

Effect of formulated feeds on the amylase activity and growth in three species of carps

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Abstract. Assay of amylase activity carried out in 3 species of carps viz. *Cyprinus carpio*, *Catla catla* and *Hypothalmichthys molitrix*, when fed with 3 formulated feeds viz. protein, lipid and carbohydrate rich diets, showed an increase in the enzyme activity discernible after 15 days of feeding. The activity decreased during the starvation period. Protein rich diet ensured better growth in fishes than the lipid and carbohydrate rich diets.

Keywords. *Cyprinus carpio*; *Hypothalmichthys molitrix*; *Catla catla*; amylase; feeding; starvation.

1. Introduction

The presence of amylase in different organs viz. pancreas, pyloric caeca, intestine, liver and bile have been demonstrated by many workers (Sarbah 1951; Chiu and Benitez 1981; Hofer 1982; Bitterlich 1985; Sturmbauer and Hofer 1986). Though data on pH and temperature optima for enzyme activity are available, information on the effect of feeding formulated diets on the activity of amylase is scanty. The effects of different carbohydrates on the activity of amylase in *Brylon melanopteres*, carp and trout have been worked out by Reimer (1982) and Hofer and Sturmbauer (1985). The present paper describes the effect of 3 formulated feeds on the amylase activity and growth in the common carp *Cyprinus carpio*, catla *Catla catla* and silver carp *Hypothalmichthys molitrix*.

2. Materials and methods

Fingerlings (55 each) of *C. carpio*, *C. catla* and *H. molitrix* obtained from the State Govt. Fish Farm, Gaznoor, were stocked separately in aerated glass aquaria (300 l) in duplicate sets and fed *ad libitum* twice daily at 9000 and 1700 h for 60 days with 3 different artificial pelleted feeds viz. protein, carbohydrate and lipid rich feeds prepared according to the composition given by Reimer (1982). Samples were drawn before the commencement of the feeding (control), and at 5 day intervals during the feeding period of 60 days and post feeding starvation respectively. Whole gut was used for assay. The enzyme was extracted using glass distilled water (20 ml/g gut). Amylase activity was determined by the method of Sumner (1924) using 1% starch as substrate. The activity was calculated on the basis of maltose released in 5 min by hydrolysis of starch. One unit of amylase activity (AU) was defined as the mg of maltose liberated by 0.1 ml extract at 20°C in 5 min.

3. Results and discussion

Amylase activity increased throughout the feeding period in *C. carpio* fed on

protein rich diet except on 10th and 50th days (figure 1). During the first half of starvation period the decrease in the activity was moderate, while it was very steep during the second half. In the case of fish fed with carbohydrate rich diet, initially the activity fluctuated during the first 10 days and increased during the subsequent feeding period. A maximum value of 0.437 AU was recorded on the 40th day. The activity decreased by 0.138 AU during the 10 days of starvation. Almost a similar trend was observed in the enzyme activity in fish fed on lipid-rich feed. However, till the first 20 days, wider fluctuations were observed. On starvation the activity decreased only marginally during the first 5 days, while during the next 5 days there was a sharp decline.

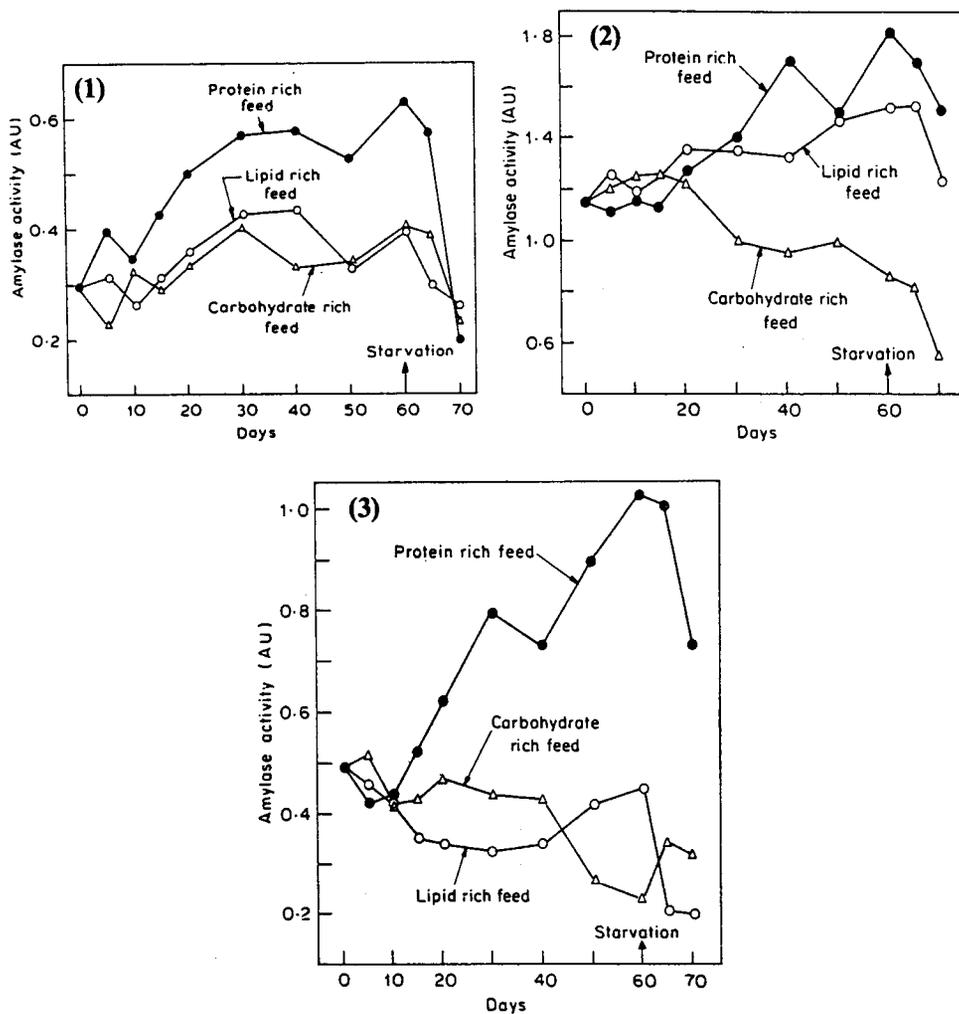
In *C. catla* fingerlings fed on protein-rich diet, amylase activity showed very little variation during the first 20 days. The activity increased thereafter till 40th day, decreased on 50th day and increased again on 60th day (1.843 AU). The activity decreased slightly during the starvation period (figure 2). After the initial increase till 15th day, the activity in fish fed on carbohydrate rich feed was found to decrease till the end of feeding period reaching a value of 0.876 AU. During starvation period also, the activity decreased. In fish fed on lipid rich diet an overall increase during the feeding period (0.381 AU) was noticed. During starvation, the activity increased slightly during the first 5 days, while it decreased rapidly during next 5 days.

