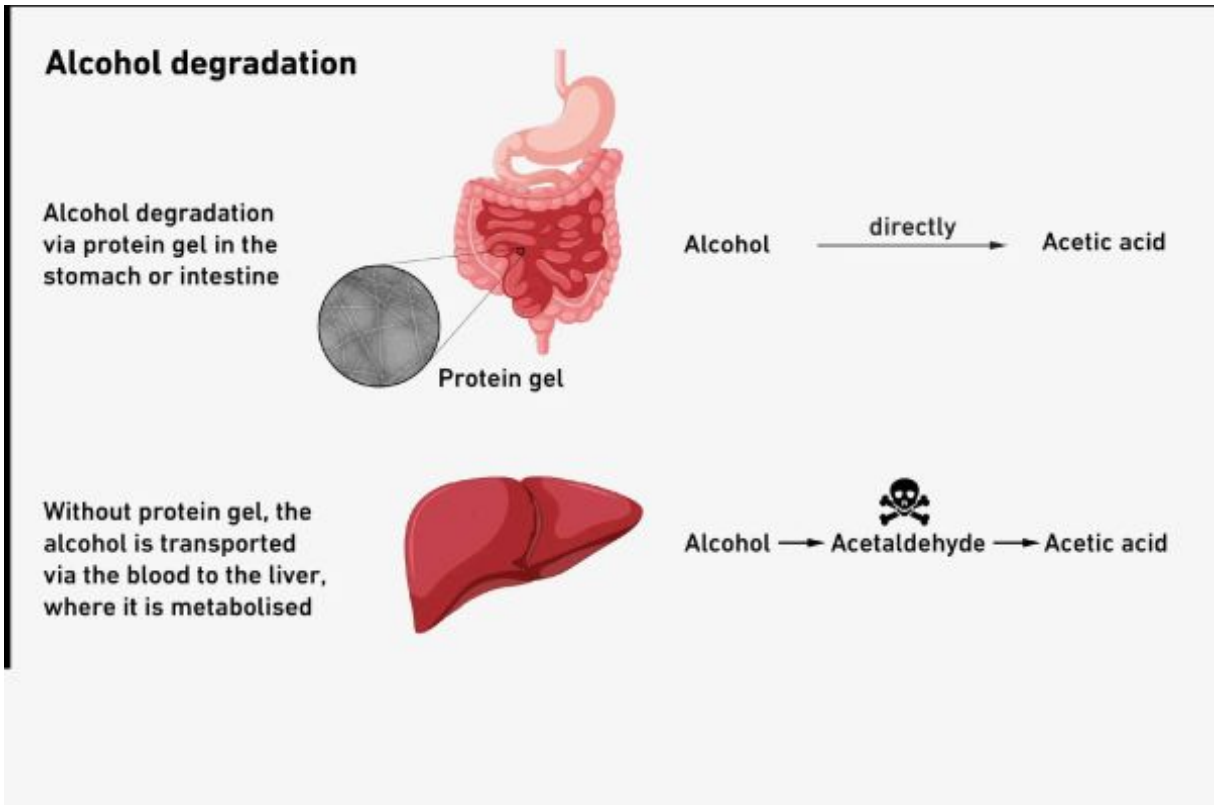


New gel breaks down alcohol in the body

An international team of researchers, led by ETH Zurich and with the participation of ICFO, has developed a protein-?based gel that breaks down alcohol in the gastrointestinal tract without harming the body. In the future, people who take the gel could reduce the harmful and intoxicating effects of alcohol.

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Most alcohol enters the bloodstream via the mucous membrane layer of the stomach and the intestines. These days, the consequences of this are undisputed: even small amounts of alcohol impair people's ability to concentrate and to react, increasing the risk of accidents. Drinking large quantities on a regular basis is detrimental to one's health: common consequences include liver disease, inflammation of the gastrointestinal tract and cancer. According to the World Health Organization, around 3 million people die every year from excessive alcohol consumption.

