

Exposure of Pacu, *Piaractus mesopotamicus* Gill Tissue to a High Stocking Density: An Ion Regulatory and Microscopy Study

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Abstract : Gills are organs responsible for respiration and osmoregulation between the fish internal environment and water. Under stress conditions, oxidative response and gill plasticity to attempt to increase gas exchange area are noteworthy, compromising the physiological processes and therefore fish health. Colostrum is a dietary source of nutrients, immunoglobulin, antioxidant and bioactive molecules, essential for immunological protection and development of the gastrointestinal epithelium. The hypothesis of this work is that antioxidant factors present in the colostrum, unprecedentedly tested in gills, can minimize or reduce the alteration of its epithelium structure of juvenile pacu (*Piaractus mesopotamicus*) subjected to high stocking density. The histological changes in the gills architecture were characterized by the frequency, incidence and severity of the tissue alteration and ionic status. Juvenile (50 kg fish/m³) were fed with pelleted diets containing 0, 10, 20 or 30% of lyophilized bovine colostrum (LBC) inclusion and at 30 experimental days, gill and blood samples were collected in eight fish per treatment. The study revealed differences in the type, frequency and severity (histological alterations index - HAI) of tissue alterations among the treatments, however, no distinct differences in the incidence of alteration (mean alteration value - MAV) were observed. The main histological changes in gill were elevation of the lamellar epithelium, excessive cell proliferation of the filament and lamellar epithelium causing total or partial melting of the lamella, hyperplasia and hypertrophy of lamellar and filament epithelium, uncontrolled thickening of filament and lamellar tissues, mucous and chloride cells presence in the lamella, aneurysms, vascular congestion and presence of parasites. The MAV obtained per treatment were 2.0, 2.5, 1.8 and 2.5 to fish fed diets containing 0, 10, 20 and 30% of LBC inclusion, respectively, classifying the incidence of gill alterations as slightly to moderate. The severity of alteration of individual fish of treatment 0, 10 and 20% LBC ranged values from 5 to 40 (HAI average of 20.1, 17.5 and 17.6, respectively, $P > 0.05$), and differs from 30% LBC, that ranged from 6 to 129 (HAI mean of 77.2, $P < 0.05$). The HAI value in the treatments 0, 10 and 20% LBC reveals gill tissue with injuries classified from slightly to moderate, while in 30% LBC moderate to severe, consequence of the onset of necrosis in the tissue of two fish that compromises the normal functioning of the organ. In relation to frequency of gill alterations, evaluated according to absence of alterations (0) to highly frequent (+++), histological alterations were observed in all evaluated fish, with a trend of higher frequency in 0% LBC. The concentration of Na⁺, Cl⁻, K⁺ and Ca²⁺ did not changed in all treatments ($P > 0.05$), indicating similar capacity of ion exchange. The concentrations of bovine colostrum used in diets of present study did not impair the alterations observed in the gills of juvenile pacu.

Keywords : histological alterations of gill tissue, ionic status, lyophilized bovine colostrum, optical microscopy

Conference Title : ICAFT 2017 : International Conference on Aquaculture and Fisheries Technology

Conference Location : Lisbon, Portugal

Conference Dates : April 16-17, 2017