Quality evaluation and review of *in vivo* mammalian reproductive and developmental toxicity studies on micro- and nanoplastics

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Despite increasing evidence of human exposure to micro- and nanoplastics (MNPLs), their potential impact on reproductive and developmental health remains poorly understood. Studies have shown systemic translocation of MNPLs within organisms, including accumulation in reproductive organs, raising concerns among regulators and researchers. However, existing toxicity data vary in quality and regulatory relevance. This study aims to systematically evaluate current evidence on the effects of MNPLs on reproductive and fetal health to address these gaps.

We pursued two main objectives. First, we conducted a systematic review of *in vivo* mammalian studies assessing MNPLs effects on reproductive and developmental health. Second, we evaluated the quality of these studies in terms of Reliability and Relevance for regulatory purposes, using the Science in Risk Assessment and Policy (SciRAP) *in vivo* tool (version 2.3). To our knowledge, this is the first systematic application of SciRAP to this topic.

A total of 102 studies were included, categorized into three themes: Biodistribution, Reproductive System, and Fertility and Development. We found evidence of MNPLs accumulation in reproductive organs, leading to impairments in testicular, ovarian, and uterine functions. Both the quantity and quality of male and female gametes were reduced. Evidence also indicated maternal transfer via the placenta and breastfeeding, negatively affecting fetal development and offspring health.

Quality assessment revealed frequent gaps in reporting, particularly in dose and particle characterization. Since SciRAP was designed for chemicals, it does not fully address MNPLs-specific aspects. To adapt it, we included additional parameters such as polymer type, particle size, and shape under the tool's "Other" criterion and introduced a "Non-evaluable" option in the Relevance evaluation.

In conclusion, while several studies indicate potential reproductive and developmental toxicity of MNPLs, methodological limitations and inconsistent reporting hinder interpretation and weight-of-evidence assessments. Instead of calling for more studies, we emphasize improving study quality to strengthen the evidence base and support informed regulatory decisions.

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