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LIPASE ACTIVITY IN THE LIVER AND DIGESTIVE TRACT OF SOME CICHLIDS (PISCES: CICHLIDEA)

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ABSTRACT

Lipase activity in the liver and digestive tract *of Hemichromis fasciatus, Oreochmis niloticus Sarotherodon galilaeus* and *Tilapia zillii* from a small lake in Ilorin was studied. The digestive tract was divided into anterior, middle and posterior sections and the crude extracts of these sections and the liver of these fishes were assayed for lipase activity . Results indicated that there were lipase activity in the whole digestive tract and liver *of H. fasciatus, O. niloticus, S. galilaeus* and *T. zillii.* The presence of lipase in the anterior section implies that lipid digestion takes place in this portion of the digestive tract of these fishes. This result shows that lipid digestion in these cichlids does not follow the same pattern as in higher vertebrates

Keywords: *Cichlids, enzyme, lipase, liver and digestive tract.*

INTRODUCTION

Hemichromis fasciatus, Oreochromis niloticus, Sarotherodon galilaeus and *Tilapia zillii* belong to the family cichlidae, these are freshwater fishes which are distinguished by a single nostril. They have deep laterally compressed body. The body is covered with scales and they are characterized by double lateral line. The dorsal fin consist of spiny first half which is followed without a break by a second half which has soft branch rays (Holden & Reed 1972).

Based on methods of reproduction the cichlids are separated into three groups: *Tilapia* which are also called substrate spawners; *Oreochromis* refers to maternal mouth brooders while the biparental mouthbrooders are called *Sarotherodon* (Trewavas1982)

The cichlids are endemic to Africa (Balarin 1979). Aguilar-Manjarrez and Nath (1998) stated that Africa has the largest potential for fish farming with 56-70% of its land having the highest yield potential for tilapia. Currently in Nigeria the cichlids are among the cultured fish species. Tilapias also constitute a high percentage of the fish landing in Nigeria from freshwater bodies.

H. fasciatus is identified by the presence of five black patches on the sides, they are carnivores and feed on invertebrates (Reed *et. al.* 1967,Holden & Reed 1972*).S. galilaeus* is identified by its silvery grey colour with faint dark bars or spots on the flank. *T. zillii* is the most attractive species, the throat is red and the rest of the body is olive green. *O. niloticus* are (recognized by the characteristic pattern of dark and white bands crossing the caudal fin, dorsal and anal fins (Reed *et. al.* 1967;Holden & Reed 1972) Growth of fish results from consumption of food and the synthesis of materials from the consumed food to build up the body. Lundstedt *et. al.(* 2002) observed that the availability of the nutrients depends on factors such as synthesis of appropriate enzyme, the production of the enzyme in suitable amount and enzyme distribution along the gut lumen. The fatty acid in the liver may be converted to a useful product and stored or oxidized to another product.

Some of the work reported on the Cichlids includes: Fagade (1983) who showed that *Chromidotilapia guntheri* feed mostly on plant material, Achionye Nzeh (1994) determined the age of *Sarotherodon galilaeus* using opercular bones and showed that the fishes attained a mean length of 293mm at 7+.

Smith and Wootton (1994) observed that *Haplochromis argens* females Cichlidae that were mouth brooders took longer time to respawn. This was attributed to cessation of feeding during spawning.

T. zillii, S. galilaeus, O. niloticus and *H. fasciatus* are commercially important to freshwater fisheries in Nigeria and they are good sources of animal protein. There is paucity of knowledge on enzyme lipase activity in the digestive tract. Buddington *et. al.(* 1997) stated that enzyme analysis of all gut sections is the best way to assess the whole digestive capacity of an animal.

Research on lipid digestion may provide insight to feeding problems of some of the cichlids. The work is aimed at elucidating lipase activity in

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the digestive tract *of T. zillii, H. fasciatus, O. niloticus and S. galilaeus.*

MATERIALS AND METHODS

Specimens of *H. Fasciatus, S. galilaeus, O. niloticus and T. zillii* used in the study were collected from a small lake in Ilorin, Nigeria. They were transported to the laboratory in ice chest soon after capture.

Sixty specimens were examined. Standard laboratory measurements were taken: standard length and total weight. The head was separated from the body by decapitation. The digestive tract was dissected out and the total length of the digestive tract was measured. The digestive tract was divided into three sections anterior, middle and posterior.

Tissue Extract: Samples from anterior, medium and posterior sections and liver were homogenized in cold 0.25M sucrose solution (temp 4^0C) in the ratio 1.5(W/V). the homogenate were centrifuged at 2,000g for 15 minutes and the supernatant (crude extract) were used as enzyme source.

Enzyme Assay:Lipase determination was by the method of Tietz and Fiereck (1966) modified by Isong (1987). 2ml of crude extract were put into two test tubes labelled test and blank. The blank was placed in boiling water for 5 minutes and cooled. O.5ml phosphate butter of pH7.4 and 2ml of substrate (Olive oil) were introduced into both the test and blank test tubes. The test tubes were shaken and incubated at 27^0C for 24h. 2ml of ethanol and 2drops of phenolphthalein indicator were added to the samples in a conical flask and titrated with standard 0.05N NaOH. Lipase activity was computed and expressed in mg\ml\min.

RESULTS

The results showed that *O.niloticus, S.galilaeus and T.zillii* had no definite stomach while *H.fasciatus* had a definite stomach. Standard length range was 8 to 10cm in *H.fasciatus* and 10.60 to 18.8cm in *S. galilaeus. O. niloticus* standard length range was15.7 to 24.5cm while in *T. zillii* the standard length range was 12.2 to 18.10cm.

