

**AQUACULTURE OF TAMBAQUI AND ITS VITAMIN C
REQUIREMENTS**

Rodrigo Roubach
Aquaculture Department
Instituto Nacional Pesquisa da Amazônia/INPA
CP 478, CEP 69011-970, Manaus, AM, Brasil.
Tel. +55-92-643-1894 / Fax. +55-92-642-1384
roubach@inpa.gov.br

Alzira Miranda de Oliveira
Laboratory for Ecophysiology and Molecular Evolution
Instituto Nacional Pesquisa da Amazônia/INPA
alziramiranda@bol.com.br

Nívea Geovana Feitosa de Oliveira
INPA/BADPI
ngeovana@bol.com.br

Edsandra Campos Chagas
EMBRAPA, Amazônia Ocidental
edsandra@cpaa.embrapa.br

Adalberto Luís Val
Laboratory for Ecophysiology and Molecular Evolution
Instituto Nacional Pesquisa da Amazônia/INPA
dalval@inpa.gov.br

EXTENDED ABSTRACT ONLY - DO NOT CITE

Vitamin requirements in fish vary quantitatively between different species due to several factors, e.g. sex, age, weight, size, nutrition, temperature, toxicity and metabolic functions (growth, stress responses and resistance to diseases) (Lovell, 1989). Ascorbic acid (vitamin C) is a water soluble vitamin, heat sensible, composed of six carbon atoms and structurally related with the glucose and other hexoses (Lovell, 1989). Recent experiments had shown that addition of vitamin C in tambaqui diet promotes greater resistance to stress, favoring growth and a better weight increase in these animals (Chagas, 1998).

Amongst the factors that directly affect fish survival, temperature is a major one, since it also affects growth and reproduction. Temperature is the biggest limiting factor in the biological processes, from simple chemical reactions to the ecological distribution of one given species. In the Amazon basin, air temperature determines, to a large extent, the average water temperature of the great rivers, lakes and flooded plains. During wider climatic variations in the region, average temperature of Amazonian waters oscillates between 25 and 34°C (Araújo-Lima & Goulding, 1998). Native fish of the Amazon, in general, need waters with temperature between 25 and 30°C for the accomplishment of its vital functions. Therefore sudden changes in water temperature can cause stress, leaving individuals vulnerable to diseases. Temperature variations exert considerable effect on physiological processes and especially on fish metabolism. In general, a rise of 10°C in temperature provokes an increase of 2 to 3 times the normal oxygen consumption.

Colossoma macropomum, known as tambaqui, belongs to the Serrasalmidae family and the Characiformes order. It is widely distributed in the northern part of South America. Currently, it is the main species raised at local commercial aquaculture in Central Amazon region. Due to its great regional economic importance and its great potential for aquaculture, tambaqui is a species that continues to draw attention from researchers and fish farmers (Val & Honczaryk, 1995; Araújo-Lima & Goulding, 1998).

A 60-day feeding trial was conducted in individual tanks system to evaluate the effect of ascorbic acid (vitamin C) on growth and hematology of *Colossoma macropomum* under different temperatures and to evaluate if dietary vitamin C (0 and 500 mg/kg) positively influences in the physiology and growth response of the experimental animals to such conditions.

Duplicate groups of 10 fish each with a initial weight of 8.7 g were reared at four temperatures (24, 26, 30 and 32°C) and were fed practical (fish meal + soybean meal) type diets supplemented with two levels of vitamin C (0 and 500mgAA/kg).

Fish exposed to 30°C presented a better growth and weight gain (Table 1). Ascorbic acid level did not influence those parameters at this temperature. However, best feed conversion was observed on the group that received the vitamin C supplementation in the diet.

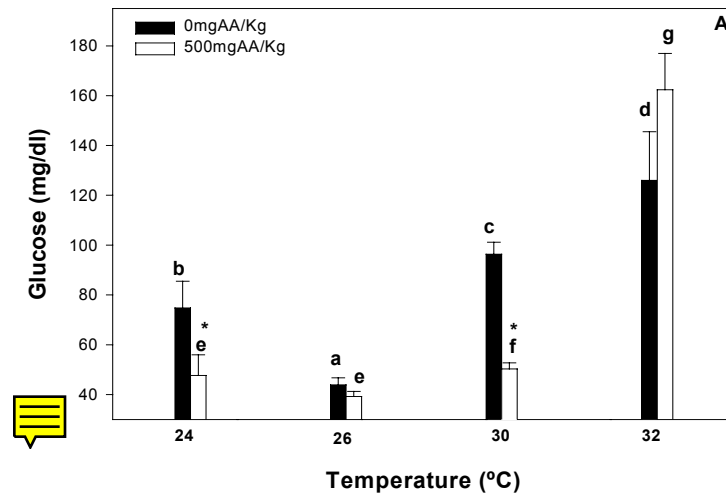
Table 1. Vitamin C supplementation effect on the growth parameters of tambaqui, *Colossoma macropomum*, under different temperatures (n=12; mean \pm SD). (* and **) indicates significant (P<0.05) statistical differences between temperatures.

