Researchers at the Yale School of Medicine have shown that the brains of heavy drinkers process alcohol in a way that encourages substance dependence.

The study found that the brains of heavy drinkers consume acetate, a molecule produced from alcohol in the liver, at twice the rate of light drinkers. While the brain typically runs on the sugar glucose, it can also use acetate for energy, which suggests that the finding has implications for understanding alcohol dependence, said senior author and professor of psychiatry Graeme Mason GRD '91. The paper appears in the March 8 issue of The Journal of Clinical Investigation.

"If you are really binging and not eating properly for a day or two, when you start drinking, your blood sugar can drop acutely, enough to make you uncomfortable," he said. "The brain may learn that if you have a drink, you feel better because this little bit of extra energy from the acetate can make up the difference for what is missing in the blood sugar."

Mason recruited seven heavy drinkers — defined as men who consumed more than 14 drinks per week or women who consumed more than eight — and seven light drinkers who consumed fewer than two drinks a week. The researchers injected acetate, a byproduct of alcohol metabolism, in the subjects to examine the molecule's interactions with the brain. After tracing the molecule using magnetic resonance spectroscopy, a technology measuring metabolic changes in the brain, they confirmed their hypothesis that the brains of heavy drinkers burned the acetate more readily than those of light drinkers.

Indiana University School of Medicine psychiatry professor Sean O'Connor said he thinks the finding is important because it explains one of the many ways alcohol changes the brain.

"I thought it was one of the more significant pieces of research that I have seen in my field in a while," he said.

In the past decade, Mason demonstrated that the brains of diabetic individuals consume an increased amount of acetate when their blood sugar drops. In this study, he wanted to explore the connection between alcoholism and acetate consumption because consuming alcohol on an empty stomach can induce a similar rapid drop in blood sugar levels.

While the current study did not explore the mechanism behind increased acetate consumption levels in the brain, Mason said he suspects the transport proteins in the blood-brain barrier that uptake acetate are either more numerous or more active in the brains of heavy drinkers. He hopes to explore whether this is a "state or trait" effect — whether people who have greater ability to burn acetate are more likely to be drinkers, or drinking more induces increased acetate consumption.

The finding that the brain is dependent on acetate suggests that providing acetate to a patient detoxifying from alcohol may alleviate the withdrawal symptoms. Mason said he hopes to come

up with such a strategy to deliver acetate in the future.

"Nothing is going to make the process [of detoxification] an easy thing," he said. "But if we can make it easier so that 5 or 10 percent more people quit, that would be a victory."

According to the National Institute on Alcohol Abuse and Alcoholism, nearly one in three American adults drink enough to risk alcohol dependence.

Experts make a distinction between alcohol abuse and alcoholism (also called alcohol dependence). Unlike alcoholism, alcohol abusers have some ability to set limits on their drinking. However, their alcohol use is still self-destructive and dangerous to themselves, can progress into alcoholism and they need help. Click here to learn more about the Common Signs and Symptoms of Alcohol Abuse

Source: Yale Daily News