

# Researchers identify epigenetic changes caused by binge drinking

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Credit: MU School of Medicine

Researchers at the University of Missouri School of Medicine have identified epigenetic protein changes caused by binge drinking, a discovery that could lead to treatments for alcohol-related liver diseases.

"We know that chronic alcohol use is damaging to the liver, but binge drinking amplifies that damage," said Shivendra Shukla, Ph.D., Margaret Proctor Mulligan Professor at the MU School of Medicine and lead author of the study.

Excessive alcohol use is one of the most common causes of [chronic liver failure](#). Long-term [liver damage](#) from alcohol use is irreversible. Excessive alcohol use is also associated with high blood pressure, heart disease, stroke, cancer and digestive problems.

The National Institute on Alcohol Abuse and Alcoholism defines binge drinking as a pattern of drinking that brings a person's [blood alcohol concentration](#) to 0.08 grams percent or above. This typically happens when men consume five or more drinks or women consume four or more drinks over a two-hour period.

"Our latest research shows that epigenetic modifications in histone structures occur within the liver as a result of heavy binge drinking," Shukla said. "Epigenetic alterations are changes in genes that are not caused by changes in the DNA sequence or genetic code."

Histones are proteins that act like a spool to compact and organize the thread-like DNA strands that wrap around them. Histones work to protect the DNA strand and help it function correctly. Although histone modification does occur naturally, Shukla and his team found that binge drinking results in unnatural modifications to histones. In turn, these changes adversely affect how a person's genetic code is interpreted and how it is regulated.

"Every response in the body is due to alterations in proteins," Shukla said. "Binge drinking is an environmental trigger that negatively affects histones by altering the correct binding of DNA. The result is unnecessary replication in the copied structure. This initially causes inflammation and damage to the cells as they form, but it is also eventually the cause of more serious diseases such as cirrhosis and cancer."

Because the liver is the main metabolic site in the body, it is the first

organ to experience damage from binge drinking. But because the liver is responsible for nutrient and drug metabolism and distribution, as well as the production of multiple agents that are needed for the heart, kidney, blood vessels and brain to function properly, liver damage can affect many other systems in the body.

"It is important to specify that binge drinking should not be associated only with liver damage," Shukla said. "Binge drinking can create an inflammatory response in the liver that is like a cluster bomb, sending out various damaging signals to other organ systems in the body. If those organs are working at a lower level of function, then a whole host of physiological processes are affected as a consequence of binge drinking."

Shukla says that [excessive alcohol consumption](#) with a binge drinking pattern is emerging as a major public health concern globally. In the U.S., [binge drinking](#) is the most common form of excessive alcohol use — so common in fact, that the Centers for Disease Control and Prevention reports approximately one in six adults binge drinks about four times each month.

"This is not a problem that is going away," said Shukla. "It is actually growing. More work is needed on the research we are doing, but findings such as these are very promising and may lead to future treatments for alcohol-related liver damage."

**More information:** The study, "Epigenetic Histone Modifications in a Clinically Relevant Rat Model of Chronic Ethanol-Binge-Mediated Liver Injury" was recently published in *Hepatology International*, the journal of the Asian Pacific Association for the Study of the Liver.

Provided by University of Missouri-Columbia

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