Vitamin C (mg/kg)	Temperature (°C)							
	24		26		30		32	
	0	500	0	500	0	500	0	500
Parameters								
Initial weight (g)	21.9 \pm 5.5	19.5 \pm 5.5	19.7 \pm 0.8	21.8 \pm 1.1	20.0 \pm 1.1	24.8 \pm 1.3	24.9 \pm 3.3	27.9 \pm 3.3
Initial length (cm)	10.7 \pm 1.0	9.9 \pm 0.9	8.5 \pm 0.1	8.9 \pm 0.1	8.7 \pm 0.1	13.0 \pm 0.4	11.4 \pm 0.6	11.6 \pm 0.8
Final weight (g)	24.5 \pm 5.7	23.3 \pm 5.4	41.8 \pm 2.5	46.9 \pm 2.4	55.8 \pm 4.1	64.6 \pm 4.7	35.1 \pm 5.4	42.7 \pm 7.9
Final length (cm)	11.6 \pm 0.9	11.3 \pm 0.8	10.6 \pm 0.2	11.3 \pm 0.3	13.5 \pm 0.4	13.0 \pm 0.4	13.3 \pm 0.9	14.2 \pm 0.8
Weight gain (%)	11.48*	19.5*	112.1*	115.8*	178.4*	159.9*	41.0*	53.0*
Size increase (%)	8.58**	14.1**	24.74**	27.0**	56.17**	47.8**	16.7**	22.4**
Feed conversion	7.2	3.4	1.8	1.7	1.6	1.4	2.6	1.8
Total biomass (g)	292.88	279.6	441.4	503.8	714.6	794.2	421.2	512.4

All treatments presented significant differences (p<0.05) in growth after 60 experimental days.

Vitamin C did not influence fish blood parameters analysed (hematocrit, hemoglobin, circulating red cells, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration) (data not shown) at the lowest tested temperature (24°C) or highest (30 and 32°C) compared to the ambient water temperature of 26 °C. Vitamin C effect on the blood parameters observed in this work with *Colossoma macropomum* is similar to those previously described with other important aquaculture species of the Serrasalminidae family.

Fish exposed to 30°C and fed diet supplemented with vitamin C showed lower glucose levels than fish fed diets without vitamin C. While fish exposed to 32°C showed higher glucose levels for the group fed vitamin supplemented diets, which suggests that at this temperature the diet supplemented with 500mgAA/kg vitamin C was too high. Therefore, for the metabolic processes, vitamin C is important for these species regulatory processes affected by temperature variation.



References

- Araujo-Lima, C.A.R.M. & Goulding, M. 1997. So fruitful a fish. Ecology, conservation, and aquaculture of the amazon's tambaqui. Biology and resources management in the tropics. Columbia University Press, New York, New York, USA.
- Chagas, E.C. 1998. Efeito do ácido ascórbico (vitamina C) sobre a resistência ao estresse hipóxico em *Colossoma macropomum* (Cuvier, 1818). Monografia. Fundação Universidade do Amazonas.
- Lovell, R. T. (1989). The nutrients. In: *Nutrition and feeding of fish*. New York, AVI – VNR. v. 2, p. 11- 71.
- Martins, M. L. (1995). Effect of ascorbic acid deficiency on the growth, gill filament lesions and behavior of pacu fry (*Piaractus mesopotamicus* Holmberg, 1887). *Braz. J. Med. Biol. Res.*, v. 28, p. 563 - 568.
- Val, A.L.; Almeida-Val, V.M.F. & Affonso, E.G. (1990) Adaptative features of Amazon fishes: Hemoglobin, hematology, intraerythrocytic phosphates and whole blood bohr effect of *Pterygoplichthys multiradiatus* (Siluriformes). *Comp. Biochem. Physiol.* 97B, 3;p.435-440.
- Val, A. L. & Honczaryk, A. (1995). Criando peixes na Amazônia. Manaus, INPA. 160p. (Eds.).

