Researchers show influence of nanoparticles on nutrient absorption

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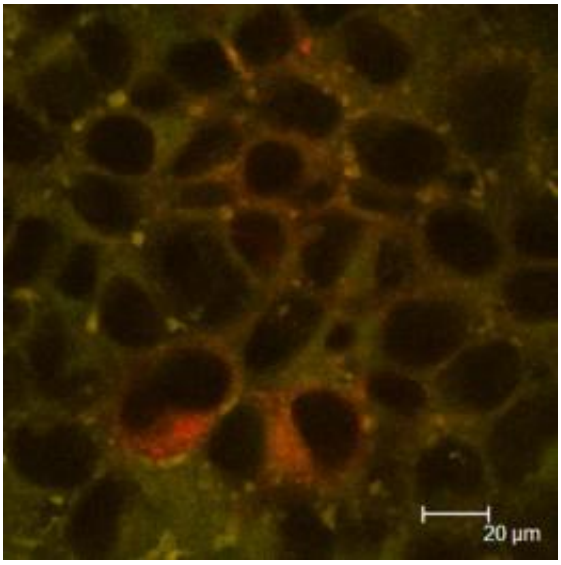

This figure shows 50 nm carboxylated polystyrene nanoparticles (green) interacting with a cell culture model of the intestinal epithelium (red). Oral exposure to these particles was shown to affect iron transport. Credit: *Nature Nanotechnology*

Nanoparticles are everywhere. From cosmetics and clothes, to soda and snacks. But as versatile as they are, nanoparticles also have a downside, say researchers at Binghamton University and Cornell University in a recent paper published in the journal *Nature Nanotechnology*. These tiny particles, even in low doses, could have a big impact on our long-term health.

According to lead author of the article, Gretchen Mahler, assistant professor of bioengineering at Binghamton University, much of the existing research on the safety of nanoparticles has been on the direct health effects. But what Mahler, Michael L. Shuler of Cornell University and a team of researchers really wanted to know was what happens when someone gets constant exposure in small doses – the kind you'd get if you were taken a drug or supplement that included nanoparticles in some form.

"We thought that the best way to measure the more subtle effects of this kind of intake was to monitor the reaction of intestinal cells," said Mahler. "And we did this in two ways – in vitro, through human intestinal-lining cells that we had cultured in the lab; and in vivo, through the intestinal linings of live chickens. Both sets of results pointed to the same thing – that exposure to nanoparticles influences the absorption of nutrients into the bloodstream."

The uptake of iron, an essential nutrient, was of particular interest due to the way it is absorbed and processed through the intestines. The way Mahler and the team tested this was to use polystyrene nanoparticles because of its easily traceable fluorescent properties.

"What we found was that for brief exposures, iron absorption dropped by about 50 percent," said Mahler. "But when we extended that period of time, absorption actually increased by about 200 percent. It was very clear – nanoparticles definitely affects iron uptake and transport."

While acute oral exposure caused disruptions to intestinal iron transport, chronic exposure caused a remodeling of the intestinal villi – the tiny, finger-like projections that are vital to the intestine's ability to absorb nutrients – making them larger and broader, thus allowing iron to enter the bloodstream much faster.

"The intestinal cells are a gateway that ingested nanoparticles must go through to get to the body," said Mahler. "We monitored iron absorption both in vivo and in vitro and found that the polystyrene nanoparticles affected the absorption process and caused a physiological response."

The next step for Mahler and the team is to take a look at whether similar disruptions in nutrient absorption could be possible in other inorganic elements such as calcium, copper and zinc. Also on the research agenda is the reaction of other nutrients such as fat-soluble vitamins A, D, E and K. And chickens and their intestines will definitely be part of this next phase of the study.

"The gastrointestinal tract of chickens have very similar features to that of humans," said Mahler. "We can learn a great deal from the way chicken tissue works which means we can make better predictions about how humans will react."

And humans certainly consume enough nanoparticles – about 100 trillion of them every day. Their ultra-small size and amazing qualities makes them increasingly common in food and pharmaceutical products. Although the impact of chronic exposure remains somewhat unknown, the ingestion of dietary particles is thought to promote a range of diseases, including Crohn's disease. With so many nanomaterials under development and with so much yet to be learned about nanoparticle toxicity and potential human tissue reactivity, Mahler and the team are hoping that their work, particularly the in vitro model, will provide an effective low-cost screening tool.

Provided by Binghamton University

https://phys.org/news/2012-03-nanoparticles-nutrient-absorption.html