

Acute and non-acute Effects of Cannabis on Human Memory Function: a Critical Review of Neuroimaging Studies.

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Abstract

Smoking cannabis produces a diverse range of effects, including impairments in learning and memory. These effects are exerted through action on the endocannabinoid system, which suggests involvement of this system in human cognition. Learning and memory deficits are core symptoms of psychiatric and neurological disorders such as schizophrenia and Alzheimer's disease, and may also be related to endocannabinoid dysfunction in these disorders. However, before new research can focus on potential treatments that work by manipulating the endocannabinoid system, it needs to be elucidated how this system is involved in symptoms of psychiatric disorders. Here we review neuroimaging studies that investigated acute and non-acute effects of cannabis on human learning and memory function, both in adults and in adolescents. Overall, results of these studies show that cannabis use is associated with a pattern of increased activity and a higher level of deactivation in different memory-related areas. This could reflect either increased neural effort ('neurophysiological inefficiency') or a change in strategy to maintain good task performance. However, the interpretation of these findings is significantly hampered by large differences between study populations in cannabis use in terms of frequency, age of onset, and time that subjects were abstinent from cannabis. Future neuroimaging studies should take these limitations into account, and should focus on the potential of cannabinoid compounds for treatment of cognitive symptoms in psychiatric disorders.

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J Addict Dis. 2000;19(1):1-22.

Brain morphological changes and early marijuana use: a magnetic resonance and positron emission tomography study.

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Abstract

BACKGROUND:

The focus of this report is on the possible role that the age of first use of marijuana may play on brain morphology and function.

METHODS:

Magnetic resonance imaging (MRI) and positron emission tomography (PET) were utilized to study 57 subjects. Brain volume measures (whole brain, gray matter, white matter and lateral ventricle volumes), global cerebral blood flow (CBF) and body size were evaluated.

RESULTS:

There are three primary findings related to age of first use of marijuana. Subjects who started using marijuana before age 17, compared to those who started later, had smaller whole brain and percent cortical gray matter and larger percent white matter volumes. Functionally, males who started using marijuana before 17 had significantly higher CBF than other males. Both males and females who started younger were physically smaller in height and weight, with the effects being greater in males.

CONCLUSIONS:

These findings suggest that the age at which exposure to marijuana begins is important. Early adolescence may be a critical period for effects that are not present when exposure begins later. These results are discussed in light of reported effects of marijuana on gonadal and pituitary hormones.

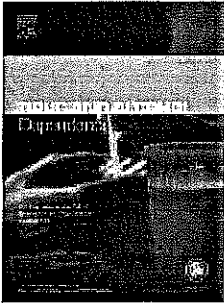
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Altered brain tissue composition in heavy marijuana users

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Abstract

Marijuana is the most widely used illicit substance in the United States; however, previous imaging studies have not detected altered brain structure in marijuana users compared to non-users. Voxel-based morphometry was used to investigate possible differences in brain tissue composition in a group of 11 heavy marijuana users and a group of 8 non-users. All participants were male. Statistical comparisons were made at the voxel level on T1-weighted magnetic resonance images to determine differences in gray matter and white matter tissue density. Compared to non-users, marijuana users had lower gray matter density in a cluster of voxels in the right parahippocampal gyrus ($P = 0.0001$), and greater density bilaterally near the precentral gyrus and the right thalamus ($P < 0.04$). Marijuana users also had lower white matter density in the left parietal lobe ($P = 0.03$), and higher density around the parahippocampal and fusiform gyri on the left side compared to non-users ($P < 0.002$). Longer duration of marijuana use (in years) was significantly correlated with higher white matter tissue density in the left precentral gyrus ($P = 0.045$). Our preliminary results suggest evidence of possible structural differences in the brain of heavy marijuana users, and localize regions for further investigation of the effects of marijuana in the brain.

Keywords

- Marijuana;
- Imaging;
- Gray matter;
- White matter;
- Hippocampus



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Dose-related neurocognitive effects of marijuana use

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1. Also available:
2. Figures Only
3. Data Supplement
4. PPT Slides of All Figures

Abstract

Background: Although about 7 million people in the US population use marijuana at least weekly, there is a paucity of scientific data on persistent neurocognitive effects of marijuana use.

Objective: To determine if neurocognitive deficits persist in 28-day abstinent heavy marijuana users and if these deficits are dose-related to the number of marijuana joints smoked per week.

Methods: A battery of neurocognitive tests was given to 28-day abstinent heavy marijuana abusers.

Results: As joints smoked per week increased, performance decreased on tests measuring memory, executive functioning, psychomotor speed, and manual dexterity. When dividing the group into light, middle, and heavy user groups, the heavy group performed significantly below the light group on 5 of 35 measures and the size of the effect ranged from 3.00 to 4.20 SD units. Duration of use had little effect on neurocognitive performance.

Conclusions: Very heavy use of marijuana is associated with persistent decrements in neurocognitive performance even after 28 days of abstinence. It is unclear if these decrements will resolve with continued abstinence or become progressively worse with continued heavy marijuana use.

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