

**EFFECTS OF DIETARY L-ASCORBYL-2-POLYPHOSPHATE
IN TAMBAQUI.**

Edsandra Campos Chagas
Embrapa Amazônia Ocidental, CP 319, CEP: 69011-970, Manaus-AM-Brazil,
Phone: (92) 621-0300, Fax: (92) 622-1100, e-mail: edsandra@cmaa.embrapa.br

Adalberto Luís Val
National Institute for Research in the Amazon – INPA, Ave André Araújo,
2936, CP 478, CEP: 69083-000, Manaus-AM-Brazil, Phone: (92) 643-3187,
Fax: (92) 643-3186, e-mail: dalval@inpa.gov.br

EXTENDED ABSTRACT ONLY – DO NOT CITE

Introduction

The ascorbic acid (vitamin C) is an essential nutrient, involved in many biological functions as hydroxylation and collagen formation, growth, reproduction, disease resistance, stress and immune response (Reviewed by Li and Robinson, 1999; Chagas *et al.*, 2002). The importance of ascorbic acid (AA) supplementation in fish diet is due to the lack of L-gulonolactone oxidase enzyme that catalyzes the last step of AA synthesis pathway (Chatterjee, 1973; Fracalossi *et al.*, 2001).

Ascorbic acid requirements in fish is affected by many environmental (temperature, presence of toxic products, etc.) and physiological factors (stress, diseases, etc.) (Lovell, 2000). Indeed, the AA requirement is species specific and also depends on strain and age of the animals (Li and Robinson, 1999; Chagas *et al.*, 2002).

As tambaqui, *Colossoma macropomum*, is unable to synthesize AA (Fracalossi *et al.*, 2001), the supplementation of its diet with an adequate level of AA is essential. The present paper analyses the effect of ascorbic acid polyphosphate on growth and health status of juveniles of tambaqui (*Colossoma macropomum*).

Materials and Methods

Juveniles of tambaqui (*Colossoma macropomum*) were obtained from a commercial tambaqui supplier and held at the National Institute for Amazon Research (INPA), Manaus, Brazil, for at least 2 weeks in 500L outdoor aquaria. After this acclimation period fish (mean weight 33.30 ± 0.48 g/fish) were distributed in 8 tanks, observing a density of 20 fishes/tank and a completely randomized design.

Four practical diets (protein 35% and energy 397 Kcal EB/100 g) containing 0, 100, 200 and 400 mg/kg of ascorbic acid polyphosphate (Rovimix stay-C 35; Hoffmann La Roche, Switzerland) were formulated. The test diets were fed to satiety, one time per day, to groups of tambaqui for a period of 8 weeks. After this period, the growth (body weight, feed conversion rate and survival) and health status (hematology) were examined. The results were subjected to analysis of variance (one-way-ANOVA), and differences between means were determined at the 5 % probability level using Tukey's (Honestly significant difference) procedure (Zar, 1999).

Results and Discussion

Tambaqui reared on ascorbic acid supplemented diets had significantly higher ($p < 0,05$) final live body weights at 8 weeks than tambaqui reared on diet not supplemented with ascorbic acid (Table 1). Indeed, feed conversion rate were significantly higher ($p < 0,05$) for the group reared on diets without added ascorbic acid in comparison to ascorbic acid-supplemented groups (Table 1). Among the ascorbic acid-supplemented groups, the feed conversion rate was lowest in tambaqui reared with 200 mg of ascorbic acid per kg diet.

Table 1

Final body weight¹, feed conversion rate¹ and sobrevivency¹ of tambaqui after 8 weeks on the test diets

Diet mgAA/kg	Final body weight (%)	Feed conversion rate	Survival (%)
0 mg/kg	87.52 ^a	3.97 ^a	100 ^a
100 mg/kg	101.55 ^b	1.81 ^a	100 ^a
200 mg/kg	132.42 ^c	1.44 ^b	100 ^a
400 mg/kg	123.52 ^c	1.54 ^b	100 ^a

¹ Values in the same column and the same superscript are not significantly different.

