SUPPLEMENTALS

SUPPLEMENTARY METHODS

Cross-laboratory comparability of µFTIR analyses

To evaluate the methodological comparability of datasets included in the pooled analysis, information on µFTIR workflows was extracted from two published studies - Lee et al.(25) (Republic of Korea) and Leonard et al.(15) (United Kingdom) - together with the protocol used for the present analysis (Measurelabs, Finland). All three applied µFTIR spectroscopy for MP polymer identification in human blood samples, operating in the mid-infrared range (4000-690 cm^{-1}) with comparable spectral resolution (8 cm^{-1}). Reported instrumentation included the *Bruker LUMOS II* (Bruker Optics Inc., Billerica, MA, USA) used by Lee et al., the *Thermo Scientific Nicolet iN10* infrared microscope (Thermo Fisher Scientific, Waltham, MA, USA) used by Leonard et al., and the *PerkinElmer Spotlight 400* infrared imaging system (PerkinElmer Inc., Waltham, MA, USA) used by Measurelabs.

Sample pretreatment in all protocols aimed to remove organic components while preserving polymer integrity. The present and UK studies used enzymatic-oxidative digestion combining *proteinase K* and *30 % H_2O_2*, whereas the Korean study employed a purely oxidative procedure using *30 % H_2O_2* followed by *68 % HNO_3*. Filtration systems differed slightly (stainless-steel 10 µm, aluminium-oxide 0.02 µm, or silicon 5 µm filters), resulting in lower detection limits ranging from approximately 5 to 20 µm across datasets.

All studies implemented rigorous contamination control using ISO 5 laminar-flow hoods, glass or metal equipment, and procedural blanks. Polymer identification and classification were performed using validated spectral matching approaches: *siMPle* software (Aalborg University, Denmark / Alfred Wegener Institute, Germany) in our and Korean studies, and *OMNIC Picta* with Thermo OMNIC Polymer Libraries in the UK study. The reference libraries in all analyses contained major polymer spectra (PE, PP, PS, PET, PVC, PA, PU, PMMA, PC), with comparable matching thresholds (Hit Quality Index or spectral match ≥ 65-70%).

For completeness, the study by *Leslie et al.(16)* (Netherlands) was reviewed but not included in the pooled analysis. That work quantified microplastics in blood using pyrolysis-gas chromatography/mass spectrometry (Pyr-GC/MS), which differs from µFTIR spectroscopy in

analytical principle, particle detection limit, and reporting metrics. Because cross-method comparability has not been validated for µFTIR and Pyr-GC/MS, inclusion of these data was deemed inappropriate.

While the three µFTIR workflows differed in certain procedural aspects - such as digestion chemistry, filter material, and detection threshold - they shared key analytical characteristics including comparable spectral range, resolution, and contamination control standards. These shared analytical parameters provide a sufficient methodological basis for cautious quantitative comparison of microplastic particle counts across studies. This interpretation aligns with published interlaboratory comparison and validation studies showing that µFTIR yields reproducible results across laboratories when standardized pipelines are applied.(22, 23) Accordingly, the datasets were considered sufficiently aligned to permit cautious pooled quantitative analysis in the present study.

491 **SUPPLEMENTARY TABLES**

Parameter	**Present study (Measurelabs, Finland)**	**Leonard et al.(15) (United Kingdom)**	**Lee et al.(25) (Republic of Korea)**
Analytical principle	µFTIR imaging, transmission mode	µFTIR imaging, transmission mode	µFTIR imaging, transmission mode
Instrument; detector	PerkinElmer Spotlight 400; FPA detector	Thermo Scientific Nicolet iN10; MCT detector	Bruker LUMOS II; FPA detector
Spectral range; resolution	4000-690cm^{-1}; 8cm^{-1}	4000-1250cm^{-1}; 8cm^{-1}	4000-750 cm^{-1}; 8cm^{-1}
Sample pretreatment	Enzymatic and oxidative digestion (proteinase K + 30% H_2O_2)	Enzymatic and oxidative digestion (proteinase K + 30% H_2O_2)	Oxidative digestion (30% H_2O_2 + 68% HNO_3)
Filtration system; pore size	Stainless-steel mesh (Tulip system); 10 µm	Aluminium-oxide (Anodisc) filter; 0.02 µm	Silicon filter; 5 µm
Polymer identification software	siMPle software (Aalborg University, Alfred Wegener Institute)	OMNIC Picta with Thermo OMNIC Polymer Libraries	siMPle software (Aalborg University, Alfred Wegener Institute)
Contamination control	Laminar-flow hood ISO 5; glass and metal equipment; procedural blanks	Laminar-flow hood ISO 5; glass and metal equipment; procedural blanks	Laminar-flow hood ISO 5; glass and metal equipment; procedural blanks
Quality validation	Recovery tests for representative polymers	Procedural blanks and recovery spike controls	SEM validation and recovery tests reported

492

Supplemental Table S1. Comparison of micro-Fourier transform infrared (µFTIR) methodologies across studies included in the pooled analysis. Excluded dataset: Leslie et al. (Netherlands) - used pyrolysis-gas chromatography/mass spectrometry (Pyr-GC/MS) rather than µFTIR; therefore, not directly comparable due to different analytical principle, particle detection threshold, and reporting metrics. Abbreviations: FPA: focal-plane array; MCT: mercury-cadmium-telluride; SEM: scanning electron microscopy.

