Soap Ingredient Worsens Fatty Liver Disease in Mice

Mice with diabetes that were fed triclosan in addition to a high-fat diet tend to have more liver fat and worse fibrosis.

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Triclosan, an antimicrobial agent often found in soap and other consumer products, compounds fatty liver disease in mice fed a high-fat diet, according to findings published in the Proceedings of the National Academy of Sciences.

“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,” Robert H. Tukey, PhD, of the University of California, San Diego, said in a press release.

Arising from the accumulation of fat in the liver, non-alcoholic fatty liver disease (NAFLD) and its more severe form, non-alcoholic steatohepatitis (NASH), are responsible for a growing proportion of advanced liver disease worldwide. As a result of inflammation, NAFLD can lead to the buildup of scar tissue (fibrosis), cirrhosis (advanced scarring) and even liver cancer. With no effective approved medical therapies, disease management is dependent on lifestyle changes, such as weight loss and exercise.

Despite the Food and Drug Administration’s ruling that triclosan be left out of over-the-counter antibacterial washing solutions, the antimicrobial is often found in various products as well as in aquatic ecosystems.

In an earlier study, Tukey and colleagues found that exposure to triclosan sped up the formation of liver tumors. But because the mechanisms underlying the effects of triclosan are virtually unknown, the team sought to explore them.

Mice with type 1 diabetes were fed a high-fat diet; some of them were also fed triclosan. Blood analyses indicated that triclosan levels in the mice were similar to those seen in human blood samples.

While mice fed a high-fat diet develop NAFLD, the addition of triclosan ramped up the development of liver fat accumulation and fibrosis. The mice that were fed both a high-fat diet and

triclosan, developed NASH, along with an increase in collagen deposition, inflammatory responses and oxidative stress.

Under normal circumstances, a high-fat diet triggers the production of fibroblast growth factor 21 (FGF21), which keeps liver cells safe from harm. When triclosan is added to the mix, it interferes with the functioning of the molecules ATF4 and PPARgamma, which are necessary for the synthesis of the growth factor. As a result, there is less FGF21 going around, thwarting its protective effect on the liver.

The researchers found that mice fed a high-fat diet and triclosan had higher levels of abdominal white adipose tissue. An indicator of liver pathogenesis, lipid droplets appeared to accumulate when the mice consumed triclosan.

Moreover, triclosan not only interfered with genes important for metabolism but also affected the diversity of the gut microbiome. Mice fed triclosan had fewer varieties of bacteria in their gut, and the microbiome composition resembled that seen in people with NAFLD. Mice on a high-fat diet had fewer Bacteroidetes and more Firmicutes bacteria species, and these differences were compounded with the addition of triclosan.

“The finding that triclosan exacerbates high-fat-diet-induced metabolic disorders by disrupting regulation of FGF21 expression provides a basis for a therapeutic approach in treating nonalcoholic fatty liver disease and steatohepatitis,” wrote the researchers.

Click here to read the study abstract.
