

# Heavy cannabis use associated with reduced dopamine release in brain, similar to other addictions

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Cannabis indica. Credit: Wikipedia

In a recent study, researchers found evidence of a compromised dopamine system in heavy users of marijuana. Lower dopamine release was found in the striatum - a region of the brain that is involved in

working memory, impulsive behavior, and attention. Previous studies have shown that addiction to other drugs of abuse, such as cocaine and heroin, have similar effects on dopamine release, but such evidence for cannabis was missing until now.

"In light of the more widespread acceptance and use of marijuana, especially by young people, we believe it is important to look more closely at the potentially addictive effects of cannabis on key regions of the brain," said Anissa Abi-Dargham, MD, professor of psychiatry (in radiology) at Columbia University Medical Center (CUMC) and a lead author of the paper.

The study included 11 adults between the ages of 21 and 40 who were severely dependent on cannabis and 12 matched healthy controls. On average, the cannabis group started using at age 16, became dependent on cannabis by age 20, and have been dependent for the past 7 years. In the month prior to the study, nearly all users in this study smoked marijuana daily.

Using [positron emission tomography](#) (PET) to track a radiolabelled molecule that binds to dopamine receptors in the brain, the scientists measured [dopamine release](#) in the [striatum](#) and its subregions, as well as in several brain regions outside the striatum, including the thalamus, midbrain, and globus pallidus. The cannabis users in this study stayed in the hospital for a week of abstinence to ensure that the PET scans were not measuring the acute effects of the drug. Participants were scanned before and after being given oral amphetamine to elicit dopamine release. The percent change in the binding of the radiotracer was taken as an indicator of capacity for dopamine release.

Compared with the controls, the [cannabis users](#) had significantly lower dopamine release in the striatum, including subregions involved in associative and sensorimotor learning, and in the globus pallidus.

The investigators also explored the relationship between dopamine release in a key area of the striatum and cognitive performance on learning and working memory tasks. Although there was no difference between groups in task performance, in all participants lower dopamine release was associated with worse performance on both tasks.

"We don't know whether decreased dopamine was a preexisting condition or the result of heavy cannabis use," said Dr. Abi-Dargham. "But the bottom line is that long-term, heavy cannabis use may impair the dopaminergic system, which could have a variety of negative effects on learning and behavior."

Jeffrey Lieberman, MD, Chair of Psychiatry at CUMC and past president of the American Psychiatric Association, noted that "these findings add to the growing body of research demonstrating the potentially adverse effects of [cannabis](#), particularly in youth, at the same time that government policies and laws are increasing access and use."

Provided by Columbia University Medical Center

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