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Juveniles build up physical -- but not mental -- tolerance for alcohol in new study

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Research into alcohol's effect on juvenile rats shows they have an ability to build up a physical, but not cognitive, tolerance over the short term — a finding that could have implications for adolescent humans, according to Baylor University psychologists.

The research findings are significant because they indicate that blood alcohol concentration levels alone may not fully account for impaired orientation and navigation ability, said Jim Diaz-Granados, Ph.D., professor and chair of psychology and neuroscience at Baylor. He co-authored the study, published in the journal *Brain Research*.

"There's been a lot of supposition about the reaction to blood alcohol levels," Diaz-Granados said. "We use the blood alcohol level to decide if someone is going to get arrested, because we think that a high level means impairment. But here we see a model where we can separate that out. You may have a tolerance in metabolism, but just because your blood alcohol concentration is less than the legal limit doesn't mean your behavior isn't impaired."

"More research is needed to fully understand how adolescents react to alcohol, but this contributes a piece to the puzzle," said study co-author Douglas Matthews, Ph.D., a research scientist at Baylor and an associate professor in Psychology at Nanyang Technological University in Singapore.

The study was conducted in the Baylor Addiction Research Center of

Baylor's Department of Psychology and Neuroscience in Baylor's College of Arts & Sciences.

More than half of under-age alcohol use is due to binge drinking, according to the Substance Abuse and Mental Health Services Administration, and "when initial alcohol use occurs during adolescence, it increases the chance of developing alcoholism later in life," said lead study author Candice E. Van Skike, a doctoral candidate in psychology at Baylor.

Researchers have long been interested in whether adolescents react differently to alcohol than adults and how alcohol use affects their brains when they reach adulthood, but Baylor researchers also wanted to test the short-term effect of alcohol on adolescents' brains in terms of memory about space and dimension.

In the study, 96 rats were trained to navigate a water maze to an escape platform. Half were exposed to alcohol vapor in chambers for 16 hours a day over four days (a method to approximate binge-like alcohol intake), while others were exposed only to air. After a 28-hour break, some were injected with alcohol, then both groups tested again in the maze.

A comparison found that those who had undergone the chronic intermittent ethanol exposure built up a metabolic tolerance. They were better able to eliminate alcohol from their systems than ones who had been exposed only to air, based on a comparison of the blood ethanol concentrations of the two groups after they had been injected with alcohol later.

While the alcohol-injected rats swam as hard and as fast as the others, their ability to find the escape platform was impaired.

Previous research at Baylor led by Matthews showed that adolescents are

less sensitive than adults to motor impairment during alcohol intake because a particular neuron fires more slowly in adults who are drinking. The lack of sensitivity may be part of the reason adolescents do not realize they have had too much to drink.

"It's difficult to compare metabolic and cognitive tolerance in adults with those of juveniles, because many studies that have looked at the cognitive aspect of chronic ethanol exposure didn't measure blood alcohol concentration levels," Van Skike said. "It would be an interesting comparison to make, and it is an avenue for future research."

Other research has shown that high levels of alcohol consumption during human adolescence are mirrored in animals. Adolescent rats consume two to three times more ethanol than adults relative to body weight, suggesting that adolescents are who drink are pre-disposed to do so in binges.

More information: The research paper may be viewed online at http://www.sciencedirect.com/science/article/pii/S0006899312004428

Provided by Baylor University