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MICROPLASTICS ENDOCRINE-DISRUPTING CHEMICALS AND HUMAN HEALTH: METABOLIC AND REPRODUCTIVE RISKS IN A *ONE HEALTH* PERSPECTIVE

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Microplastics (MPs) are ubiquitous contaminants with clear evidence of human exposure. In fact, they have been detected in placenta[1], blood, meconium, and breast milk[2], raising urgent concerns about early-life and prenatal vulnerability. Far from being inert, MPs can penetrate cells, localize within organelles, and trigger oxidative stress, mitochondrial and endoplasmic reticulum dysfunction, inflammation, and apoptosis, thus altering metabolic and reproductive health of organisms. Beyond their physical presence, MPs undergo degradation in biological and environmental contexts, releasing chemical additives such as bisphenols and phthalates. These degradation products act as potent endocrine-disrupting chemicals (EDCs), amplifying the systemic toxicity of MPs. Clinically, MPs/EDCs exposure has been linked to insulin resistance, dyslipidemia, obesity, altered steroidogenesis, impaired gametogenesis, and reduced reproductive fitness, with evidence for sex-specific and potentially transgenerational effects. These findings position MPs-EDCs as active modulators of human health, affecting metabolism, reproduction, and epigenetic programming. Experimental studies in zebrafish reveal conserved pathways of EDCs-induced cellular stress and reproductive dysfunction, offering predictive insights for human health. Cutting-edge human models, including intestinal organoids and osteoblast spheroids[3], allow investigation of EDCs toxicity, identification of early biomarkers, and testing of potential interventions. A One Health approach is essential, integrating environmental monitoring, mechanistic toxicology, advanced in vitro models, and microbiome-targeted strategies to prevent exposure, to enable early diagnostics, and to develop therapeutic interventions ultimately safeguarding human and ecosystem health in the Anthropocene.

References

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