

Cocaine use during adolescence is even more harmful than during adulthood

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A pile of cocaine hydrochloride. Credit: DEA Drug Enforcement Agency, public domain

People who begin using cocaine during adolescence exhibit more significant cognitive deficits than people who begin using the drug in adulthood. Long suspected by experts in neuroscience, the hypothesis

received objective confirmation by researchers working at the University of São Paulo's Medical School (FM-USP) in Brazil.

When scientists compared the two groups of [cocaine users](#), they observed pronounced differences, mainly in specific neuropsychological functions such as sustained attention (required for performing long tasks, such as completing a questionnaire), working memory (used in specific actions, for example, a waiter remembering the order of each person at a table) and declarative memory (storing and retrieving data after a period of time).

They also found that among early-onset users, the concurrent consumption of cannabis and alcohol was 50 percent and 30 percent more frequent, respectively, compared with late-onset users, defined as those who began using cocaine at or over the age of 18. The complete findings of the [research project](#) were published in the journal *Addictive Behaviors*.

"Adolescence is considered one of the key stages of brain development when surplus synapses are eliminated and the structures essential to adulthood are selected and refined. Drug use in this stage can impair the brain programming process and lead to the loss of important connections," said Paulo Jannuzzi Cunha, a professor at FM-USP and principal investigator for the project.

Differentiated Methodology

According to Cunha, one of the novel aspects of the research project was the measurement of cognitive functions during controlled abstinence. "Many studies of this kind assess outpatients without any possibility of knowing whether they'll use drugs when they go home," he said. "In our case, however, all participants were hospital inpatients. We can therefore be sure the findings didn't reflect acute effects of cocaine

or other substances."

The sample contained 103 cocaine-dependent patients, 52 of whom were early-onset users who had begun using the drug before they were 18, while 51 were late-onset users who began when they were 18 or older. All individuals were evaluated after at least a week of abstinence. The absence of cocaine metabolites was verified by toxicological urine tests. A third group of 63 people with no history of psychoactive substance use served as the control.

The participants' ages ranged from 20 to 35. The proportions of men and women were similar. One of the early-onset users had begun consuming cocaine at age 12.

"Data in the scientific literature shows that a brain region called the [prefrontal cortex](#) continues to develop until age 25. This region relates to what are known as executive functions such as planning, decision making, inhibitory control, attention and working memory. We therefore decided to investigate whether these functions were more impaired in early-onset users," said psychologist Bruna Mayara Lopes, first author of the article.

The evaluation involved a number of tests, including the Frontal Assessment Battery (FAB), Stroop Color Word Test (SCWT), Controlled Oral Word Association Test (COWAT), Wisconsin Card Sorting Test (WCST), Rey Osterrieth Complex Figure Test (ROCFT) and Iowa Gambling Task (IGT). The use of alcohol and other drugs was assessed using the Addiction Severity Index (ASI-6).

"Basically, we presented the participants with a task they had to complete, such as repeating a sequence of numbers in reverse order or reproducing a figure from memory about 30 minutes after observing it," Lopes said.

When they compared late-onset users with the control group and adjusted the results for variables such as age and intelligence quotient (IQ), the only difference the researchers found was in divided attention, which relates to the ability to perform multiple tasks at the same time.

In a study underway at USP's Neuroimaging Laboratory (LIM-21), the researchers are now seeking to correlate the cognitive profile observed in the two groups of cocaine-dependent patients with decision making and resting-state brain activity using functional magnetic resonance imaging (fMRI). Studies of brain structure and correlations with levels of a protein known as BDNF (brain-derived neurotrophic factor) will also be performed using these findings.

"We're measuring such variables as prefrontal cortex volume and white matter integrity. We'll be able to disclose some of our findings shortly," said Priscila Dib Gonçalves, a co-author of the article.

White matter, found in the deeper tissues of the brain, contains axons connecting grey matter, which is where all synapses are located.

According to Gonçalves, a higher probability of cognitive impairment due to early-onset drug use was previously observed in a study involving 104 chronic cannabis users. This study, [published](#) in 2011 in the *British Journal of Psychiatry*, was conducted at the Federal University of São Paulo (UNIFESP) by Maria Alice Fontes. It found that people who began smoking marijuana before age 15 underperformed late-onset users in tests that assessed executive functions.

For Gonçalves, both studies indicate the need to develop more effective prevention strategies and programs targeting adolescents. "We live in a society that associates recreation with the use of psychoactive substances, and this is an important cultural aspect," she said. "One way to raise awareness of the risks could be to hold workshops with students,

who should be called on to play a leading role in this awareness-raising process, rather than being passive recipients of information." For Cunha, the results also show that patients with severe cognitive deficits need intense multidisciplinary treatment, including medication as well as therapy.

More information: Bruna Mayara Lopes et al, Distinct cognitive performance and patterns of drug use among early and late onset cocaine users, *Addictive Behaviors* (2017). [DOI: 10.1016/j.addbeh.2017.04.013](https://doi.org/10.1016/j.addbeh.2017.04.013)

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