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DISTRIBUTION OF CARBOHYDRASES IN THE DIGESTIVE SYSTEM OF CAT FISHES *H.FOSSILIS* AND *C. BATRACHUS*

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ABSTRACT

The present study deals with the comparative activity of carbohydrases in the cat fish *Heteropneustes fossilis* and *Clarias batrachus*, assessed by qualitative methods. A wide range of fluctuation in the amylase, maltase and invertase activity was recorded in the various parts of the gut. However, lactase and cellulase activity was absent in these fishes. Our observations points that these fishes are omnivorous, though the carbohydrate forms the qreater bulk of their food. The inferences of this study can by utilize in the recommendation of a balanced dietary regimen and in solving applied nutritional problems such as adequacy of artificial food to the digestive abilities of fishes.

KEYWORDS: Pisciculturist, Aquaculture, Cyprinid fishes.

INTRODUCTION

Only few workers have made qualitative estimation of digestive enzymes in fishes. A perusal of literature reveals that information regarding enzyme activity in fresh water fishes are limited and confined to only few species. Therefore, in the present investigation an attempt has been made to compare the activity of different carbohydrases in the gut of aforesaid two cat fishes of almost similar feeding habits. Such a study may be of great importance in prescribing a suitable feeding regimen to the pisiciculturists in our country.

MATERIALS AND METHODS

Fishes were purchased from local fish market and transferred in glass aquaria. Before starting the experiments fishes were kept under starvation for 24 hours. Fishes were dissected on ice plate and alimentary canal as well as digestive glands were removed carefully. Different part of alimentary tract were homogenised seperately with10 volumes of ice cold distilled water to make a homogenate. Homogenate of each part was centrifused at 5000 rpm for 15 min. The supernatent fluied collected has been tested different carbohydrases.

Amlase - 1ml of 1% starch was added to 2 ml of phosphate buffer (pH 1.0) mixture was incubated with 0.2 ml of tissue extract and 2 drops toluene. After 24 hourse of incubation at 37^0C the mixture was tested for amylase with 2 drop of iodine solution. Negative colour in test tube shows presence of amylase.

Invertase - 1 ml of 2% sucrose solution added to 2ml of phosphate buffer (pH6.0). 1 ml of tissue extract and 2 drops of toluene was at 37^0C incubated for 24 hour. From this mixture 0.5 mI solution was added to 2 ml of Benidict sugar solution and heated in water bath for 5 min. Appearance of brown colour indicated invertase activity.

Maltase - 2ml of 2% maltase solution was added to 4.0 mi phosphate buffer (pH.7.0). The mixture was incubated with 0.5 ml of tissue extract at 37^0C for 24 hours. 5.0 ml of incubated solution was acidified with 10 drops of acetic acid. 3 drops of phenylhydrazine solution and solid sodium acetate. Mixture was warmed in water bath for 5 min and filtered. Filterate was again warmed for 10 min, cooled and examined under microscope. Needle like crystals of glucosazone indicated maltase activity.

Lactase - 1.0 ml of 2% lactese was added to 2ml of phosphate buffer (pH 7.0) and incubated with 0.5 ml of tissue extract at 37^0C for 24 hours. After incubation 1 ml of test solution and 2 ml of Barfoed's reagent was boiled for 5 min and allowed to cool. Appearance of brick red colour shows presence of lactase.

Cellulase - 1 ml of 5.0% microcrystalline cellulose solution and 2.0 ml of phosphate buffer (pH 7.0) and 0.5 ml of tissue suspension were added and kept for incubation at 37^0C for 3 hours. After incubation the mixture war tested for glucose by Osazone test.

OBSERVATIONS AND RESULTS

Table 1 comprises a comparative data on the activity of carbohydrases in *H. fossilis* and *C. batrachus* and a record of its presence in the associated digestive glands. In *H. fossilis* the pancreas and liver are fused to form a composite structure as hepatopancreas whereas in *C. batrachus* both are separate organs. It was recorded that the enzymes lactase and cellulase were altogether absent in every part of the digestive tract and also in the associated glands, the liver, pancreas and hepatopancreas. But amylase, invertase and maltase have been found to show differential activity in various parts of the digestive tube , the description of which is a follows :

Amylase-strong amylase activity has been observed in the proximal part of the intestine of both the fishes but in distal part it was moderately active in *C. batrachus*. However, identical weak activity is observed in the stomach. No activity in the oesophagus of these fishes. The presence of this enzyme in the hepatopancreas of *H. fossilis* and in the liver and pancreas of *C. batrachus* was recorded.

