Metabolic response of tambaqui fish (*Colossoma macropomum*) to graded dietary levels of sugar beet pulp

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Introduction: The low availability and formulation of low cost feed have largely limited the expansion of fish farming [1]. Feeds for farmed fish can account for up to 80% of the total farming costs, of which protein sources are the most expensive components of the diet [2,3]. Hence, optimizing feed costs and maximizing production is paramount. The present study investigated the metabolic and intestinal response of tambaqui to graded dietary levels of sugar beet pulp to understand how this herbivorous fish deals with fibre sources.

Animals, materials and methods: Eighteen tambaqui fish (1.6 ± 0.1 kg; 2 years old) were randomly divided over 6 similar tanks with 3 fish per tank and randomly attributed to one of the six dietary treatments 0, 5, 10, 15, 20 and 25% beet pulp addition and reared for 8 weeks with measurements of water quality parameters on bi-weekly basis. Blood, muscle tissue and intestines were sampled for nutrient profiles, blood metabolite, stress indicators and histomorphometry evaluations [4,5]. Data were subjected to regression and principle component analysis.

Results and discussion: A quadratic increase in muscle tissue essential fatty acids (pick values of 0.2 g for C16:1; 3.8 g for C22:6n-3; 2.9 g for C16:1n-7; 27.4 g/100g fatty acid for C18:1n-9 all at 15% beet pulp addition) and intestinal villous length (highest for duodenum 955 µm at 15%), paravilli (highest for duodenum 322 µm at 15%) and absorptive surface (highest for duodenum 555 mm^2 at 10%) were observed with beet pulp addition. A better supply of glucogenic substrate to the citric acid cycle was seen with beet pulp addition due to the positive correlation with the propionylcarnitine/acetylcarnitine ratio while no effect was observed on ketogenesis as measured through the 3-hydroxybutyrylcarnitine/acetylcarnitine ratio [6]. No pronounced change of serum and whole fish histamine and reducing concentrations of serum malondialdehyde were observed with beet pulp addition. Ammonia concentration decreased significantly with beet pulp with the highest mean concentration recorded in the control group (1.65 ± 0.52 ppm) and the least for 25% pulp addition (0.19 ± 0.05 ppm). Nevertheless, the pH pattern varied inversely with the highest and least pH recorded in 25% and control groups as 7.68 ± 0.06 and 6.48 ± 0.36 ppm, respectively.

Conclusion: Beet pulp promoted intestinal absorptive capacity, and provided functional nutrients to the tambaqui fish with no measured signs of inflammation or oxidative stress. The non-linear pattern of some blood and muscle components with increasing beet pulp may call for future optimal dosing and feed form of beet pulp together with monitoring of the biotic (water microbiome) and abiotic environment of the fish.

References: [1] da Silva et al. (2007) Acta Amazon. 00:1-9; [2] Cheng et al. (2003) Aquaculture 215:1-4; [3] Sandre et al. (2017) Aquac. Rep. 6; [4] AOAC (1990) [5] AOAC (1995); [6] Xu et al. (2016) J. Clin. Endocrinol. Metab. 101:12.