

Dietary sodium citrate improved oxidative stability in red hybrid tilapia (*Oreochromis sp.*) but reduced growth, health status, intestinal short chain fatty acids and induced liver damage

ABSTRACT

Among organic acids, citric acid and their salts are currently the most studied as a supplement in aquafeeds to potentially improve growth and nutrient utilization in fish. The results have been generally beneficial but no studies have been performed on tilapia. A 50 day experiment was conducted on the effects of dietary sodium citrate at 0, 1, 2 and 4% on the growth, feeding efficiency, body indices, muscle proximate composition, muscle lipid peroxidation, some plasma and blood parameters, intestinal short chain fatty acids (SCFA), and liver histopathology of red hybrid tilapia (*Oreochromis sp.*). Triplicate groups of 60 tilapia fingerlings (initial weight of 1.86 ± 0.01) were in each treatment. Results showed that, while not significant, increasing dietary sodium citrate reduced tilapia growth ($p > 0.05$). However, muscle crude protein ($r^2 = 0.931$), lipid ($r^2 = 0.962$), and ash ($r^2 = 0.834$) significantly decreased at increasing dietary sodium citrate levels ($p < 0.05$). Plasma ALT significantly increased ($p < 0.05$; $r^2 = 0.357$) with increasing dietary sodium citrate treatments along with histopathological liver damage that included hemorrhages, necrosis and inflammatory responses. Many of the cell differential counts were significantly ($p < 0.05$) altered by increasing dietary sodium citrate levels. Among the intestinal SCFA in tilapia, acetic acid was the highest, followed by propionic and butyric acid, and these all significantly decreased ($p < 0.05$) with increasing dietary sodium citrate. In all dietary sodium citrate treatments, muscle lipid peroxidation was significantly less ($p < 0.05$; $r^2 = 0.211$) indicating increased oxidative stability. While dietary sodium citrate was toxic to tilapia at the levels used, and is not recommended as a supplement, the decreased lipid peroxidation warrants further investigation with other species. Such research may have important implications for file quality over prolonged storage. Statement of relevance: Sodium citrate reduced growth but may increase shelf-life.

Keyword: Organic acid; Oxidative stability; Histology; Short chain fatty acids; Liver damage; Phagocytic activity; Phytic acid