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Possible impacts of foodborne engineered nanomaterials on the murine gut microbiome

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For its multiple local and systemic implications, the gut microbiome has been deemed the 'forgotten organ'[1]. So far, rodent studies on the effects of engineered nanomaterials (ENM) on the gut microbiome, particularly with Ag, have led to a broad range of results[2]. The aim of this study was to assess the effects of four well-investigated model ENM under a realistic exposure scenario.

In two independent feeding studies, C57BL6/J mice were fed with ENM-containing pellets *ad libitum*. In substudy 1, female mice were exposed to 1% SiO_2 or 1% CeO_2 in feed (w/w) for three weeks. In substudy 2, both female and male mice were exposed to 1% TiO_2 P25 or 0.2% Ag-PVP in feed (w/w) for four weeks. Next generation 16S rDNA sequencing and an amplicon sequence variants-based approach were applied to assess impacts on the gut microbiome.

None of the ENM had an effect on the α- and β-diversity. In substudy 2, a sex related difference in the β-diversity was observed. A difference in the β-diversity was also shown comparing the female control mice of the two substudies. A decreased relative abundance of the phylum Actinobacteria was observed in SiO_2 treated mice. In female mice, the relative abundance of the genus Roseburia was increased with Ag-treatment.

Specific effects seen in this study, such as the decreased relative abundance of Actinobacteria, a phylum pivotal for gut homeostasis[3], call for further research to clarify their meaning for human health. Still, compared to other studies, relatively few effects were found[4, 5]. This may be due to varying study designs, concerning e. g. the way of administration or the origin of the test animals. The latter is strongly supported by the differences between the control mice of the two substudies, which originated from two distinct breeding facilities. Moreover, the sex related differences stress the importance to include both sexes when designing microbiome studies with xenobiotics.

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1. In a realistic oral exposure scenario, ENM had minor effects on the murine gut microbiome.

Abstract

2. There is a demand for further research to understand the meaning of effects on specific taxonomic groups of the microbiome for human health.
3. Standardization of microbiome studies to increase their comparability is strongly needed.