

POSTER

COMBINED EMBRYOTOXIC EFFECTS OF MICROPLASTICS AND HEAVY METALS IN *XENOPUS LAEVIS***S. Di Marino, C. Fogliano, C.M. Motta, B. Avallone, R. Carotenuto***Dept. of Biology, University of Naples Federico II, Italy*

Microplastic particles, smaller than 5 mm, have been detected in humans and in marine and freshwater environments [1]. Due to their ability to bioaccumulate and biomagnify across trophic levels, they may seriously harm both humans and aquatic organisms [2]. In freshwater ecosystems, microplastics frequently co-occur with heavy metals (HMs), raising important environmental concerns [3]. However, the effects of combined exposure, often more toxic than single contaminants, remain poorly understood. In this study, we investigated the developmental toxicity induced by single and combined exposure to cadmium, copper, and lead together with 5 μ m aged polystyrene microbeads (PSMBs), used to better mimic environmental conditions, in embryos of the model organism *Xenopus laevis*. This species is widely considered an excellent model for studying embryonic development in higher vertebrates. A multi-endpoint approach was employed, including a FETAX assay to evaluate mortality, growth, and malformations, together with histological and molecular analyses. Although mortality rates remained around 20%, except in cadmium-exposed groups, a high incidence of malformations was observed. Embryos exhibited craniofacial abnormalities involving the first and second branchial arches, intestinal malrotation, mucosal damage, al-

tered pigmentation, and diffuse edema. Furthermore, exposure to these contaminants induced oxidative stress and increased apoptosis, particularly in embryos exposed to mixtures of metals and HM+PSMB combinations. Significant dysregulation of key developmental genes (*otx2*, *pax6*, *sox3*, *sox9*, *egr2*, *bmp4*, *fgf8*) was also detected and correlated with the observed malformations. In addition, genes associated with apoptosis (*p53* and *p65*) and cellular detoxification (*abcb1*) showed marked alterations in expression, especially after combined exposures. Overall, our findings demonstrate that microplastics induce physiological stress during early development and exacerbate the bioaccumulation and toxicity of coexisting contaminants in aquatic organisms⁴. These results highlight the importance of evaluating microplastics within complex environmental contaminant mixtures.

References

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2. Au SY et al. Integr. Environ. Assess. Manag 2017.
3. Patider K et al. Phys. Chem. Earth A/B/C 2023.
4. Sun T et al. J. Hazard. Mater 2022.