An international team of researchers led by ETH Zurich scientists has now developed a protein gel that breaks down alcohol in the gastrointestinal tract. In a study recently

published in the journal Nature Nanotechnology, they show that in mice, the gel converts alcohol quickly, efficiently and directly into harmless acetic acid before it enters the bloodstream, where it would normally develop its intoxicating and harmful effects.

Reducing health damage caused by alcohol

i¿½**The gel shifts the breakdown of alcohol from the liver to the digestive tract. In contrast to when alcohol is metabolised in the liver, no harmful acetaldehyde is produced as an intermediate product**,i¿½ explains Professor Raffaele Mezzenga from the Laboratory of Fo d & Soft Materials at ETH Zurich. Acetaldehyde is toxic and is responsible for many heal h problems caused by excessive alcohol consumptio
. In the future, the gel could be taken orally before or during alcohol consumption to preve t blood alcohol levels from rising and acetaldehyde from damaging the body. In contrast o many products available on the market, the gel combats not only the symptoms of harmf l alcohol consumption but also its causes. Yet, the gel is only effective as long as there is sti l alcohol in the gastrointestinal tract. This means it can do very little to help with alcoh l poisoning, once the alcohol has crossed into the bloodstream. Nor does it help to redu e alcohol consumption in general. i¿½**s healthier not to drink alcohol at all. However, the gel could be of particular interest to people who don't want to give up alcohol completely, but don't want to put a strain on their bodies and aren't actively seeking the effects of alcohol,**i¿ ? Mezzenga say

Main ingredients: Whey, iron and gold

The researchers used ordinary whey proteins to produce the gel. They boiled them for several hours to form long, thin fibrils. Adding salt and water as a solvent then causes the fibrils to cross-?link and form a gel. The advantage of a gel over other delivery systems is that it is digested very slowly. But to break down the alcohol, the gel needs several catalysts. The researchers used individual iron atoms as the main catalyst, which they distributed evenly over the surface of the long protein fibrils. i¿½**We immersed the fibrils in an iron bath, so to speak, so that they can react effectively with the alcohol and convert it into acetic acid,** i¿½ says ETH researcher Jiaqi Su, the first author of the study. Tiny amounts of hydrog n peroxide are needed to trigger this reaction in the intestine. These are generated by n upstream reaction between glucose and gold nanoparticles. Gold was chosen as a cataly t for hydrogen peroxide because the precious metal is not digested and therefore sta s effective for longer in the digestive tract. The researchers packed all these substances - iro , glucose and gold - into the gel. This resulted in a multi-?stage cascade of enzymatic reactio s that ultimately converts alcohol into acetic aci

Gel works in mice

The researchers tested the effectiveness of the new gel on mice that were given alcohol just once as well as on mice that were given alcohol regularly for ten days. Thirty minutes after the single dose of alcohol, the prophylactic application of the gel reduced the alcohol level in the mice by 40 percent. Five hours after alcohol intake, their blood alcohol level had dropped

by as much as 56 percent compared to the control group. Harmful acetaldehyde accumulated less in these mice, and they exhibited greatly reduced stress reactions in their livers, which was reflected in better blood values.

In the mice that were given alcohol for ten days, the researchers were able to demonstrate not only a lower alcohol level but also a lasting therapeutic effect of the gel: the mice that were given the gel daily in addition to alcohol showed significantly less weight loss, less liver damage and hence better fat metabolism in the liver as well as better blood values. Other organs in the mice, such as the spleen or the intestine, as well as their tissues also showed much less damage caused by alcohol.

Reference

Su J, Wang P, Zhou W, Peydayesh M, Zhou J, Jin T, Donat F, Jin C, Xia L, Wang K, Ren F, Van der Meeren P, Garcia de Arquer P, and Mezzenga R. Single-?site iron-?anchored amyloid hydrogels as catalytic platforms 1 for alcohol detoxification. Nature Nanotechnology. DOI: external page10.1038/s41565-?024-01657-7call_made