Adolescent brains are insensitive to alcohol for a short time, but at great cost

- Adolescent brains can compensate for some of alcohol’s effects, including intoxication and hangover.
- New findings indicate they are also less impaired by alcohol’s effects on social inhibition.
- However, this ability to have more drinks per occasion will also likely lead to alcohol abuse.

Whereas brain development during adolescence may initially serve to “safeguard” youth from certain effects of alcohol such as intoxication and hangover, it will also likely make them more vulnerable to the longer-term effects of alcohol. A first-of-its-kind study uses rodents to examine development of acute tolerance to alcohol-induced social impairment among adolescents and adults. Findings show that younger rodents have nervous systems that quickly adapt to alcohol’s effects – called tolerance – which permits heavy drinking at an early age.

Results are published in the November issue of Alcoholism: Clinical & Experimental Research.

“Adolescence is a time of rapid changes of the brain,” said Elena I. Varlinskaya, a research professor at Binghamton University and the study’s corresponding author, “particularly in the prefrontal cortex and limbic and mesolimbic brain systems of human adolescents. Adolescent rodents show similarities with human adolescents in terms of dramatic age-related remodeling of the brain. Using animal models, researchers have shown that unpleasant physical symptoms associated with alcohol intoxication and hangover, which make adults stop drinking, are not experienced to the same degree by adolescents.”

“There are several potential implications of having a brain that is less sensitive to alcohol,” said Marisa M. Silveri, assistant professor of psychiatry at Harvard Medical School, “such as a disconnect between the behavioral and the physiological effects of alcohol use. Adults may not be aware of the level of intoxication in teens, given that they demonstrate significantly less motor impairment and sedation than adults do given the same amount of alcohol. Thus, a lack of overt signs of intoxication may mask the more potentially damaging effects of alcohol on neural systems involved in learning and memory.”

Varlinskaya added that adolescent insensitivity to alcohol may also be related to an ability to rapidly counteract different effects of alcohol with compensatory responses such as acute tolerance. “Acute tolerance is characterized by a more rapid decline in alcohol-induced impairment than in blood or brain alcohol levels following a single alcohol dose,” she said. “We know that social behavior is sensitive to low-to-moderate doses of alcohol. Therefore, this study examined development of acute tolerance to alcohol-induced impairment of social behavior among adolescent and adult rats.”

Researchers used Sprague- Dawley rats. Social activity was examined after the animals were administered alcohol, after a five- or 30-minute interval: on postnatal day (P) 28, the equivalent of early adolescence; P35, mid adolescence; P42, late adolescence; or P70, the equivalent of young adulthood. Brain alcohol concentrations were also measured in the animals.
“We found greater acute tolerance in adolescent than adult animals at alcohol levels comparable to human binge drinking,” said Varlinskaya. “In other words, both adolescents and adults showed the same degree of social impairment when tested immediately after or five minutes following alcohol exposure. However, the social behavior of adult animals was still severely suppressed 30 minutes after alcohol administration, whereas the social behavior of adolescents was almost similar to that of animals not exposed to alcohol.”

“This study extends previous findings that adolescents are generally less impaired by alcohol’s effects to now include alcohol’s effects on social inhibition,” said Silveri. “These findings support the notion that the adolescent brain functions quite differently than the adult brain, particularly in its response to alcohol. Even though the adolescent brain has the capacity to adapt to an alcohol challenge, this will likely come at great cost as valuable cerebral resources are redirected from the important role of brain development to instead adapting to an alcohol challenge, and then restoring the system back to status quo once alcohol is eliminated or the challenge is removed.”

Varlinskaya concurs. “This ability of adolescents to rapidly counteract some unpleasant alcohol effects by developing acute tolerance may allow them to have more drinks per occasion,” she said. “This binge pattern of drinking, being unsafe in general, might be extremely dangerous for adolescents, given that their brain is especially vulnerable to alcohol-related damage.”

“Social behavior is an understudied area, particularly with regard to adolescence and alcohol’s effects,” added Silveri. “The choice of this dependent variable is timely in that human neuroimaging studies are beginning to examine developmental changes in brain function that are commensurate with the development of emotional intelligence and social behavior. In addition, this is one of the first studies to document tolerance to alcohol’s effect on social behavior, which occurs in an age-dependent manner.”

“Human adolescents are confronted with a variety of potentially stressful challenges, and they often use alcohol to control stress and cope with problems,” said Varlinskaya. Her future work will therefore focus on the impact of stress on the effects of alcohol on social behavior of adolescent and adult rodents.

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Articles were written based on the following published research:


Article can be found at: http://www.nattc.org/asme/details.asp?ID=0611a