NEWS

Microplastics affect gut function and microbiota

Scientists find chronic exposure of mice to polystyrene microplastics affects intestinal barrier function, gut microbiota composition, metabolic indices

September 7, 2018 Ksenia Groh Reading time: 2 minutes

In an article (https://www.sciencedirect.com/science/article/pii/S0048969718333242) published on August 28, 2018, in the peer-reviewed journal *Science of the Total Environment*, Yuanxiang Jin and colleagues from the College of Biotechnology and Bioengineering, Zhejiang University of Technology, Hangzhou, China, report on the gut-related effects of oral exposure to polystyrene (PS) microplastic in mice.

The scientists exposed 6-week-old mice to PS particles with an average size of 5 µm. The particles were delivered with drinking water at two different concentrations, 100 and 1000 µg/L, corresponding to 1,456,000 and 14,560,000 particles per liter, respectively. The exposure continued for 6 weeks.

Secretion of gut mucus decreased in both treatment groups compared to unexposed mice, accompanied by a downregulation of several genes involved in mucus secretion and ion transport. Microplastic exposure also decreased abundance and diversity of gut microbiota.

In the serum of exposed mice, increased levels of serum pyruvate and decreased levels of triglycerides and total cholesterol were measured in microplastic-exposed groups. Furthermore, several metabolites known to be "associated with the occurrence of metabolic diseases," were also affected. The authors summarized that "amino acid metabolism, the tricarboxylic acid (TCA) cycle and the urea cycle were . . . influenced" by exposure to microplastic. In addition, exposure to the higher concentration of microplastic was found to increase total bile acids in the liver, but not in the serum. An increased expression of several genes involved in bile acid synthesis and transport was also observed in the liver of microplastic-exposed mice.

The authors conclude that exposure to microplastic "could induce gut microbiota dysbiosis, intestinal barrier dysfunction and metabolic disorders."

Several studies measuring microplastics in drinkable water reported concentrations up to 35,436 particles per liter in bottled mineral water (FPF reported (https://www.foodpackagingforum.org/news/microplastic-and-pigment-particles-in-water)). Large (>5 µm) particles of microplastics have also been detected in tap water (https://www.theguardian.com/environment/2017/sep/06/plastic-fibres-found-tap-water-around-world-study-reveals), beer (https://www.foodpackagingforum.org/news/microplastics-found-in-beer), salt (https://www.foodpackagingforum.org/news/microplastics-in-sea-salt), fish (https://www.foodpackagingforum.org/news/microplastics-in-supermarket-fish). Currently, particles smaller than 1.5 µm are considered to be the most relevant toxicologically, because they are more likely to penetrate deeper into the body (see, e.g., European Food Safety Authority's (EFSA) statement on microplastics in food

(https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2016.4501)) (FPF reported (https://www.foodpackagingforum.org/news/efsa-plastic-pollution-in-food)). It is assumed that concentrations of smaller particles could be even higher than those measured for particles sized 5 µm and above (FPF reported (https://www.foodpackagingforum.org/news/standard-methods-for-measuring-microplastics-needed)). However, reliably measuring microplastic particles sized at and below 1 µm remains technically challenging to date (FPF reported (https://www.foodpackagingforum.org/news/technical-solutions-for-studying-microplastics)).

Reference

Jin, Y., et al. (2018). "Impacts of polystyrene microplastic on the gut barrier, microbiota and metabolism of mice. (https://www.sciencedirect.com/science/article/pii/S0048969718333242)" *Science of the Total Environment* 649: 308-317.

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