Figure 3 represents the effect of feeding different diets on amylase activity in *H. molitrix*. A total increase of 0.526 AU could be observed at the end of 60 days feeding period in fish fed on protein-rich feed. During the starvation period, the activity decreased considerably. The enzyme activity in fish fed on carbohydrate-rich feed showed a decrease right from the start of the experiment till 30th day of feeding, and increased thereafter. During starvation, the activity decreased by 0.249 AU within 10 days. A decrease in enzyme activity was noticed in fish fed on lipid rich feed also. However, the activity increased sharply during the first 5 days of cessation of feeding and then slightly during subsequent 5 days of starvation.

The highest growth was observed in fish fed with protein rich diet followed by lipid rich diet and carbohydrate rich diet in all the 3 species (figure 4). Among the 3 species, fingerlings of *H. molitrix* showed the maximum growth among the 3 feeds tested. The increment in weight over the initial for the protein rich diet were 98.1% in *C. carpio*, 133.9% in *C. catla* and 134% in *H. molitrix*. The corresponding values for lipid rich feed were 69.6, 110.8 and 112.6% and for carbohydrate rich diet 53.8, 45.9 and 98.1% respectively. During starvation a loss in weight was observed in all the 3 species.

In the present study, definite trend in enzyme activities were discernible only after 15 days which indicate the time requirement for metabolic adjustments to the feeds. Kawai and Ikeda (1972, 1973) have observed definite trends in enzyme activities in *C. carpio* after 7 days and in trouts after 10 days of commencement of feeding.

Earlier workers have demonstrated that amylase activity is related to the carbohydrate quantity in the diets (Fal'ge *et al* 1978; Spannhof and Plantikow 1983; Hofer and Sturmbauer 1985). Inclusion of crude starch in the diet is known to reduce amylase activity as a result of adsorption of amylase to crude starch. In the present formulated feeds, fish meal was the main source of protein and all the fishes showed maximum growth on protein rich feed. The growth of common carp and silver carp on lipid rich and carbohydrate rich feeds was similar while in catla it was decidedly better in fish fed on lipid rich diet than those on carbohydrate rich



Figures 1-3. Effect of feeding and starvation on amylase activity in fingerlings of (1) *C. carpio*, (2) *C. catla* and (3) *H. molitrix*.

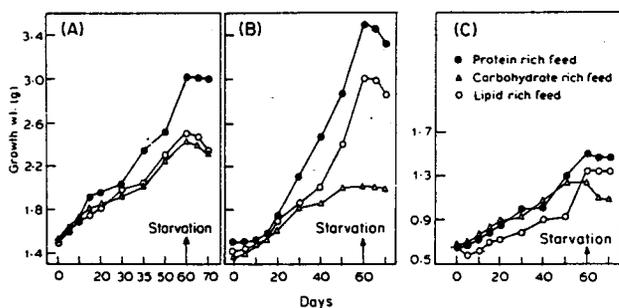


Figure 4. Effect of feeding and starvation on growth of fingerlings of (A) *C. carpio*, (B) *C. catla* and (C) *H. molitrix*.

diet. Compared to the lipid and protein rich feeds, growth of fish on carbohydrate rich diet was poor. Low growth rates on high starch diet have also been noticed in carps by Kawai and Ikeda (1973). Chiou and Ogino (1975) have attributed this to the type of starch. They found that the digestibility of β -starch was lower than that of α -starch and that digestibility of α -starch averaged 85%, regardless of starch levels, while that of β -starch decreased gradually as the starch level increased.

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*Not seen in original.