The gut length in (Table 1*) O. niloticus, S. galilaeus, T. zillii and H. fasiciatus* were 142 to 286cm, 105 to 182cm, 95 to 165cm, and 16 to 23cm respectively.

Lipase activity was observed in the Liver and anterior, middle, posterior sections of the digestive tract *of H. fasciatus, O. niloticus S. galilaeus and T. zillii* (Table2).

TABLE 1: STANDARD LENGTH, TOTAL WEIGHT AND GUT LENGTH OF *OREOCHROMIS NILOTICUS, SAROTHRODON GALILAEUS, TILAPIA ZILLII AND HEMICHROMIS FASCIATUS*

		STANDARD LENGTH			TOTAL LENGTH			TOTAL WEIGHT			GUT LENGTH		
SPECIES	NO. OF SOECIES	RANGE	MEAN	S.D	RANGE	MEAN	S.D	RANGE	MEANS	S.D	RANGE	MEAN	S.D
Oreochromis nikloticus	11	15.7-24.5	20.21	3.28	20.1-31.5	25.67	4.05	145.5-475	319.59	126.63	142-286	207.41	45.79
Sarotherodon galilaeus	26	10.6-18.8	13.96	2.19	12.3-22.3	17.13	2.55	50-250	99.16	46.87	105-181.5	149.43	21.42
Tilapia zillii	15	12.2-18.1	14.9	1.96	15.6-21.7	17.91	2.25	78.3-156.5	106.69	29.05	95.40-165.80	125.69	23.49
Heichromis fasciatus	8	8.80-10.10	9.63	0.54	11.00-13.30	12.26	0.76	21.59-32.69	27.27	3.97	15.8-23.0	20.21	3.04

In *H. fasciatus* the anterior section of the digestive tract showed mean lipase activity of 3.3 mg/ml/min. While the mean lipase activity in the liver was 6.2.mg/ml/min. *In O. niloticus* the mean activity observed in the anterior and middle sections was approximately 11.0mg/ml/min while the posterior section was 5.8mg/ml/min. In the liver *of O. niloticus* the mean value was approximately 16 mg/ml/min.(Table 2). In *S. galilaeus* the mean enzyme lipase activity was about 9.0mg/ml/min in both the anterior and middle sections of the digestive tract while the posterior section and liver were 3.92mg/ml/min and 14.13mg/ml/min respectively (Table 2). *In T. zillii* the mean activity of enzyme lipase were 19mg/ml/min in the anterior section, 6.6mg/ml/min in the middle section and 3.7 mg/ml/min the posterior section. The liver also showed high lipase activity with a mean value of 26.7mg/ml/min. Statistical test for significant difference in the enzyme activity using ANOVA showed that there was no statistical significant

difference P>0.05 in the enzyme activity with sections of the digestive tract.

TABLE 2 LIPASE ACTIVITY (mm/ml/min) IN THE VARIOUS SECTIONS OF THE DIGESTIVE TRACT AND LIVER OF *HEMICHROMIS FASCIATUS, OREOCHROMIS NILOTICUS, SAROTHERODON GALILAEUS AND TILAPIA ZILLII*

SPECIES	DIGESTIVE TRACT ANTERIOR	MIDDLE	POSTERIOR	LIVER
HEMICHROMIS FASCIATUS	3.3 ± 1	1.68 ±0.62	1.68 ±0.7	6.2 ±0.69
OREOCHROMIS NILOTICUS	10.88±2.0	11.96±5.2	5.88±1.53	15.9±1.17
SAROTHERODON GALILAEUS	**9.4±1.14**	**8.05±0.7**	**3.92±1.17**	**14.13±2.17**
TILAPIA ZILLII	**19±2.58**	**6.65±2.1**	**3.75±1.45**	**26.7±2.56**

Each value is a mean of 5 determination ± SD

DISCUSSION

The results obtained in the gut length (Table 2) showed that *O. niloticus, S. galileaus, T. zillii* had long digestive tract respectively but they lacked a well- developed stomach. This result indicates that the long digestive tract increased the retention time of food in the digestive tract so that the enzymes will have more time to act on the food and more time for absorption of digested food (Bond 1996).

H. fasciatus has very short digestive tract this is related to its carnivorous feeding pattern and also to the size of the fish species *H. fasciatus* are usually very small in size (Reed *et. al.* 1967).

Lipase activity was present in the digestive tract *of O. niloticus, H. fasciatus, S. galileaus and T. zillii* indicating the presence of lipids in their food hence the presence of enzyme lipase to hydrolyze the lipid. The liver of the fishes is involved in absorption conversion and oxidation of fatty acids however during fasting phase some of the processes that occurred during the absorptive phase were reversed this may explain high lipase activity observed in the liver. Similar result was obtained *in Pseudoplatystoma coruscans* a Brazilian catfish (Lundsledt *et. al.* 2002). Apart from pepsin other enzyme contained in the stomach of fishes were Chitinase and Lipase (Bond 1996). In the present work enzyme lipase occurred in the anterior section of the digestive tract. The result has shown that hydrolysis of lipid food in fishes may not follow the same pattern as in higher vertebrate. In higher vertebrates the stomach is too acidic that only enzyme pepsin can function in the stomach (Guttman 1999.) In these cichlids studied the results indicate that the anterior section of the digestive tract may not be acidic since fishes are lower vertebrate the cost of maintaining an acidic stomach may be expensive for their bodies. Therefore lipase activity occurred in the anterior section of the digestive tract.

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