The brain's caudate nucleus and frontal cortex are less active in people who drink more

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Alcohol abuse and dependence are common problems in the United States due to a number of factors, two of which may be social drinking by college students and young adults, and risk taking that may lead to heavier drinking later in life. A study of the neural underpinnings of risk-taking in young, non-dependent social drinkers has found that the caudate nucleus and frontal cortex regions of the brain show less activation in people who drink more heavily.

Results will be published in the May 2012 issue of *Alcoholism: Clinical & Experimental Research* and are currently available at Early View.

"Most problem drinkers in the U.S. are young adults, with men about three times as likely to be engaged in problem drinking compared to women," said Chiang-shan R. Li, associate professor of psychiatry and neurobiology at Yale University School of Medicine as well as corresponding author for the study.

Li explained that a number of psychological and cognitive processes are known to influence drinking behaviors. "Risk taking is one such process," he said. "Risk taking can be examined in many different ways. In this study, we sought to identify the pattern of brain activations during risking taking and examine whether this pattern of activations is different in people who drink more/more frequently. That is, we explored whether there is a neural marker of risk taking that may be

associated with heavier drinking in non-dependent young adult drinkers."

Li and his colleagues examined two groups of college-based social drinkers – 20 young adults (11 women, 9 men) who consumed high levels of alcohol, defined as number of drinks per month, and 21 demographically matched drinkers (15 women, 6 men) with low to moderate alcohol use – during a functional magnetic resonance imaging study of the stop signal task. Comparing the results recorded during risk taking (equivalent to speeding) with those of risk aversion (equivalent to slowing), study authors were able to analyze the neural correlates of risk taking.

"Along with our earlier work, we identified a number of key structures in the brain that respond to risk taking during the behavioral task," said Li. "We found that the caudate nucleus and frontal cortex, which are inter-connected anatomically, show less activation in people who drink more heavily."

These two brain structures typically demonstrate greater activity whenever individuals encounter a significantly risky situation, explained Li. "Yet people who are engaged in heavier drinking show less activation in these structures, presumably because taking a risk is less salient for them," he said. "These results thus confirm the importance of risk taking as a psychological process that is associated with alcohol use. It also shows that the caudate nucleus and frontal cortex are playing an important role in mediating this association."

The study also found this association was stronger in women than in men, and significantly correlated with the women's frequency of drinking. "This result suggests that risk-taking as a psychological factor may be more directly related to how often women drink compared to men," said Li.

Li pointed out that study participants were typical social drinkers. "On average, they drank about five times per month, with two to three drinks per occasion, so these are really average social drinkers," he said. "Our findings may suggest that even people who are engaged in average drinking are probably more risk prone than those who do not drink at all. While risk taking can be important in many endeavors it also comes with some consequences that we want to avoid."

Li plans to continue examining other neural correlates of non-dependent drinking. "We are investigating how expectations of positive alcohol effects might be related to drinking behaviors, and what cerebral structures are mediating this influence," he said. "We will use a number of different imaging techniques to examine this."

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