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A ONE HEALTH APPROACH TO MICROPLASTICS RISK ASSESSMENT IN THE FOOD ECOSYSTEM

Gabriel Mustatea [1, *] and Elena L. Ungureanu [1]

[1] National Research and Development Institute for Food Bioresources - IBA Bucharest

5 Ancuta Baneasa Street, 020323, Bucharest, Romania

(*) Email: gabi.mustatea@bioresurse.ro

INTRODUCTION

Microplastics—plastic particles less than 5 mm in size—have emerged as pervasive pollutants affecting terrestrial, aquatic, and atmospheric environments [1]. Their persistence, bioaccumulation potential, and interactions with co-contaminants raise serious concerns across human, animal, and environmental health domains [2]. Increasing evidence links microplastics to adverse effects on soil fertility, crop productivity, and the health of wildlife and humans, with implications for food safety and ecosystem services [3,4]. These risks are further amplified in the context of climate change, contributing to food system vulnerabilities, pathogen dynamics, and disruptions such as soil erosion and urban flooding [5]. Despite growing awareness, the complexity of microplastic pollution—including variability in polymer types, shapes, and weathering states—challenges risk assessment and regulatory responses. A One Health approach, which recognizes the interconnectedness of human, animal, and environmental health, offers a comprehensive framework for understanding and managing microplastic risks in the food ecosystem. By fostering interdisciplinary collaboration, this approach supports the development of context-specific research and holistic mitigation strategies.

Fig. 1. Plastic pollution has multiple potential effects on every aspect of global health.

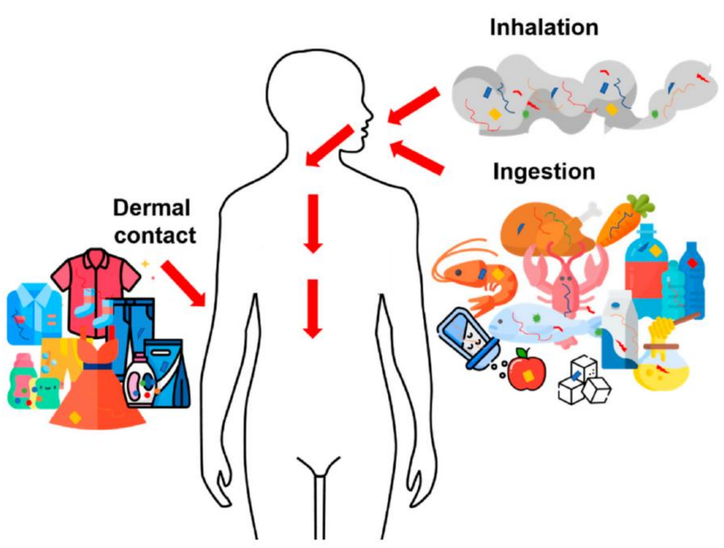

Fig. 2. Schematic representation of exposure to microplastics

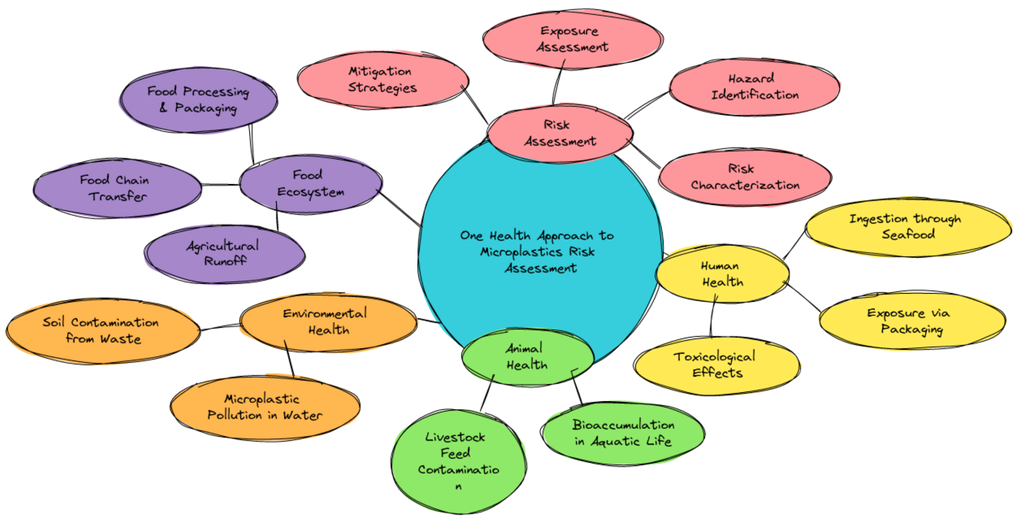

Fig. 3. Mindmap diagram of a One Health approach to microplastics risk assessment in the food ecosystem

