

Responses of the African catfish *Clarias gariepinus* to long-term exposure to glyphosate- and paraquat-based herbicides

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Direct and indirect contamination of the aquatic environment by pesticides results in a decrease in fish productivity and may elevate concentrations of undesirable chemicals in edible fish tissues. The effects of long-term exposure of *Clarias gariepinus* juveniles to sublethal concentrations of glyphosate and paraquat, two commonly used herbicides, for eight weeks were investigated using three concentrations of the 96 h LC₂₀ of each herbicide: 3.5, 7 and 14 µg l⁻¹ for paraquat, and 26.5, 53 and 106 µg l⁻¹ for glyphosate. Enzyme assay and histological analysis were conducted every fortnight. Significant increases in the activities of alanine aminotransferase (ALT), aspartate aminotransferase (AST), lactate dehydrogenase (LDH), alkaline phosphatase (ALP) and hepatocyte vacuolation in the livers of the exposed fish confirms the toxicity of the herbicides, and thus could be useful tools in environmental monitoring.

Keywords: enzymes, histopathology, pesticide, sublethal, toxic