

Note to readers with disabilities: *EHP* strives to ensure that all journal content is accessible to all readers. However, some figures and Supplemental Material published in *EHP* articles may not conform to [508 standards](#) due to the complexity of the information being presented. If you need assistance accessing journal content, please contact ehp508@niehs.nih.gov. Our staff will work with you to assess and meet your accessibility needs within 3 working days.

Supplemental Material

A Children's Health Perspective on Nano- and Microplastics

Kam Sripada, Aneta Wierzbicka, Khaled Abass, Joan O. Grimalt, Andreas Erbe, Halina B. Röllin, Pál Weihe, Gabriela Jiménez Díaz, Randolph Reyes Singh, Torkild Visnes, Arja Rautio, Jon Øyvind Odland, and Martin Wagner

Table of Contents

Literature search bibliography

Literature search bibliography

Primary studies on health effects of nano- and microplastics relevant for pregnancy and childhood.

- Abbasi S, Keshavarzi B, Moore F, Delshab H, Soltani N, Sorooshian A. 2017. Investigation of microrubbers, microplastics and heavy metals in street dust: A study in Bushehr City, Iran. Environmental Earth Sciences 76:19.
- Abbasi S, Keshavarzi B, Moore F, Turner A, Kelly FJ, Dominguez AO, et al. 2019. Distribution and potential health impacts of microplastics and microrubbers in air and street dusts from Asaluyeh County, Iran. Environ Pollut 244:153-164.
- Akhbarizadeh R, Dobaradaran S, Nabipour I, Tajbakhsh S, Darabi AH, Spitz J. 2020. Abundance, composition, and potential intake of microplastics in canned fish. Mar Pollut Bull 160:111633.
- Akhbarizadeh R, Dobaradaran S, Torkmahalleh MA, Saeedi R, Aibaghi R, Ghasemi FF. 2021. Suspended fine particulate matter (pm2.5), microplastics (mps), and polycyclic aromatic hydrocarbons (pahs) in air: Their possible relationships and health implications. Environmental Research 192.
- Akhbarizadeh R, Moore F, Keshavarzi B. 2018. Investigating a probable relationship between microplastics and potentially toxic elements in fish muscles from northeast of persian gulf. Environmental Pollution 232:154-163.
- Akhbarizadeh R, Moore F, Keshavarzi B. 2019. Investigating microplastics bioaccumulation and biomagnification in seafood from the persian gulf: A threat to human health? Food Addit Contam Part A Chem Anal Control Expo Risk Assess 36:1696-1708.
- Alberg T, Hansen JS, Lovik M, Nygaard UC. 2014. Particles influence allergic responses in mice–role of gender and particle size. J Toxicol Environ Health A 77:281-292.
- Barboza LGA, Cunha SC, Monteiro C, Fernandes JO, Guilhermino L. 2020. Bisphenol a and its analogs in muscle and liver of fish from the north east atlantic ocean in relation to microplastic contamination. Exposure and risk to human consumers. J Hazard Mater 393:122419.
- Becquemin MH, Swift DL, Bouchikhi A, Roy M, Teillac A. 1991. Particle deposition and resistance in the noses of adults and children. Eur Respir J 4:694-702.
- Becquemin MH, Yu CP, Roy M, Bouchikhi A. 1991. Total deposition of inhaled particles related to age - comparison with age-dependent model-calculations. Radiation Protection Dosimetry 38:23-28.
- Bosman SJ, Nieto SP, Patton WC, Jacobson JD, Corselli JU, Chan PJ. 2005. Development of mammalian embryos exposed to mixed-size nanoparticles. Clin Exp Obstet Gynecol 32:222-224.
- Conti GO, Ferrante M, Banni M, Favara C, Nicolosi I, Cristaldi A, et al. 2020. Micro- and nano-plastics in edible fruit and vegetables. The first diet risks assessment for the general population. Environmental Research 187:7.
- Cox KD, Covernton GA, Davies HL, Dower JF, Juanes F, Dudas SE. 2019. Human consumption of microplastics. Environ Sci Technol 53:7068-7074.
- Dehghani S, Moore F, Akhbarizadeh R. 2017. Microplastic pollution in deposited urban dust, Tehran metropolis, Iran. Environ Sci Pollut Res Int 24:20360-20371.
- Dris R, Gasperi J, Mirande C, Mandin C, Guerrouache M, Langlois V, et al. 2017. A first overview of textile fibers, including microplastics, in indoor and outdoor environments. Environ Pollut 221:453-458.
- Fournier SB, D'Errico JN, Adler DS, Kollontzi S, Goedken MJ, Fabris L, et al. 2020. Nanopolystyrene translocation and fetal deposition after acute lung exposure during late-stage pregnancy. Part Fibre Toxicol 17:55.

