How microbes may help mitigate mercury absorption

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Element mercury (Hg), liquid form. Credit: Wikipedia.

New research by a team at Pennsylvania State University suggests that microbes in the human gut could be harnessed to help the body absorb useful nutritional metals—like iron, which is critical for red blood cells—and block or even remove the absorption of toxic ones, like mercury. The group presents their findings at ASM Microbe 2023, the annual meeting of the American Society for Microbiology.

Methyl mercury is particularly worrisome, said Daniela Betancurt-Anzola, a graduate student at Penn State who led the new study. It is a neurotoxin that can lead to blindness, organ damage, and, if untreated, even death. Pregnant women are particularly vulnerable to mercury poisoning, and prenatal exposure could lead to blindness, seizures and brain damage.

Most mercury exposure is through fish or shellfish, but it can show up elsewhere as well. "It accumulates in living things, in plants and fish," she said. "We eat those things, and it accumulates in us."

Betancurt-Anzola and her colleagues first analyzed thousands of genomes from gut bacteria, focusing on genetic determinants associated with the ability to interact with metals. Many genes are known to be connected to metal resistance, she said, but the group focused on those that enabled bacteria to absorb methyl mercury and keep it out of the gut.

To understand how those genes function and impact the host, the team used metagenomic sequencing to study how human and mouse microbes responded to mercury exposure. Finally, the investigators used those insights to develop a probiotic specifically designed to detoxify a harmful type of mercury often found in the human diet. They inserted genes from Bacillus megaterium bacteria, which is known to be highly resistant to methyl mercury, into strains of Lacticaseibacillus, a genus of lactic acid bacteria.

"It's a perfect probiotic for this because it can survive in the gut but it's very bad at colonizing in the body," Betancurt-Anzola said. "It is inside the gut, it grabs the methyl mercury, then it goes out."

The group has begun pilot studies on mice exposed to mercury, she said, and early results suggest that those mice that had received the probiotic fared better than those that hadn't.

For now, she said, the group is focused on understanding how gut microbes interact with mercury, but they plan to investigate other metals as well. Their ultimate goal is to develop interventions that could help reduce levels of dangerous metals—like mercury—and boost absorption of those that the human body needs. "We are interested in studying how the entire microbial community reacts to different metals," Betancurt-Anzola said.

More information: Conference: asm.org/Events/ASM-Microbe/Home

Provided by American Society for Microbiology