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Supplementary information

Microplastics and nanoplastics in the human gut: from signals to standards

In the format provided by the authors and unedited

Table 1 | Standards for microplastics and nanoparticle research in the gastrointestinal tract.

Experimental stage (applicability)	**Domain**	**Reporting (using standardized descriptors)**	**Rationale**
Particle preparation & characterization *(in vitro, in vivo)*	Particle characterization	• polymer type • size distribution • shape • surface chemistry • concentration	Gut interactions are particle-dependent; incomplete characterization limits comparability
	Particle state reporting	• whether particles are pristine or weathered • presence of additives • likelihood of biocorona	Particle state alters uptake, toxicity, and exposure realism
	Dose metrics and benchmarking	• mass • particle number and/or surface area • benchmark to plausible human exposure	Mass-only dosing obscures biologically relevant differences
Exposure delivery & dosing *(in vitro, in vivo; partially clinical)*	Exposure context	• exposure route (gavage, diet, water, culture exposure) • duration (acute vs chronic) • timing relative to gut physiology	Route and timescale shape transit and biological response
	Exposure definition (delivered dose)	• MNP fraction reaching the relevant gut compartment • aggregation state • particle losses during handling and delivery	Administered dose does not equate with region-specific epithelial exposure
	Environmental contamination control	• background plastic sources • mitigation strategies	Environmental plastics confound exposure estimates
	QA/QC and recovery controls	• positive controls (size-matched non-plastic particles, known inducers of oxidative stress) • negative controls • recovery and loss assessments	QA/QC improves reproducibility and confidence
Detection, identification & localization	Detection strategy and limitations	• analytical method(s) • resolution limits • known trade-offs	Method constraints limit biological interpretation

Experimental stage (applicability)	**Domain**	**Reporting (using standardized descriptors)**	**Rationale**
(in vitro, in vivo, clinical)	Spatial relevance	• luminal vs epithelial vs translocated signal • gut region analyzed	Local detection is often overgeneralized
	Multimodal validation	• complementary detection methods (where feasible)	Multimodal validation reduces false positives
	QA/QC	• procedural contamination (i.e., blanks) • recovery of the method	QA/QC distinguishes true signal from procedural contamination and method loss
Host, tissue & disease context *(in vivo, clinical)*	Barrier and tissue status	• baseline barrier status (mucus integrity, permeability) • post-exposure barrier status • gut region specificity	Barrier state governs MNP interaction and effects
	Physiological modifiers	• diet • disease state • transit time • inflammation • host genetics-specific modifiers	Host context strongly modulates outcomes and requires appropriate controls
Biological readouts & interpretation *(in vitro, in vivo, clinical)*	Outcome alignment	• readouts matched to exposure scale • duration-appropriate endpoints	Sensitive endpoints may not indicate pathology
	Interpretation of sensitive endpoints	• conservative interpretation of microbiome/omics data	Sensitivity does not imply causality
Directionality & clinical relevance *(in vivo, clinical, translational)*	Directionality and causality	• longitudinal sampling • stratification by barrier status • intervention designs	Associations cannot establish causation
	Translational framing	• mechanistic vs associative vs hypothesis-generating	Prevents overextension to human health claims

QA, quality assurance; QC, quality control.