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Antimicrobial Soap Additive Worsens Fatty Liver Disease in Mice

University of California San Diego School of Medicine researchers found evidence that triclosan — an antimicrobial found in many soaps and other household items — worsens fatty liver disease in mice fed a high-fat diet.

The study, published November 23, 2020 in [Proceedings of the National Academy of Sciences](#), also details the molecular mechanisms by which triclosan disrupts metabolism and the gut microbiome, while also stripping away liver cells' natural protections.

“Triclosan’s increasingly broad use in consumer products presents a risk of liver toxicity for humans,” said Robert H. Tukey, PhD, professor in the Department of Pharmacology at UC San Diego School of Medicine. “Our study shows that common factors that we encounter in everyday life — the ubiquitous presence of triclosan, together with the prevalence of high consumption of dietary fat —constitute a good recipe for the development of fatty liver disease in mice.”

Tukey led the study with Mei-Fei Yueh, PhD, a project scientist in his lab, and Michael Karin, PhD, Distinguished Professor of Pharmacology and Pathology at UC San Diego School of Medicine.

[In a 2014 mouse study](#), the team found triclosan exposure promoted liver tumor formation by interfering with a protein responsible for clearing away foreign chemicals in the body.

In the latest study, the researchers fed a high-fat diet to mice with type 1 diabetes. As previous studies have shown, the high-fat diet led to non-alcoholic fatty liver disease (NAFLD). In humans, NAFLD is an increasingly common condition that can lead to liver cirrhosis and cancer.



Triclosan, an antimicrobial found in many soaps and other household items, worsens fatty liver disease in mice fed a high-fat diet. Credit: [Pixabay](#)

Diabetes and obesity are risk factors for NAFLD.

Some of the mice were also fed triclosan, resulting in blood concentrations comparable to those found in human studies. Compared to mice only fed a high-fat diet, triclosan accelerated the development of fatty liver and fibrosis.

According to the study, here's what's likely happening: Eating a high-fat diet normally tells cells to produce more fibroblast growth factor 21, which helps protect liver cells from damage. Tukey and team discovered that triclosan messes with two molecules, ATF4 and PPARgamma, which cells need to make the protective growth factor. Not only that, the antimicrobial also disrupted a variety of genes involved in metabolism. In addition, the mice exposed to triclosan had less diversity in their gut microbiomes — fewer types of bacteria living in the intestines, and a makeup similar to that seen in patients with NAFLD. Less gut microbiome diversity is generally associated with poorer health.

So far, these findings have only been observed in mice who ingested triclosan. But since these same molecular systems also operate in humans, the new information will help researchers better understand risk factors for NAFLD, and give them a new place to start in designing potential interventions to prevent and mitigate the condition.

“This underlying mechanism now gives us a basis on which to develop potential therapies for toxicant-associated NAFLD,” said Tukey, who is also director of the National Institute of Environmental Health Sciences Superfund Program at UC San Diego.

In 2016, the U.S. Food and Drug Administration (FDA) ruled that over-the-counter wash products can no longer contain triclosan, given that it has not been proven to be safe or more effective than washing with plain soap and water. However, the antimicrobial is still found in some household and medical-grade products, as well as aquatic ecosystems, including sources of drinking water.

An estimated 100 million adults and children in the U.S. may have NAFLD. The precise cause of NAFLD is unknown, but diet and genetics play substantial roles. Up to 50 percent of people with obesity are believed to have NAFLD. The condition typically isn't detected until it's well advanced. There are no FDA-approved treatments for NAFLD, though several medications are being developed. Eating a healthy diet, exercising and losing weight can help patients with NAFLD improve.

Additional co-authors of the study include: Feng He, Chen Chen, Catherine Vu, Anupriya Tripathi, Rob Knight, and Shujuan Chen, all at UC San Diego.

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Disclosure: Michael Karin is a founder, inventor and an Advisory Board Member of Elgia Therapeutics and has equity in the company.

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