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Understanding the ecotoxicological effects of Sulfamethoxazole and Trimethoprim on zebrafish embryo

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Abstract

Background: In the last 50 years the two most used antibiotics to prevent and treat bacterial infections are Sulfamethoxazole (SMX) and Trimethoprim (TRIM) [1]. These antibiotics were considered priority substances by the Water Framework Directive, being essential to determine the risk they may pose to aquatic ecosystems and human health. Different studies report the toxicity of SMX and TRIM to several aquatic organisms, namely Danio rerio, however, the existing data are quite incomplete. **Objective:** Evaluate the sub-lethal effects of SMX and TRIM in Danio rerio embryos. **Methods:** Fish embryo acute toxicity assays were performed, evaluating the percentage of survival, hatching, and morphological alterations after SMX (0.156 to 2.5 mg/L) and TRIM (25 to 400 mg/L) exposure for 96 h [2, 3]. Sub-individual parameters were also evaluated, namely oxidative stress (CAT and GSTs activities and TBARS levels) and neurotoxicity (AChE activity) biomarkers. **Results:** SMX showed to be more toxic, causing a maximum of 15 % mortality after 48 h at 0.156 mg/L. A hatching delay of the zebrafish embryos was observed after exposure to concentrations up to 30 mg SMX/L and 100 mg TRIM/L. Both antibiotics caused different morphological alterations in zebrafish, being the most common enlarged swim bladder, body curvatures, and pericardial oedema. Other abnormalities were also observed, namely hemagglutinations, yolk sac oedemas, and head and eye malformations after exposure to both antibiotics. Additionally, SMX and TRIM caused an oxidative stress scenario and neurotoxicity, however only SMX caused lipid peroxidation. **Conclusions:** These results highlight the impact of SMX and TRIM in D. rerio embryos, showing that these antibiotics can affect individually (e.g., growth and survival) and sub-individually (e.g., antioxidant defenses) this species. More studies should be conducted to better understand the toxicity of these antibiotics at ecologically relevant concentrations and in long-term effects on zebrafish life cycle.

Keywords: *Danio rerio*; antibiotics; acute toxicity; bioassays; biomarkers

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