The effect of AA dietary supplementation was clearly observed on weight and feed conversion rate of juveniles of tambaqui. The best AA level is 200 mgAA/kg of food. These results are similar to those described for other Brazilian fishes species as *Piaractus mesopotamicus*, *Astronotus ocellatus* and *Pterophylum scalare* that have their AA requirements estimated to be 139 mgAA/kg, 25 mgAA/kg and 360 mgAA/kg, respectively (Reviewed by Li and Robinson, 1999; Chagas *et al.*, 2002).

Deficiency symptoms like scoliosis, lordosis or loss of appetite were not observed on animals fed on lower dietary AA level (0 mgAA/kg). Reduced growth has been shown in the literature to be a sign of ascorbic acid deficiency in many fish species (Reviewed by Li and Robinson, 1999; Chagas *et al.*, 2002), as observed here for tambaqui. Increased mortality, fin erosion, dark skin coloration, anemia, internal and external hemorrhage, lower concentration of vertebra hydroxyproline and broken back syndrome are other AA deficiency symptoms. All these symptoms have been reported for many species belonging to different groups of fish including salmonids, ictalurids, cichlids, cyprinids and characids (Reviewed by Li and Robinson, 1999; Chagas *et al.*, 2002). Mortalities were not observed as AA deficiency symptom in tambaqui, perhaps due to the duration of this study (8 weeks).

Hematocrit (Ht), hemoglobin (Hb) and red blood cell counts (RBC) of tambaqui were similar in all analysed animals of all experimental treatments (0, 100, 200 and 400 mgAA/kg) (Table 2), a situation similar to that reported for hybrid tilapia (Nitzan *et al.*, 1996). However, anaemia has been reported for many fish species as *Clarias gariepinus*, channel catfish, rainbow trout, Indian major carp, pacu and acará-açú (Reviewed by Li and Robinson, 1999; Chagas *et al.*, 2002).

The results suggest that tambaqui have a vitamin C requirement as 200 mg AA/kg diet to provide maximum growth and physiological status, using L-ascorbyl-2-polyphosphate as the dietary vitamin C source.

Table 2

Effect of ascorbic acid supplementation on hematocrit (Ht), haemoglobin (Hb) and total number of erythrocytes (RBC) of *Colossoma macropomum* fed 0, 100, 200 and 400 mg AA/kg diet. Values are mean±SEM of eight different samples.

	AA level (mg/kg diet)			
	0	100	200	400
Ht (%)	34.06±0.64 ^a	32.00±1.69 ^a	33.13±1.01 ^a	33.94±0.65 ^a
Hb (g/dl)	7.80±0.49 ^a	8.01±0.2 ^a	7.44±0.27 ^a	8.44±0.30 ^a
RBC (10⁶/mm³)	1.99±0.12 ^a	1.85±0.12 ^a	1.66±0.12 ^a	1.81±0.10 ^a

References

- Chagas, E.C., Mesquita-Saad, L.S.B., Aride, P.H.R., Mendes, F.A., Almeida-Val, V.M.F. and Val, A.L. 2002 (in press). Vitamins C, D and E in fish. In: Val, A.L. (Eds.), *Fish Adaptation*.
- Chartterjee, I. B. 1973. Evolution and the biosynthesis of ascorbic acid. *Science*, 182: 1271-1272.
- Fracalossi, D. M., Allen, M.E., Yuyama, L.K. and Oftedal, O.T. 2001. Ascorbic acid biosynthesis in Amazonian fishes. *Aquaculture*, 192: 321-332.
- Li, M.H. and Robinson, E.H. 1999. Dietary ascorbic acid requirement for growth and health in fish. *Journal of Applied Aquaculture*, 9: 53-79.
- Lovell, R.T. 2000. Dietary requirements for ascorbic acid by warmwater fish. In: K. Dabrowski (Eds.), *Ascorbic acid in aquatic organisms: status and perspectives*, CRC Press, Boca Raton.
- Nitzan, S.; Angeoni, H. and Gur, N. 1996. Effects of ascorbic acid polyphosphate (AAPP) enrichment on growth, survival and disease resistance of hybrid tilapia. *The Israeli Journal of Aquaculture-Bamidgeh*, 48: 133-141.
- Zar, J. H. 1999. *Biostatistical Analysis*. Editora Prentice Hall, New Jersey, 4 edição. 663 p.