

Acute Nanoplastic Exposure effects on Thyroid Hormone Axis and Behavior in Zebrafish Larvae

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Abstract:

Introduction: Plastic production has increased exponentially in the last decades. Macroplastics in the environment are degraded by mechanical, physical, and biological processes, ultimately producing Nanoplastics (NP). NP have been found in air, water, and soil, and there is a growing concern regarding environmental and human health. NP can accumulate in tissues, affecting them and causing disruptions in metabolism, development, and fertility, although their mechanisms of action are still largely unknown. The zebrafish embryo (ZFE) poses an ideal model to investigate this due to it is high homology with humans. The present work's main objective was to determine the impact of acute exposure to polystyrene (PS) NP on the thyroid endocrine system in ZF larvae that have largely completed development.

Methods: Larvae were exposed at 120 hours post-fertilization for 1h to a concentration gradient of PSNP (0 -10 mg/L). After exposure, alterations in gene transcriptions of thyroid related genes were examined by qPCR. In addition, behavioral assays were conducted to evaluate activity patterns in reaction to visual and auditory stimuli, and confocal microscopy was performed to assess NP incorporation, using fluorescently labeled NP. Results: NP were able to enter ZF larvae within 1h of exposure and they altered the expression of different thyroid-related genes in a concentration-dependent or biphasic manner. In addition, NP acute exposure affected larvae locomotion, with hypo or hyperactivity observed depending on type of stimuli and NP concentration.

Conclusion: These findings underscore the urgent need for additional studies on possible impacts of NP on human health and offer more proof of NP's possible mode of action as thyroid disruptors.