Polymer Type	Stroke (n=20)	Healthy (n=15)	Total (n=35)
PE	230; 100%; 11 [4-18]	132; 87%; 5 [1-13]	362; 94%; 9 [4-16]
PP	29; 75%; 2 [1-2]	17; 53%; 1 [0-1]	46; 66%; 1 [0-2]
PVC	1; 5%; 0 [0-0]	-	1; 3%; 0 [0-0]
PA	1; 5%; 0 [0-0]	2; 13%; 0 [0-0]	3; 9%; 0 [0-0]
PS	1; 5%; 0 [0-0]	1; 7%; 0 [0-0]	2; 6%; 0 [0-0]
PET	14; 25%; 0 [0-1]	10; 33%; 0 [0-2]	24; 29%; 0 [0-1]
EVA	-	-	-
PVA	-	-	-
BIO	3; 15%; 0 [0-0]	-	3; 9%; 0 [0-0]
POM	-	-	-
Others	-	-	-

Supplementary Table S2. Particle count per polymer type by group and total. Values are given as total number of particles detected; proportion of samples with ≥1 particle (%); median [IQR] MPs/mL per sample. Note: Polymer types with 0 [0-0] values indicate rare detections in isolated participants; rows with "-" reflect no detections in that group. Abbreviations: PE: polyethylene; PP: polypropylene, PVC: polyvinyl chloride, PA: polyamide, PS: polystyrene, PET: polyethylene terephthalate, EVA: ethylene-vinyl acetate; PVA: polyvinyl alcohol; BIO: bio-based polymers; POM: polyoxymethylene.

Size class	Stroke (n=20)	Healthy (n=15)	Total (n=35)
20-50 µm	116; 95%; 4.5 [2-8]	64; 80%; 3.0 [1-6]	180; 89%; 4.0 [2-8]
50-100 µm	117; 100%; 4.5 [3-11]	110; 80%; 8.5 [3.25-10]	227; 91%; 6 [3-10]
100-500 µm	26; 60%; 1.0 [0-2]	17; 53%; 1.0 [0-2]	43; 57%; 1.0 [0-2]

511

512 **Supplementary Table S3. Particle count per size class by group and total.** Values are given as
513 total number of particles detected; proportion of samples with ≥1 particle (%); and median
514 [IQR] MPs/mL per sample.

Predictor	Logistic Regression (High vs Low Burden)*	Negative Binomial Regression (Total MP Counts)†
Sex (female vs male)	OR 3.58 (95% CI 0.69-18.53), p=0.129	IRR 1.52 (95% CI 0.68-3.39), p=0.316
Group (stroke vs healthy)	OR 4.98 (95% CI 0.63-39.13), p=0.127	IRR 1.38 (95% CI 0.64-2.97), p=0.403
Age (per year)	OR 0.97 (95% CI 0.91-1.03), p=0.283	IRR 0.99 (95% CI 0.96-1.02), p=0.474

Supplementary Table S4. Logistic and negative binomial regression analyses of predictors of MP burden. * Logistic regression model $\chi^2(3)=5.89$, p=0.117; Hosmer-Lemeshow p=0.463; Nagelkerke $R^2=0.21$. † Negative binomial model: Pearson $\chi^2/df=0.77$, AIC=256.3. Reference categories: male (sex), healthy (group). Both models converged without warnings. Abbreviations: Odds Ratio (OR); Incidence Rate Ratio (IRR).

Study	n	Detection rate	Mean (MPs/mL)	SD (MPs/mL)	Range (MPs/mL)
Leonard et al.(15)	20	8/20 (40%) above LOQ	2.47	4.17	0-4.8
Lee et al.(24)	36	32/36 (89%)	4.3	5.5*	0-26
Present study (Healthy)	15	13/15 (87%)	10.8	11.0	0-35
Pooled healthy reference	71	-	5.1	7.3	-
Present study (Stroke)	20	20/20 (100%)	13.95	8.73	1-28

Supplemental Table S5. Microplastic (MP) concentrations in human blood reported across cohorts and pooled estimate used for comparative analysis. *For studies reporting only ranges, the standard deviation was approximated using established conversion formulas for moderate sample sizes (SD ≈ range ÷ 4.7).(38)