TRANSFLUTHRIN- AND PRALLETHRIN-BASED INSECTICIDES ELICIT SPECIFIC ENZYMATIC ANTIOXIDANT RESPONSES IN DIFFERENT TISSUE OF ZEBRAFISH.

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INTRODUCTION: Pyrethroid-based insecticides such as prallethrin (P-BI) and transfluthrin (T-BI) are widely used in household and animal husbandry formulations and are often considered safe. However, long-term exposure, even at low doses, may impair the antioxidant defense system, potentially contributing to the development of pathologies with unknown etiologies. Oxidative stress (OS), an imbalance between reactive oxygen species production and antioxidant defense, can cause cellular damage and dysfunction. It may also impair the activity of δ-aminolevulinic acid dehydratase (δ-ALA-D), a key enzyme in heme biosynthesis. The zebrafish (*Danio rerio*) serves as a valuable model for studying oxidative damage and toxicological responses.

OBJECTIVES: This study aimed to investigate the effects of P-BI and T-BI at commonly used and sub-threshold doses on the antioxidant system and δ-ALA-D activity in zebrafish tissues.

MATERIALS AND METHODS: Adult zebrafish were chronically exposed to both insecticides at used and under-threshold concentrations. We assessed enzymatic antioxidant activity, lipid peroxidation, and δ-ALA-D activity in brain, liver, and muscle tissues to evaluate oxidative responses and heme biosynthesis.

RESULTS AND CONCLUSIONS: Tissue-specific effects were observed. In muscle, both antioxidant defense lines were activated, yet oxidative damage occurred, making it the most affected tissue. In the brain, superoxide dismutase (SOD) and catalase (CAT) activities were suppressed, but glutathione S-transferase (GST) overactivation appeared to compensate, preventing lipid damage. δ-ALA-D activity was significantly reduced in all tissues, suggesting impaired heme synthesis and possible physiological dysfunction. These findings indicate that P-BI and T-BI, even at low or sub-threshold doses, can disrupt antioxidant defenses and heme biosynthesis in zebrafish, with implications for long-term health and potential links to neurodegenerative processes.

KEYWORDS: Zebrafish; Pyrethroids; Oxidative Stress; Cellular Damage.

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