

**DIGESTIVE AMYLOHYDROLITIC PROFILE**  
**OF *Collossoma macropomum*, *Piaractus mesopotamicus***  
**AND THEIR HYBRID:**  
**A COMPARATIVE APPROACH**

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**EXTENDED ABSTRACT ONLY – DO NOT CITE**

Carbohydrates constitute one of the three prime components of the fish diet that are used as an energy source to support animal growth and occur as natural constituents or are added in food as ingredients or additives. It has been proposed that an appropriate level of this nutrient in the diet can ensure maximum utilization of the other nutrients (Voragen, 1998; Peragon *et al.*, 1999).

Enzymatic digestion of carbohydrates (starch) has been detected in the digestive tract of several species so far studied. This enzymatic hydrolysis of starch is started by the action of amylase activity.

According to Smith (1980) the enzyme activity reflects the herbivorous, omnivorous or carnivorous nature of the species studied. The knowledge of digestive enzymes in fish is important because it can clarify some aspects of

their nutrient physiology and help to solve some nutritional problems on fish feeding in aquaculture.

Many authors agree that a study of amylohydrolitic profile in fish can reveal the capacity of different species to use carbohydrates. Therefore, the amylohydrolitic profile of two omnivorous *Colossoma macropomum* (tambaqui) and *Piaractus mesopotamicus* (pacu) and their hybrid tambacu were studied in the digestive tract (stomach, cecus and proximal and distal intestine).

*C. macropomum* inhabits Amazonas-Orinoco drainage system and is one of the most promising native freshwater fish. *P. mesopotamicus* inhabits the Paraguai-Uruguaí rivers, which is extended also into the swamp of Mato Grosso, Brazil. Tambacu is a hybrid resulted from the crossing of *C. macropomum* female and *P. mesopotamicus* male.

Young fish of tambaqui (n=6), pacu (n=6) and tambacu (n=10) were kept in well-aerated tanks of 250 liters at 25 ° c under natural photoperiods. Fish were fed pellets with 7 percent of cornstarch, protein contents of 26 percent and total energy of 2700 kcal. The nourishment period was 15 days. Then they were killed by a blow to the head and punched in the spinal cord. The digestive tract was excised, rinsed with cold saline, separated and kept in a freezer at -20°C for the posterior analysis.

Amylohydrolitic assays were performed in 0.2M citrate/phosphate buffer pH 7.0 by using 2.7% of starch solution and 0,5% NaCl as cofactor, as described by Bernfeld (1955). The enzyme reaction was performed at 25°C lasting 30 minutes. The reaction was killed by addition of barium-zinc solutions' to a final concentration of 5% ZnSO<sub>4</sub> and 0.3N Ba(OH)<sub>2</sub>. Glucose, as reaction product, was determined by Park-Johnson's method (1949).

Dates were analyzed by non-parametric method of wilcoxon and mann-whitney (zar, 1984). The accepted level of confidence was 5%.

The results (Table 1) show that the starch was hydrolyzed in every region of digestive tract of pacu, tambaqui and the hybrid tambacu. However, cecus was significantly more active than the other regions. The presence of amylase activity in the three species indicates that the starch hydrolyzed probably has an important role in the energetic metabolism.

+Table 1. Amylase activity in digestive tract in three species of fish, determined at 25 ° C.

Species	Digestive Tract			
	Stomach	Cecus	Proximal Intestine	Distal Intestine
Tambaqui	40.64 ± 0.39	137.1 ± 8.1	74.1 ± 3.3	23.33 ± 0.14
Pacu	16.16 ± 3.5	78.09 ± 3.5	58.92 ± 7.6	45.02 ± 3.1
Tambacu (Hybrid)	37.56 ± 4.9	382.4 ± 19.3	100.8 ± 3.8	42.38 ± 5.9

Amylase activity was expressed as  $\mu\text{mols of glucose. Min}^{-1}.\text{g}^{-1}$ . Wet tissue. Values are mean  $\pm$  se. The comparison among the species showed the amylohydrolitic profile from the tambacu hybrid cecus more efficient than pacu and tambaqui one, suggesting a remarkable expression of the hybrid carbohydrases.

### References

- Bernfeld, p. 1955.  $\alpha$ -and  $\beta$ -amylases. In: Colowick, S.P. & Kaplan, N. (eds.), *Methods in Enzymology*, Academic Press, New York, vol. 1.
- Park, J.T. and M.J. Johnson. 1949. A submicro determination of glucose. *J.Biol.Chem.* 181: 149-151.
- Peragón, J., J.B. Barroso., L. García-Salguero, M. de la Higuera and J.A. Lupiáñez. 1999. Carbohydrates affect protein-turnover rates, growth, and nucleic acid content in the white muscle of rainbow trout (*Oncorhynchus mykiss*). *Aquaculture* 179: 425-437.

Smith, L.S. 1980. Digestion in teleost fishes. In Lectures presented at the  
FAO/UNDP Training Course in Fish Feed Technology,  
ADCP/REP/80/11, pp.3-17.

Voragen, A.G.J. 1998. Technological aspects of functional food-related  
carbohydrates. Trends in Food Science & Technology 9: 328-335.

Zar, J.H. 1984. Biostatistical Analysis. Englewood Cliffs, NJ:Prentice-Hall.

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