How alcohol blunts the ability of hamsters to 'rise and shine'

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Chronic alcohol consumption blunts the biological clock's ability to synchronize daily activities to light, disrupts natural activity patterns and continues to affect the body's clock (circadian rhythm), even days after the drinking ends, according to a new study with hamsters.

The study describes the changes that drinking can produce on the body's master clock and how it affects behavior. The research provides a way to study human alcoholism using an animal model, said researcher Christina L. Ruby.

The study "Chronic ethanol attenuates circadian photic phase resetting and alters nocturnal activity patterns in the hamster" appears in the *American Journal of Physiology - Regulatory, Integrative and Comparative Physiology*. Christina L. Ruby, Allison J. Brager, Marc A. DePaul, and J. David Glass, all of Kent State University, and Rebecca A. Prosser of the University of Tennessee, conducted the study. The American Physiological Society published the research.

Batteries not included

Alcohol consumption affects the master clock, located in the suprachiasmatic nucleus (SCN) section of the brain. This clock controls the circadian cycle, a roughly 24-hour cycle, which regulates sleeping and waking, as well as the timing of a variety of other physiological functions, such as hormonal secretions, appetite, digestion, activity levels

and body temperature. The SCN synchronizes physiological functions so that they occur at the proper times and keeps these functions synchronized with daylight. Disruption of the clock dramatically increases the risks of developing cancer, heart disease, and depression, among other health problems.

The researchers used hamsters to find out how alcohol affects circadian rhythms. Although hamsters are nocturnal, light synchronizes their clocks, just as with humans. The animals were divided into three groups, differing only on what they drank. The control group received water only. A second group received water containing 10% alcohol and the third group received water containing 20% alcohol. Hamsters, when given a choice, prefer alcohol, which they metabolize quickly.

The animals drank as much as they wanted and lived in an environment that provided 14 hours of light and 10 hours of darkness each day.

Sleeping in

The researchers recorded the activity levels of the three groups throughout the day. Late in the dark cycle, about three hours before the nocturnal animals would normally be settling in to sleep, the researchers put on a low-level light for 30 minutes. The light was similar to the dim light of dawn. At another time, the groups received a brighter light, akin to the light in an office building. Hamsters exposed to the light late in their active cycle will normally settle down to sleep at the same time, but will wake up earlier. In effect, the light pushes their circadian clock forward.

In addition, the researchers tracked how long it takes alcohol to travel to the master clock in the brain. They also took regular readings of subcutaneous alcohol levels, which are akin to blood alcohol levels. In the final phase of the experiment, the hamsters that received alcohol

were switched to regular water to examine the effects of withdrawal.

The study found that:

- The hamsters that drank alcohol had the hardest time shifting their rhythms after exposure to the dim light, and the more alcohol they drank, the harder it was to adjust. Exposure to dim light caused the water-only hamsters to wake up 72 minutes earlier than they normally would. The 10% alcohol group woke up 30 minutes earlier and the 20% alcohol group woke up only 18 minutes earlier.

- Exposure to bright light helped the alcohol-consuming hamsters to wake up sooner, greatly reducing the difference in wake up times among the groups. The control animals woke up 102 minutes earlier compared to the 20% alcohol group that woke up 84 minutes earlier.

- Total time spent active during the 24-hour period was the same for all three groups. However, the hamsters that consumed alcohol had fewer bouts of activity that lasted longer than the water-consuming controls. The control group had more bouts of activity over the course of the day.

- When the hamsters were withdrawn from alcohol for 2-3 days and then exposed to the same light treatment again, they woke up much earlier than the animals that had drunk only water. The hamsters that were withdrawn from alcohol woke up 126 minutes sooner compared to the water drinking controls, who advanced 66 minutes. This exaggerated response persisted even up to three days later, when the experiment ended.

- The hamsters drank the most heavily shortly after the beginning of the dark cycle, when they would naturally be most active. A peak in alcohol reached the suprachiasmatic nucleus in the brain 20 minutes later.

Human applications?

The researchers aim to apply the research to people, who also show circadian disruptions from drinking. Specifically, the study suggests the following:

- People who drink alcohol, particularly late into the night, may not respond to important light cues to keep their biological clocks in synch with daylight over the next 24 hours. Even low levels of alcohol may impair the response to light cues, said Ruby.

- After the first 24 hours, the circadian cycle continues to be affected, even without further consumption of alcohol.

- Exposure to bright light in the morning may reduce the disruption of alcohol to the biological clock.

- Chronic drinking continues to affect the biological clock even after withdrawal from alcohol. The hamsters withdrawn from alcohol woke up much earlier in response to light than they normally would, just like people who are trying to stop drinking. Getting a person's circadian rhythm back in line after quitting may be why staying abstinent is so difficult.

- Chronic drinking may affect activity patterns, making drinkers less active at times of the day when they should be active and more active when they should not be, such as late at night.

More information: To read the full study click here.

Source: American Physiological Society (news : web)