Lab study raises questions over nano-particle impact

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Tests involving chickens have raised questions about the impact on health from engineered nano-particles, the ultra-fine grains commonly used in drugs and processed foods, scientists said. Chickens exposed to high oral doses of polystyrene particles 50 nanometres (50 billionths of a metre) across absorbed less iron in their diet, according to their study.

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At the same time, birds that were chronically exposed to these doses had

a "remodelling" of their intestinal villi, the microscopic finger-like projections that play an important role in absorbing nutrients.

The changes meant that the villi increased the surface area available for taking in iron.

Intestinal uptake of calcium, copper, zinc and vitamins A, D, E and K may also be affected by high exposure to nanoparticles, although further research is needed to investigate this, say the authors.

The team, led by Michael Shuler of Cornell University in New York, tested the particles on chickens as a substitute for the human intestine and also used lab-dish cells from the lining of the human gut.

The chickens were given roughly the same dose, weight for weight, as an adult human in a developed country.

"The intestinal epithelial layer represents the initial gate that ingested nanoparticles must pass to reach the body," says the paper, which appears in the specialist journal *Nature Nanotechnology*.

"The polystyrene particles used in these experiments are generally considered non-toxic, but their interaction with a normal physiological process suggests a potential mechanism for a chronic, harmful, but subtle response."

Engineered nano-particles are used increasingly in the form of titanium oxide or as aluminium silicates in pills to help deliver pills and in food, where they are used as stabilisers or anti-caking agents in fluids and creams.

In developed countries, individuals may be consuming each day a thousand billion engineered particles ranging from fine to ultrafine in

scale, according to figures from 2002 research quoted in the study.

Previous research has suggested micron- and nano-sized particles could play a role in the painful inflammatory gut disorder called Crohn's disease, says the paper.

Most of these particles have a negatively-charged surface, which means they adhere to biomolecules in the gut, accumulating at lymphoid nodules called Peyer's patches, according to the earlier research.

More information: DOI:10.1038/nano.2012.3 (or www.nature.com/nnano/journal/v … bs/nnano.2012.3.html)

***Nature Nanotechnology* announcement:**
Chronic and acute oral exposure to polystyrene nanoparticles can affect iron uptake and transport in a model of human intestinal lining cells cultured in the laboratory and in a live chicken intestinal model reports a paper this week in Nature Nanotechnology. The models created in this study may provide a low-cost and high-throughput screening tool for future nanoparticle toxicity research. Because of their unique physical and chemical properties, engineered nanoparticles are used in a variety of applications, including the food industry and for drug delivery. In addition, it has been estimated that the average person in a developed country consumes over a trillion man-made fine to ultrafine particles every day. Some features of nanoparticles may, however, lead to harmful interactions with cellular material, but no studies have yet addressed the chronic effects of nanoparticle exposure on the normal function of the intestinal lining, known as the epithelium. Michael Shuler and colleagues show in cell culture and a chicken model – whose gastrointestinal tract has features similar to those of the human tract – that acute oral exposure to polystyrene nanoparticles can decrease iron uptake and transportation. They also show that chronic exposure can cause remodelling of the intestinal villi, and this increases the surface area

available for iron absorption. The authors suggest that the polystyrene particles used in these experiments are generally considered to be non-toxic, but their interaction with a normal physiological process suggests a potential mechanism for a chronic, harmful, more subtle response. They note, however, that many of the consequences of oral nanoparticle exposure remain unknown, and therefore more studies are needed, especially looking at the effects of nanoparticles on nutrient absorption.

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