69g under various feeding regimes of maintenance temperature. The average daily weight gain of the fish offered rations 1, 2, 3, 4 and 5 were 0.63, 0.69, 0.38, 0.34 and 0.35g respectively. The fish fed ration 4 showed the least SGR of 0.34g when temperature ranged from 11 to 23°C. Apparently different rations (3, 4 and 5) did not affect growth at this temperature range. Specific growth rate of *C. catla* ranged from 0.75 to 1.13 g per day when the water temperature ranged from 24 to 35°C. It was maximum (1.13g) in case of fish offered ration 2 and minimum (0.75g) in fish given ration 5. It could be stated from the data of the present study that *C. catla* performed better at the temperature range of 23 to 35°C, while this species showed a poor SGR when water temperature was below 23°C.

b. *Labeo rohita*: At a temperature of 11 to 23°C this species exhibited a SGR of 0.69, 0.75, 0.68, 0.69 and 0.44g when offered rations 1, 2, 3, 4 and 5 respectively. Apparently, the fish fed ration 2 performed a little better at this temperature when compared with fish given other rations. The temperature range of 12 to 23°C was found to be less favourable for *L.rohita* as well (Table 3).

The SGR of *L. rohita* ranged from 0.75 to 1.09g per day at optimum temperature ranging from 24 to 35°C under various feeding regimes (Table 3). The fish fed ration 2 showed maximum growth of 1.09g as compared to fish on other rations. The SGR of fish on rations 1 and 2 showed a similar pattern of growth (1.02 and 1.09g, respectively).

c. *Cirrhina mrigala:* Average daily weight gain in *C. mrigala* was found to be 0.49, 0.38, 0.42, 0.46 and

Table 3. Specific growth rate on different rations and temperatures

Carp species*	Ration 1	Ration 2	Ration 3	Ration 4	Ration 5	Temperature range
C. catla	0.63	0.69	0.38	0.34	0.35	12–23°C
L.rohita	0.69	0.75	0.68	0.69	0.44	Maintenance temperature
C.mrigala	0.49	0.38	0.42	0.46	0.41	
C. catla	0.97	1.13	0.82	0.87	0.75	24–35 °C
L. rohita	1.02	1.09	0.75	0.98	0.84	Optimum temperature
C. mrigala	0.78	0.74	0.72	0.75	0.71	

*Unpaired 't' test result showed that both temperature ranges were significantly different from each other.

0.41g per day when fed rations 1, 2, 3, 4 and 5, respectively at maintenance temperature (11 to 23°C). The overall SGR was subnormal under all feeding regimes but it was the least in case of ration 5. At 24 t 35°C, SGR ranged between 0.71–0.78. It was maximum with ration 1 and minimum with rations 3 and 5.

From the findings of this study, the optimum SGR of various species of major carps was observed at water temperature range 24 to 35°C. Statistical analysis revealed a significant difference between the effect of two ranges of temperature for SGR. The optimum temperature (24 to 35°C) showed a favourable effect. This may be attributed to higher energy cost for maintaining basic metabolic rates in lower temperature range. One may also consider low feed intake or lower digestibility of feed under maintenance temperature conditions as also indicated by Jhingran (1982). During the present study the water temperature ranged from 12 to 36°C, with an average of 28°C. The optimum temperature for carps growth and other physiological processes is approximately between 25 to 36°C (Shcherbina and Kazlauskene, 1971) and 30°C for optimum growth (Adelman, 1977). The results obtained from the present study are in broad agreement with those of other fish species (Huisman, 1976; Chua and Teng, 1982). Temperature changes the metabolic rate and thereby the energy available for growth also changes. Growth rate typically increases when temperature is optimum and at higher temperature the growth declines (over 33°C). The present study showed that maximum growth occurred in warmer months (May to early October), when the temperature is at the optimum range, whereas relatively less growth took place at minimum temperature. The above mentioned results are in conformity with those of Hepher and Pruginin (1981) who worked on the culture of *C. carpio*. In the end, the specific growth rate of *L.rohita* was recorded maximum at maintenance temperature (12–23°C), whereas *C. catla* and *C. mrigala* showed the least growth. The *C. catla* and *L. rohita* showed the maximum results concerning specific growth rate at optimum temperature (24–35°C), while the *C. mrigala* did not perform so well at this temperature (Table 3).

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