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How threat, reward and stress come together to predict problem drinking

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Having a drink after a stressful day at work may seem like a natural response for some, but can your neural circuits predict when a drink or two will become problem drinking? A study published in BioMed Central's open-access journal *Biology of Mood & Anxiety Disorders* suggests that may be the case. The study describes a highly novel mechanism predicting problem drinking in college students from fMRI data measuring individual differences in the functioning of reward and threat circuits in the brain.

Using data from the first 200 participants in the ongoing Duke Neurogenetics Study, the authors show that recent life stress (e.g., failing exams, trouble at home, bad relationships) leads to increased problem drinking. In and of itself, this is hardly novel. However, the authors go on to demonstrate that this stress-related problem drinking only occurs in students who have a specific combination of neural circuit functioning. Specifically, problem drinking related to stress emerges only in students who have both a highly reactive reward circuitry (i.e., ventral striatum) and a hypo-reactive threat circuitry (i.e., amygdala).

In other words, stress can lead to problem drinking if you have a strong reward drive (motivating you toward drinking) coupled with a weak threat drive (keeping you away from drinking). Or, as senior author Ahmad Hariri puts it: "Imagine the push and pull of opposing drives when a mouse confronts a hunk of cheese in a trap. Too much drive for the cheese and too little fear of the trap leads to one dead mouse."

The results of this study provide evidence of a novel mechanism for stress-related drinking emphasizing the importance of the balance between the reactivity of the reward and threat circuits of the brain rather than only the reward system, which has been historically the focus of drug abuse research. This work further highlights a novel protective role for the amygdala, which has been historically the focus of research into the risk for and pathophysiology of mood and anxiety disorders.

Yuliya Nikolova, who is the lead author of the study, thinks these findings may be useful for identifying individuals at particularly high risk for developing alcohol use disorders in the wake of stress, commenting "Future research identifying factors, such as genetic polymorphisms, that may predict variability in neural responsiveness to threat and reward could lead to the development of biomarkers for drug abuse risk and interventions targeting those phenotypes." Hariri adds: "We're very excited about these findings as they nicely bring together our parallel programs of research on individual differences in threat and reward processes, and represent an extension of such individual differences into a real-world phenomenon."

More information: Neural responses to threat and reward interact to predict stress-related problem drinking: A novel protective role of the amygdala, Yuliya S Nikolova and Ahmad R Hariri, Biology of Mood & Anxiety Disorders (in press)

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