

## Binge drinking has a powerful impact on the adolescent brain

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Binge drinking is the most common, costly and deadly pattern of excessive alcohol use in the U.S., according to the U.S. Centers for Disease Control and Prevention.

Defined as consuming five or more drinks in a 2-hour period for men or four or more drinks for women, <u>binge drinking</u> is associated with



numerous health problems in adults, including increased violence, accidental injuries and death, impaired memory and increased risk for cancers, heart disease and other chronic conditions.

How binge <u>drinking</u> affects adolescents, especially the <u>adolescent brain</u>, which is still developing, has not been well-understood.

Now a University at Buffalo research team has published a <u>preclinical</u> <u>study</u> demonstrating the powerful effect that binge drinking has on the brains of adolescent rats. It also found that even low and moderate amounts of <u>alcohol</u> can significantly impact <u>brain function</u>.

The paper was published May 14 in the journal Metabolic Brain Disease.

## Mapping alcohol's effects in the brain

Prior research has suggested that alcohol exposure during adolescence can lead to the development of various health risks, such as addiction, depression and <u>brain trauma</u>, in adulthood.

"To this end, we wanted to understand how adolescent binge drinking changes <u>brain</u> function and brain connectivity, the ability of different regions in the brain to interact," said Panayotis K. Thanos, Ph.D., senior author and senior research scientist in the Department of Pharmacology and Toxicology in the Jacobs School of Medicine and Biomedical Sciences at UB.

"To do this, we examined <u>glucose utilization</u>," he explained. "By mapping the utilization of glucose throughout the brain, we can get an idea of how binge drinking changes brain functioning and where in the brain these changes take place. We can then use these data to learn more about future alcohol-induced neurological or psychiatric dysfunction in adulthood."



The researchers focused on glucose metabolism in the brain because it is the brain's major source of energy.

"While the brain only makes up approximately 2% of an individual's body weight, it consumes about 20% of the glucose in the body," said Thanos. "The metabolism of glucose in the brain is critical in carrying out normal physiological processes. By understanding how the brain uses glucose, we can get a sense of how the brain is functioning."

To determine how acute ethanol binge drinking affected glucose metabolism in the adolescent brain, the researchers conducted <u>positron</u> <u>emission tomography</u> (PET) scans on rats that were provided with an alcohol/water drinking solution.

The study found that all levels of alcohol consumption—low, moderate and high—decreased blood <u>glucose metabolism</u> in the primary somatosensory cortex and visual cortex, which are key to processing sensory and visual information, as well as executing motor functions.

## 'Vast functional implications'

"Our (PET) brain-imaging data showed that adolescent binge drinking has vast functional implications in the brain," said Thanos. "Alcohol binge consumption decreased brain function in areas responsible for sensory, motor, memory and cognitive processes. This lines up with the known behavioral consequences of alcohol consumption: impaired vision, diminished motor skills and coordination, confusion and others."

He said the data also provide a circuit map of the brain's functional response to binge drinking that will be important targets for the future study of chronic effects of binge drinking.

The UB study is the first animal model of adolescent binge drinking that



features simultaneous imaging of the brain in the animal while awake. "That's important because, for obvious reasons, we cannot feasibly study the acute brain effects of underage drinking in the human population," said Thanos.

Also of interest was what the study revealed about how low and moderate amounts of alcohol consumption affected the adolescent brain.

"The interesting finding was the similarities between the low and moderate doses of alcohol consumed," said Thanos. "Although the low dose of alcohol consumed does not meet the criteria for binge drinking in humans, it still promoted a very similar profile in the brain compared to the alcohol dose that does meet binge drinking criteria."

Thanos concluded: "This <u>adolescent</u> rat model allows us to capture the effects of binge drinking and view its deleterious effects on how the brain functions," he said. "By doing so, we can begin to understand the neurobiological links between brain function and future behavioral deficits in adulthood."

**More information:** Cecilia Rapp et al, Alcohol binge drinking decreases brain glucose metabolism and functional connectivity in adolescent rats, *Metabolic Brain Disease* (2022). DOI: 10.1007/s11011-022-00977-8

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