

Rats on the Rocks: Does intermittent stress exposure during adolescence lead to increases in alcohol drinking?

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Background: Adolescence is a developmental period that includes many biological and behavioral changes (Spear, 2000). In particular, adolescents often begin experimenting with alcohol, and for many youth, this behavior can become excessive (Spear, 2018). Since research has shown that earlier initiation of alcohol drinking is associated with an increased risk for alcohol abuse later in life (Dawson et al., 2008), it is paramount that we understand the factors that might contribute to initiation and escalation of drinking during adolescence. Stress is an environmental variable that is thought to influence alcohol drinking patterns, although this relationship appears to be quite complex (Dawson, et al., 2005; Pohorecky, 1991). Animal models have therefore become an essential tool for investigating the stress-alcohol interaction, while allowing control of many genetic and environmental variables. In spite of these advantages, animal models also have shown that the relationship between stress and alcohol consumption is not straightforward (Becker, et al., 2011), with stress-related increases (Sperling et al., 2010), decreases (Chester et al., 2004), or no changes (Bertholomey et al., 2011) in alcohol intake reported. Given that adolescence is a transitional period frequently associated with stressful experiences, the current study sought to explore the influence of stress during adolescence on initiation and development of alcohol intake patterns using a rat model of adolescence.

Methods: Sprague-Dawley rats (N = 64) from our breeding colony at Ithaca College were housed in same-sex pairs and used in this experiment. The experiment began in early adolescence [postnatal day (P) 30 ± 2] and was a 2 (Sex: male vs. female) x 2 (Drinking solution: control vs. alcohol) x 2 (Stress: no stress vs. restraint stress) between subjects factorial design. Rats were first assigned to 1 of 2 possible Drinking solution groups. For the alcohol drinking groups, male and female rats were provided a choice between 2 bottles: one containing a sweetened alcohol solution and the other containing tap water. In contrast, the control groups received a choice between one bottle with sweetened water (without the alcohol) and another with tap water. All rats had access to these bottles on an intermittent schedule. Every Monday, Wednesday, and Friday, both bottles were placed on the cage and rats could choose to drink either fluid. Approximately 23 hours later, bottles were removed and a regular water bottle was returned to the cage until the next experimental drinking day. Animals were additionally assigned to 1 of 2 possible Stress conditions. Rats in the stress groups were placed into cylindrical restraint tubes (for 60 minutes) on Tuesdays and Thursdays. Non-stressed animals remained undisturbed in the homecage at these times. This pattern of alternating alcohol drinking and stress exposure continued for a total of 17 solution exposure days, thus spanning all of adolescence and into early adulthood.

Results: Drinking data from the present experiment revealed no significant effects of stress on the amount of alcohol consumption or on intake of the control sugar solution. Additionally, there were no significant differences in alcohol intake between male and female rats. Importantly, these data did show significantly elevated levels of alcohol intake in the initial phase of the experiment, which indicated early adolescent-related

increases in alcohol drinking. As adolescence gradually ended, however, levels of alcohol intake also gradually declined. At all times, and regardless of Sex or Stress condition, rats demonstrated a preference for water relative to the sweetened alcohol solution.

Discussion and Conclusions: This study investigated if exposure to stress would alter alcohol drinking during adolescence. Overall, these data suggest that intermittent stress does not impact levels of alcohol intake in either male or female adolescent rats. Given numerous studies previously reporting no significant effects of stress on alcohol consumption (e.g., Chester et al., 2004), the current study seems to add to the growing notion that stress may not so clearly lead to drinking, as once thought. However, it should also be taken into consideration that the stressor selected for use in the present study was fairly mild in intensity and duration, and was uniform across all exposures. It is possible, therefore, that the stressor became predictable and allowed the rats an opportunity to habituate over time, thus inducing no changes in alcohol intake. Future studies will investigate this possibility.

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