

Cannabis Use and Brain Structure: Are we there for an Answer?



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Overview

Despite an overall decrease in consumption of cannabis in the US since 1990s, Cannabis users have increased among adolescents especially since 2005 [1-3]. Moreover in spite of a great decrease in alcohol binge drinking among American adults, risk-associated drinking is rising slightly in past several decades consistent with changes in alcohol use pattern among adolescents. With, Marijuana being the most commonly used illicit drug among adults, overall illicit drug use trending upwards and more than half of Americans older than 12 being problem drinkers [4,5], both chronic and acute effects of cannabis and alcohol abuse have been widely investigated. In the light of a 2017 publication by Thayer et al. [6], we look into the existing literature and that from this article to see if we are there yet to claim that Cannabis use does not affect brain's structure?

Existing Literature

Existing literature investigates evidence of correlation between chronic alcohol consumption and grey matter volume changes [5]. Adolescent female alcohol abusers and adults with alcohol use disorder, depict reduced grey matter volume in frontal and hippocampal cortices and in prefrontal cortex and corpus callosum respectively. Few studies have investigated the acute effect of alcohol use on white matter structure. One study showed transient reduced fractional anisotropy in frontal lobes [6] and another showed generalized decrease white matter volume, especially in mediopontine fibers. Evidence on the effect of cannabis use on white matter microstructure are even more scant. A decrease in frontal lobe volume and white matter integrity is reported in cannabis users, correlating with age of recreational onset or chronic use. Regular adult cannabis users have shown hippocampal atrophy in almost all studies, whereas adolescents with simultaneous cannabis and alcohol use disorder were found to have increased cortical thickness in left caudal cingulate, left entorhinal, and left lingual pericalcarinegyri. Finally, a retrospective study that matched

cannabis users and healthy adults in alcohol consumption showed no meaningful different in brain morphology in either adults or adolescents.

Data Pooling

Thayer et al. [6] have pooled data from 813 adults and 403 adolescents [4]. The samples were collected from 5 major studies and another 33 studies with limited cases, adding to the heterogeneity of the design of the current work especially in measurement of onset of cannabis exposure or predisposing genetic traits. The sample size on the other hand is one strong point of this study.

Alcohol Use Disorders Identification (AUDIT) and Time Line Follow Back form (TLFB) are two standardized methods for quantitative assessment of alcohol/substance use, to which the total score estimates the overall risk of each patient. In their recent publication, Thayer et al. [6] have allocated a sensible part of their discussion to discuss these limitations.

Findings and Perspective

Thayer et al. [6] gathered measurement of alcohol use in past 6 month and cannabis in past 30 days, to explore relatives of the amount of consumption with white matter integrity and grey matter volume. Interestingly, although there was no correlation between AUDIT score and TLFB cannabis use in adults these scales were significantly correlated among adolescents. Correlating results from VBM and AUDIT score the left cerebellum VIIb, right insular region, left caudate, right cuneus, left precuneus, left posterior cingulate gyrus, left central opercular cortex and left putamen of adolescent brain as well as in right parietal operculum cortex and right anterior supra marginalgyri in adults showed significant reduction in volume with increasing alcohol use.

Comparing different parameters of structural integrity, the only significant association was between WM integrity and AUDIT scores

in adults users. Axial diffusivity in bilateral superior longitudinal fasciculi (SLF), bilateral Inferior Fronto-Occipital Fasciculi (IFOF), and left anterior thalamic radiation showed a strong positive correlation with AUDIT score in adults. This was parallel with an inverse correlation of fractional anisotropy in right IFOF and significant positive correlation of mean and radial diffusivity of bilateral SLF. Data presented in this study showed alcohol use is profoundly associated with both GM volume and WM integrity in adults, comparable with previous similar studies, while adolescent users showed significant changes in GM volume but not within white matter microstructure. This might be due to lower average alcohol use below clinical threshold of 8 in AUDIT [2], in adolescents. Of note, adolescents showed decreased grey matter volume in lower cuneus, precuneus and posterior cingulate cortices, areas that had been previously introduced in adult alcohol abusers.

Over time, studies have provided evidence for that, alcohol use is associated to increase impulsivity and incentive decision making [5], but the neural underpinnings of which has yet to be found out. Putting the literature review and result of the current study together, the writers suggest commencing alcohol consumption as early as young adulthood could harmfully affect GM growth, especially in regions playing important role control of risk-associated decision making and reward responding. Claus and his colleagues demonstrated an altered precuneal function in drinkers versus non-drinkers, in favor of activation only in response to early rewarding rather than late rewards [1], compatible the results of correlation of AUDIT score and precuneus volume in adolescents in this current study. Thayer and his colleagues failed to report any correlation between a history of 30-day cannabis use and WM

integrity or GM volume. This might be due to one major limitation of the current study and many of the previous studies the use of TLFB to measure the drug use, as it lacks factors considering potency of the drug used, measurement of alternative method of cannabis abuse or duration of use [3].

Results from Thayer et al. [6] put further spin on that destructive changes in GM volume in alcohol drinker and in WM skeleton, in both adults and adolescent, are directly correlated with alcohol consumption, while results on WM integrity in adolescents is controversial and further longitudinal studies are essential.

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