Invertase – More or less similar to that of amylase, the activity of invertase was also strong in the proximal part of intestine and moderately active in the distal part as well. Invertase activity was, however, totally absent in oesophagus of both the fishes but shows weak activity in the stomach of *C. batrachus* alone.

The strong presence of this enzyme in the respective tissue, the hepatopancreas of *H. fossilis* and pancreas and liver of *C. batrachus* was recorded. Maltase-But the strong activity of this enzymes in the proximal part of intestine of *C. batrachus*. It show a weak activity in stomach, distal part of intestine of both the fishes and also in the proximal part of intestine of both the fishes and also in the proximal part of intestine of *H. fossilis*. It was found to be absent in their oesophagus like those of the aforesaid enzymes, the presence of maltase has been assessed to be lower than that of amylase and invertase but in moderately present in the hapatopancreas of *H. fossilis* and the liver and pancreas of *C. batrachus*.

To sum up the activity of amylase and invertase has been found to be strong in the proximal part of the intestine in *H.fossilis* though the activity in the later one is moderate in distal part. To its contrary the activity of maltase is weak in the digestive tract of these fishes. This may be possibly because of a lower amount of secretion from the respective digestive gland.

Table 1- showing the results of the qualitative estimation of carbohydrases in the digestive tract and associated glands of *H. fossilis* and *C. batrachus*.

Enzymes	Regions	H.fossilis	C. batrachus.
	Oesophagus	-	-
	Starch	++	++
Amylases	Proximal part of Intestine	++++	+++
	Distal part of Intestine	++++	+++
	Hepatopancreas	+++	-
	Pancreas	-	++++
	Liver	-	++++
	Oesophagus	-	-
	Stomach	-	++
Invertase	Proximal part of Intestine	++++	++++
	Distal part of Intestine	+++	+++
	Hepatopancreas	++++	-
	Pancreas	-	++++
	Liver	-	++++
	Oesophagus	-	-
	Stomach	++	++
Maltase	Proximal part of Intestine	++	+++
	Distal part of Intestine	++	++
	Hepatopancreas	+++	-
	Pancreas	-	+++
	Liver	-	+++
	Oesophagus	-	-
	Stomach	-	-
Lactase	Proximal part of Intestine	-	-
	Distal part of Intestine	-	-
	Hepatopencreas	-	-
	Pancreas	-	-

	Liver	-	-
	Oesophagus	-	-
	Stomach	-	-
Cellulase	Proximal part of Intesline	-	-
	Distal part of Intestine	-	-
	Hapato pancreas	-	-
	Pancreas	-	-
	Liver	-	-

++++ = Strong activity ++ = Weak activity
+++ = Moderate activity - = No activity

DISCUSSION

C. batrachus and *H. fossilis* are bottom feeders. They mainly depends upon small organism in the bottom and possibly also on the falling bodies and thus are omnivorous in their feeding habits. Rathore et.al, 2006 and Kumar et. al. 2007, reported a considerably higher amylase activity in the intestine of herbivorous fish *Cyprinus carpio*. More or less similar amylase activity was also reparted in stomachless cyprinid fishes by Dhage, 1968 and Sinha; 1978.

In the present study, the strong amylase activity shows that a greater balk of their food comprises of herbivorous diet. In the present investigation, the absence of invertase is recorded in the stomach of *H. fossilis* but a very weak activity in the *C. batrachus*. However, the strong activity of invetase is observed in proximal part of intestine and moderate activity at distal part. Therefor this study differs from that of Agarwal and verma; 1966, Alarcon et. al; 2008 and goes in confirmity with that of Kawai and Ikeda; 1971 but total absence or the weak activity of invertase in the stomach of *H. fossiles* and *C. batrachus* may be associated with their omnivorous food habit.

The strongly active invertase in the hepatopancreas, liver and pancreas of the fishes under investigation points that these structures are the normal source of these enzymes and possibly they are transported in the proximal part of intestine. The relative activity of maltase is poor in the intestine and stomach of *H. fossilis* and *C. batrachus*. The total absence of cellulose and lactase in the intestine of *H. fossilis* and *C. batrachus* confirms that these fishes are not strictly herbivorous and thus all omnivorous. This study goes in confirmity with that of Alarcon et. al; 2008.

The present study may be at great help to the pisciculturists who practice cat fishes culture in choosing a specific dietary

schedule for achieving faster growth rate and consequent better yields.

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