Probiotic bacteria could provide some protection against cadmium poisoning

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Oral administration of certain probiotics reduced uptake of the heavy metal, cadmium, in the intestines of mice, and in a laboratory experiment using human intestinal cells. The research, which might ultimately be applied to improving public health in areas of heavy metal contamination, is published ahead of print May 20 in *Applied and Environmental Microbiology*, a journal of the American Society for Microbiology.

In earlier work, these investigators, led by Wei Chen, PhD, confirmed that the probiotic bacterium *Lactobacillus plantarum*, could inhibit cadmium absorption in mouse intestines by binding cadmium. In the new study, the goal was to determine whether probiotics inhibited cadmium absorption by other means.

Cadmium damages the intestinal tract, which is usually the first internal organ to be exposed, said Chen, Dean and Professor, School of Food Science and Technology, Jiangnan University, Wuxi, Peoples Republic of China. The new study provides evidence that this heavy metal induces inflammation, increases intestinal permeability, disrupts "tight junctions,"-areas where cells are so closely bound that they form a barrier that is virtually impermeable to fluid—and generally damages the gut barrier. As barrier cells are killed, permeability increases further.

The investigators fed the mice the probiotic *L. plantarum*, as well as drinking water laced with cadmium, for eight weeks. They measured cadmium in the feces weekly during the eight weeks. The quantity of

cadmium excreted in the feces rose steadily during the study period, as the bacteria became established in increasing numbers in the mice' intestines. Mice that excreted greater cadmium in the feces had less cadmium in their tissues, although that burden needs further reduction before such probiotics can be commercialized.

The probiotics reduced the inflammation, reversed the disruption of tight junctions, and reduced intestinal permeability in the mice. The authors suggest that these benefits arise from mitigation of oxidative stress caused by cadmium.

"We started the research on protection of probiotics against heavy metals in 2006 as we found out that in certain regions of Jiangxi Province in China the cadmium content of rice was way above the standard," said Chen. "We realized then that probiotics might benefit people exposed to heavy metal pollution such as cadmium and lead." Chen also noted that severe cadmium pollution incidents have been reported in Hunan and Guangxi provinces in recent years.

Additionally, major cadmium and other heavy metals from industrial slag polluted the Jinzu river basin of Japan, from the 1910s to the 1960s, contaminating local rice, causing itai-itai disease, which is the most severe manifestation of cadmium poisoning. (Itai-itai means "it hurts it hurts".) Despite soil replacement in 1,500 hectares of paddy fields from 1980-2011, a small number of cases of cadmium poisoning occurred during the '00s.

"The toxic effects of cadmium on vital organs, such as the liver, kidneys, bones, and reproductive system, are well documented, and oxidative stress is an important mechanism of the toxicity," the investigators wrote.