

## **Influence Of Cadmium On Brain And Muscle Cholinesterases In Nile Tilapia (*Oreochromis niloticus*): Implications For Bio-Monitoring Of Aquatic Pollution**

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Cholinesterase (ChE) enzyme activity measurements are widely applied in aquatic organisms for water quality monitoring, especially as a potential biomarker for Organophosphorus (OP) and Carbamate (CM) insecticides. However heavy metals such as Cadmium and Copper may also induce inhibitory effects on this enzyme. In the present study, influence of Cadmium (*in vivo* and *in vitro*) on ChE activities of brain and muscle tissues of *Oreochromis niloticus* (Nile Tilapia) were evaluated, considering the potential use of this biomarker of Nile Tilapia in monitoring aquatic pollution. The fish (4.0-6.0 cm of total length) were exposed to a series of environmentally relevant concentrations of Cd<sup>2+</sup> (5, 15, 30 µg/l) and ChE activity was detected for 28 days at different time points. Potential inhibition of ChE activities by Cd was also assessed *in vitro* and compared with that of Cu, an essential metal. Influence of Cd pre-exposure and co-exposure to environmentally relevant levels of Cd<sup>2+</sup> on *in vivo* inhibition of ChE activities of this fish induced by selected OP insecticides (Chlorpyrifos and Dimethoate) was also evaluated.

Results revealed that exposure of fish to environmentally relevant concentrations of Cd for 7 days induced only a transient inhibition of brain and muscle ChE activity (23-34%) of Nile Tilapia compared to the controls. Restoration of ChE levels occurred during continuous exposure to the same concentrations of Cd<sup>2+</sup> by 14 days. *In vitro* studies revealed that high concentrations of Cd<sup>2+</sup> or Cu<sup>2+</sup> should reach the target tissue in order to cause a biologically effective inhibition of ChE in both brain and muscle tissues. The IC<sub>50</sub> values of Cd<sup>2+</sup> on ChE activity in brain and muscle tissues were 8.37 and 43.19mM respectively, whereas, corresponding values for Cu<sup>2+</sup> were 4.02 and 10.39 mM. The ChE activity of brain tissue was found to be more sensitive to heavy metals than that in the muscle tissues. In addition potential inhibitory effect of Cu<sup>2+</sup> on ChE was higher than that of Cd<sup>2+</sup>. Prior exposure and co-exposure to low concentrations of Cd had no significant effect on depression of brain and muscle ChE levels induced by tested insecticides.

The results revealed that low levels of Cd<sup>2+</sup> contamination in water bodies may not have a significant influence on the brain and muscle ChE activities of Nile Tilapia. However, as high concentrations of Cd has a potential to depress the ChE activities, monitoring of heavy metal levels in water bodies with suspected high levels of metal inputs is needed in order to interpret the data on inhibition of ChE enzyme in this fish in biomonitoring programs in relation to OP and CM contaminations. Nevertheless, ChE activities in Nile Tilapia could be incorporated in biomonitoring programs as "a biomarker of neurotoxic effect" to evaluate the presence of neurotoxic contaminants in the tropical aquatic ecosystems.