Study of antioxidant defense and histology of geophagus of Polluted and non-Polluted pond at Biharsharif, Nalanda, India.

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Abstract

The present paper paper deals with antioxidant defense and histology of geophagus of polluted and non polluted pond at biharsharif. The livers of Geophagus were collected from both a nonpolluted site and a polluted site were analyzed for different antioxidant defenses, O2 consumption, thiobarbituric acid-reactive substance (TBARS) levels, and histological damage. Compared to controls (116.6 ± 26.1 nmol g-1), TBARS levels were enhanced at the polluted site With respect to enzymatic antioxidants, increased catalase The main histological damage observed in the hepatocytes from fish collected at the polluted site was characterized by heavy lipid infiltration. Fish collected at the end of spring showed higher O2 consumption, higher superoxide dismutase and glutathione S-transferase activities, and higher total and oxidized glutathione concentrations compared to the beginning of autumn. No seasonal changes were observed in catalase activities, glutathione or TBARS levels. Fish chronically exposed to relatively high pollution levels seem to be unable to set up adequate antioxidant defenses, probably due to severe injury to their hepatocytes. The higher antioxidant defenses found at the end of spring are probably related to the enhanced activities during high temperature periods in thermoconforming organisms.

Kew words ; Antioxidant defense, Histology, O2 consumption, Catalase.

Introduction

Qualitative data related to the evaluation of enzymatic antioxidants in fish such as superoxide dismutase (SOD) and catalase show that they are structurally and functionally very similar to those of mammals (1,2). Nevertheless, fish enzyme specific activities are quantitatively lower than those of mammals (1-4). Industrial and agricultural activities depend on the production and utilization of a variety of chemical and physical agents that continuously damage the natural environment. Much evidence indicates that xenobiotics can generate reactive oxygen species, including superoxide anion (O2 ·-), hydrogen peroxide (H2O2), hydroxyl radical (· OH), and singlet oxygen (O2 1), which in turn are responsible for cell and tissue damage associated with different pathologic processes, including mutagenesis and carcinogenesis (5). Recently, oxidative stress and some parameters of fish antioxidant defenses and biotransformation enzymes (i.e., cytochrome P-450 1A1 and glutathione S-transferase, GST) of fish and molluscs have been used as biomarkers of water pollution (6-11). Although the seasonal interference with the antioxidant defense system has not been well established in these organisms, the data available in the literature (12-14) suggest a general antioxidant defense enhancement during spring and summer when compared to low temperature periods. Since most rivers are a sink of numerous spills, urban residues, pesticides and trace metals, the present study was carried out to verify the effect of seasonality and pollution on the antioxidant defense system and the biotransformation system of the acará, Geophagus brasiliensis, caught at a polluted site (Benedito River) compared to fish caught at a non-polluted site (Ratones), southern Brazil.

Material and Methods

Adult male specimens weighing 15 to 40 g (N = 28) were collected from a non-polluted pond and the same number (N = 28) of specimens was collected from a polluted pond . For the investigation of seasonal variations, fish (N = 40) were collected only at the non-polluted site. Twenty adult males were sampled during the month of November, corresponding to the end of spring in the southern hemisphere, and 20 specimens were sampled during the month of April, corresponding to the beginning of autumn. The livers of the animals were carefully excised and rapidly weighed, and tissue oxygen consumption was measured in a thermostated (25 ± 1°C) Tucker chamber containing a Clark electrode. Homogeneizations were carried out at 4oC using 15 strokes in a Potter-Elvehjem homogenizer, followed by centrifugation at 5000 g for 10 min at 4°C. The different parameters were analyzed spectrophotometrically according to the following procedures: SOD at 550 nm by the reduction of cytochrome c promoted by the superoxide anion generated by the xanthine/ xanthine oxidase system (15), and catalase at 240 nm by the decay of hydrogen peroxide levels (16). Histopathological analysis was carried out by light microscopy on liver slices fixed in 10% buffered Bouin and stained with hematoxylin-eosin. Statistical analysis was performed using the Student t-test with a confidence interval of 5% ($P<0.05$).

Result and discussion

The main histological damage observed in the hepatocytes from fish collected at the polluted site was characterized by heavy lipid infiltration. Fish collected at the end of spring showed higher O2 consumption, higher superoxide dismutase and glutathione S-transferase activities, and higher total and oxidized glutathione concentrations compared to the beginning of autumn. No seasonal changes were observed in catalase activities, glutathione or TBARS levels. Fish chronically exposed to relatively high pollution levels seem to be unable to set up adequate antioxidant defenses, probably due to severe injury to their hepatocytes. The higher antioxidant defenses found at the end of spring are probably related to the enhanced activities during high temperature periods in thermo conforming organisms.

Conclusion

1. Histological damage in the hepatocytes at the polluted site.
2. No seasonal changes were observed in catalase activities, glutathione or TBARS levels.
3. Fish chronically exposed to relatively high pollution levels seem to be unable to set up adequate antioxidant defenses, probably due to severe injury to their hepatocytes.
4. The higher antioxidant defenses found at the end of spring are probably related to the enhanced activities during high temperature periods in thermo conforming organisms.

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