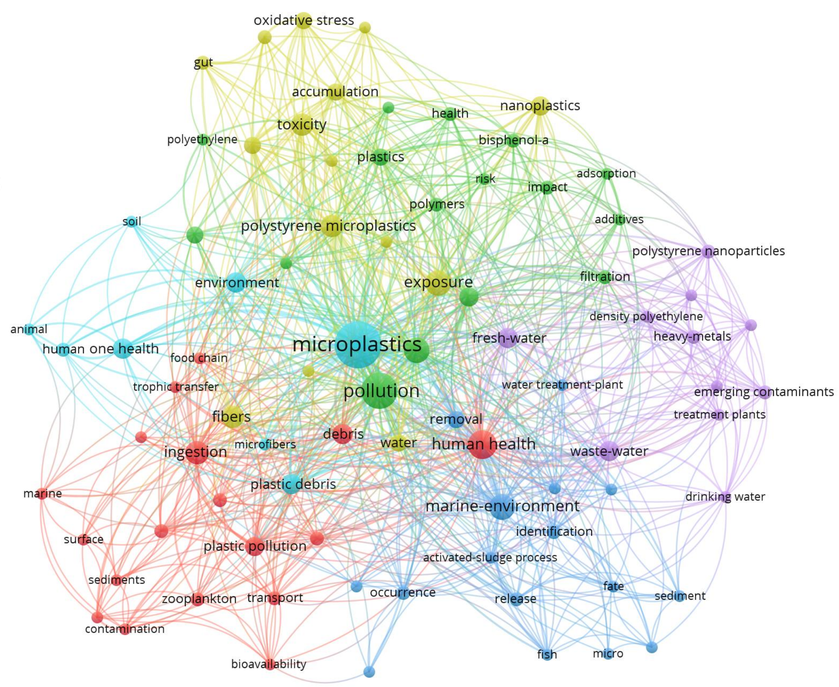

Fig. 4. Clustering of keywords related to *One Health* and *microplastics* topics in WoS (created with VOSviewer)

Growing evidence indicates that plastics affect various levels of biological organization, from molecular and cellular mechanisms to whole organisms and populations. These impacts span a broad range of biological processes, including inflammation, oxidative stress, metabolism, neurological function, behaviour, reproduction, development, and microbiome composition. Such effects arise both from the physical presence of ingested or absorbed plastic particles and from the associated chemicals and microbes they carry.

CONCLUSIONS

Microplastics pose diverse and potentially harmful effects on **animal health**, yet critical knowledge gaps remain regarding their impact under realistic environmental conditions.

Microplastics may pose serious risks to **human health** through ingestion, inhalation, and dermal exposure, but their full impact remains unclear and demands further investigation.

Microplastics disrupt key ecosystem processes and threaten **environmental** resilience, underscoring the urgent need for research on their effects under realistic ecological conditions.

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REFERENCES

1. GESAMP (2015). *Sources, fate and effects of microplastics in the marine environment: a global assessment*. (IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection), Rep. Stud. GESAMP No. 90.
2. Campanale, C., Massarelli, C., Savino, I., Locaputo, V., & Uricchio, V. F. (2020). A detailed review study on potential effects of microplastics and additives of concern on human health. *International Journal of Environmental Research and Public Health*, *17*(4), 1212.
3. de Souza Machado, A. A., Lau, C. W., Till, J., Kloas, W., Lehmann, A., Becker, R., & Rillig, M. C. (2018). Impacts of microplastics on the soil biophysical environment. *Environmental Science & Technology*, *52*(17), 9656–9665.
4. Wright, S. L., & Kelly, F. J. (2017). Plastic and human health: a micro issue? *Environmental Science & Technology*, *51*(12), 6634–6647.
5. Rillig, M. C., Ryo, M., Lehmann, A., Aguilar-Trigueros, C. A., Buchert, S., Wulf, A., ... & Yang, G. (2021). The role of multiple global change factors in driving soil functions and microbial biodiversity. *Science*, *373*(6556), 1077-1081.

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