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Can the minerals calcium and sodium, chelated to propionic acid, influence the health and zootechnical parameters of native silver catfish *Rhamdia quelen*?

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ABSTRACT

Intensive aquaculture production requires new strategies to improve the performance and health parameters of farmed fish to avoid developing resistance in bacterial genes and to avoid environmental pollution. The aim of this study was to evaluate the effects of calcium and sodium as chelants to propionic acid on the growth performance and hemato-immunological parameters of native silver catfish *Rhamdia quelen* fed for 60 days with a supplemented diet, in addition to evaluating survival and immunological parameters after exposure to the pathogenic bacterium *Aeromonas hydrophila*. A total of 225 fish were divided into 15 tanks, with 15 fish per tank in five groups: control (not supplemented), Ca-propionate 0.25% ($Ca_{0.25\%}$), Ca-propionate 1% ($Ca_{1\%}$), Na-propionate 0.25% ($Na_{0.25\%}$), and Na-propionate 1% ($Na_{1\%}$), with three replicates for each group. Fish fed $Ca_{0.25\%}$ showed the best results in terms of weight gain (43.61 ± 4.89), biomass (779.06 ± 79.40), specific growth rate (3.00 ± 0.13) and survival after pathogen exposure. This group showed 54% more survival than the $Na_{1\%}$ group after 96 h of exposure. Fish fed $Na_{1\%}$ presented high leukocytosis (12.0 ± 4.20) and lymphocytosis (9.24 ± 2.57) in relation to those fed $Na_{0.25\%}$ and $Ca_{1\%}$ (before exposure). Total protein showed a significant decrease while lysozyme and agglutinating titer increased after exposure. These results suggest the Ca-propionate 0.25% as the best additive to be used in fish farming of native silver catfish.

1. Introduction

In terms of increasing and diversifying the species normally reared in aquaculture, the silver catfish *Rhamdia quelen* (Quoy and Gaimard, 1824) is of notable importance because of its zootechnical characteristics and good acceptance in the market (Gomes et al., 2000). This species has become more prominent in catfish culture in Southern Brazil when compared to channel catfish *Ictalurus punctatus* and rainbow trout *Oncorhynchus mykiss*. Of the 39,860 tons of continental fish produced in 2013, 743.9 tons were silver catfish (Silva et al., 2017).

Nevertheless, fish farming is vulnerable to infectious diseases due to factors such as incorrect sanitary practices and poor water quality, resulting in production losses (FAO, 2017). Among the bacterial diseases in freshwater fish, aeromoniosis (which is caused by *Aeromonas hydrophila*) must be emphasized (Silva et al., 2012). Outbreaks of *A. hydrophila* have been reported by Barcellos et al. (2008) in silver catfish aquaculture.

Disease treatment in fish farms is expensive and difficult. Although most of the bacterial diseases are treated with antibiotics, inadequate use can be dangerous to human health, can lead to the selection of resistant strains, can leave a residue in the flesh, and can cause environmental pollution (Cabello, 2006; CLSI, 2006).

Among prophylactic measures and possible alternative treatments, the use of organic acids and their salts has been suggested to be suitable for use in aquaculture. Organic acids are natural products that result from the fermentation of microorganisms but are often also chemically synthesized (Thomas et al., 2013; Pandey et al., 2008). The most abundant group is the carboxylic acid, which presents the carboxyl functional group (COOH) (Snyder, 1995). When chelated to a mineral, the organic acids are transformed into salts of organic acids that are more stable and easier to handle.

Research on the supplementation of salts of organic acids to aquatic

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