- Grafmueller S, Manser P, Diener L, Diener PA, Maeder-Althaus X, Maurizi L, et al. 2015b. Bidirectional transfer study of polystyrene nanoparticles across the placental barrier in an ex vivo human placental perfusion model. *Environ Health Perspect* 123:1280-1286.
- Grafmueller S, Manser P, Diener L, Maurizi L, Diener PA, Hofmann H, et al. 2015a. Transfer studies of polystyrene nanoparticles in the ex vivo human placenta perfusion model: Key sources of artifacts. *Sci Technol Adv Mater* 16:044602.
- Gruber MM, Hirschmugl B, Berger N, Holter M, Radulovic S, Leitinger G, et al. 2020. Plasma proteins facilitates placental transfer of polystyrene particles. *J Nanobiotechnology* 18:128.
- Han Y, Song Y, Kim GW, Ha C, Lee J, Kim M, et al. 2021. No prominent toxicity of polyethylene microplastics observed in neonatal mice following intratracheal instillation to dams during gestational and neonatal period. *Toxicological Research*:8.
- Huang JP, Hsieh PCH, Chen CY, Wang TY, Chen PC, Liu CC, et al. 2015. Nanoparticles can cross mouse placenta and induce trophoblast apoptosis. *Placenta* 36:1433-1441.
- Inocencio IM, Bischof RJ, Xiang SD, Zahra VA, Nguyen V, Lim T, et al. 2017. Exacerbation of ventilation-induced lung injury and inflammation in preterm lambs by high-dose nanoparticles. *Sci Rep* 7:14704.
- Li DZ, Shi YH, Yang LM, Xiao LW, Kehoe DK, Gun'ko YK, et al. 2020. Microplastic release from the degradation of polypropylene feeding bottles during infant formula preparation. *Nature Food* 1:746-+.
- Liu CG, Li J, Zhang YL, Wang L, Deng J, Gao Y, et al. 2019. Widespread distribution of pet and pc microplastics in dust in urban China and their estimated human exposure. *Environment International* 128:116-124.
- Luo T, Wang CY, Pan ZH, Jin CY, Fu ZW, Jin YX. 2019a. Maternal polystyrene microplastic exposure during gestation and lactation altered metabolic homeostasis in the dams and their f1 and f2 offspring. *Environmental Science & Technology* 53:10978-10992.
- Luo T, Zhang Y, Wang CY, Wang XY, Zhou JJ, Shen ML, et al. 2019b. Maternal exposure to different sizes of polystyrene microplastics during gestation causes metabolic disorders in their offspring. *Environmental Pollution* 255:9.
- Makhdoumi P, Amin AA, Karimi H, Pirsahab M, Kim H, Hossini H. 2021. Occurrence of microplastic particles in the most popular iranian bottled mineral water brands and an assessment of human exposure. *Journal of Water Process Engineering* 39:8.
- Malmberg B, Leanderson P, Nilsson A, Flodin U. 2000. Powdering floor polish and mucous membrane irritation in secondary school pupils. *Int Arch Occup Environ Health* 73:498-502.
- Martinez-Tavera E, Duarte-Moro AM, Sujitha SB, Rodriguez-Espinosa PF, Rosano-Ortega G, Exposito N. 2021. Microplastics and metal burdens in freshwater tilapia (*oreochromis niloticus*) of a metropolitan reservoir in central mexico: Potential threats for human health. *Chemosphere* 266:128968.
- Mohamed Nor NH, Kooi M, Diepens NJ, Koelmans AA. 2021. Lifetime accumulation of microplastic in children and adults. *Environ Sci Technol* 55:5084-5096.
- Ragusa A, Svelato A, Santacroce C, Catalano P, Notarstefano V, Carnevali O, et al. 2021. Plasticenta: First evidence of microplastics in human placenta. *Environ Int* 146:106274.
- Smyth SH, Doyle-McCullough M, Cox OT, Carr KE. 2005. Effect of reproductive status on uptake of latex microparticles in rat small intestine. *Life Sci* 77:3287-3305.
- Tian F, Razansky D, Estrada GG, Semmler-Behnke M, Beyerle A, Kreyling W, et al. 2009. Surface modification and size dependence in particle translocation during early embryonic development. *Inhal Toxicol* 21 Suppl 1:92-96.
- Wick P, Malek A, Manser P, Meili D, Maeder-Althaus X, Diener L, et al. 2010. Barrier capacity of human placenta for nanosized materials. *Environ Health Perspect* 118:432-436.
- Zhang J, Wang L, Kannan K. 2020. Microplastics in house dust from 12 countries and associated human exposure. *Environ Int* 134:105314.

Zhou Y, Xi JX, Simpson J, Irshad H, Cheng YS. 2013. Aerosol deposition in a nasopharyngolaryngeal replica of a 5-year-old child. *Aerosol Science and Technology* 47:275-282.

Zuccarello P, Ferrante M, Cristaldi A, Copat C, Grasso A, Sangregorio D, et al. 2019. Exposure to microplastics (<10μm) associated to plastic bottles mineral water consumption: The first quantitative study. *Water Res* 157:365-371.

Review articles on health effects of nano- and microplastics relevant for pregnancy and childhood

Arroyo MC, Barrera TG, Leblie BC, Borrego AA, Collado MC. 2021. A review of the impact of xenobiotics from dietary sources on infant health: Early life exposures and the role of the microbiota. *Environmental Pollution* 269:12.

Bongaerts E, Nawrot TS, Van Pee T, Ameloot M, Bove H. 2020. Translocation of (ultra)fine particles and nanoparticles across the placenta: a systematic review on the evidence of in vitro, ex vivo, and in vivo studies. Part Fibre Toxicol 17:56.

Mortensen NP, Johnson LM, Griege KD, Ambroso JL, Fennell TR. 2019. Biological interactions between nanomaterials and placental development and function following oral exposure. *Reproductive Toxicology* 90:150-165.

Muoth C, Aengenheister L, Kucki M, Wick P, Buerki-Thurnherr T. 2016. Nanoparticle transport across the placental barrier: Pushing the field forward! *Nanomedicine (Lond)* 11:941-957.

Landrigan PJ, Stegeman JJ, Fleming LE, Allem, D, Anderson DM, et al. 2020. Human health and ocean pollution. *Annals of Global Health* 86:64.

Stone V, Johnston H, Clift MJ. 2007. Air pollution, ultrafine and nanoparticle toxicology: Cellular and molecular interactions. *IEEE Trans Nanobioscience* 6:331-340.

Zhou S, Li WX, Tang ZP, Gao YY, Liu YJ. 2020. Progress on the occurrence, migration and toxicity of airborne microplastics. *Zhongguo Huanjing Kexue/China Environmental Science* 40:5027-5037.