Associations Between Cannabis Use, HIV Status, and Myo Inositol in Brain Regions Related to Stress and Emotion Processing in Adults

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Background

In this study, we examined the associations between cannabis use, brain myo-inositol (MI) levels, and stress in individuals with and without HIV. MI is a marker of neuroinflammation and immune cell activation (gliosis) in the central nervous system. The main active component of cannabis are cannabinoids, which include tetrahydrocannabinol (THC) and cannabidiol (CBD). Given CBD's anti-inflammatory properties, we hypothesize that *cannabis users* with or without *HIV* will have lower neuroinflammation or MI levels than non-users, especially in brain regions involved in stress regulation.

Methods

Recruitment Site: UM/JMH HIV Clinic & Herbal Heart Study
Eligibility Criteria:

- Age 18-50
- No MRI contraindications
- No primary psychiatric or neurological conditions
- Cannabis use within the past month

Sample Size: 93 participants

- Males: n=47
- Females: n=46
- Mean age: 36 (SD = 7.7)
- HIV status: HIV+ (n=48) HIV- (n=45)

Group Classification:

- *HIV+MJ+* (n=37) *HIV-MJ-* (n=18)
- *HIV+MJ-* (n=7) *HIV-MJ+* (n=31)

Questionnaires:

- A comprehensive suite of questionnaires, including the Perceived Stress Scale (PSS-10).

MRI Scan:

- A 60-minute unique whole-brain MRSI protocol at 3-Tesla was processed and analyzed with MIDAS in the regional brain anatomical regions (Figure 1. TE = 17.6 mx; 17min).

Analysis:

- Blood plasma samples were used to quantified cannabis metabolites (Figure 2).
- Two-way ANOVA to assess HIV and cannabis effects.
- Significance threshold: $p < 0.05$ (SAS).

Results

HIV and cannabis use significantly affected MI in key brain regions. Significant combined interactions were found in the right insula ($F = 4.42$, $p = 0.0408$) and right putamen ($F = 4.10$, $p = 0.0488$), with higher MI in the HIV-MJ+ group (Mean MI = 17,996.86 IU, SD = 6,324.31). MI levels correlated positively with blood plasma Δ9-THC (Figure 3) in the insula bilaterally ($R = 0.49$, $p = 0.0001$) and right putamen ($R = 0.64$, $p < 0.0001$). HIV-MJ+ individuals showed a moderate trend of perceived stress scores (PSS-10) (Figure 5).

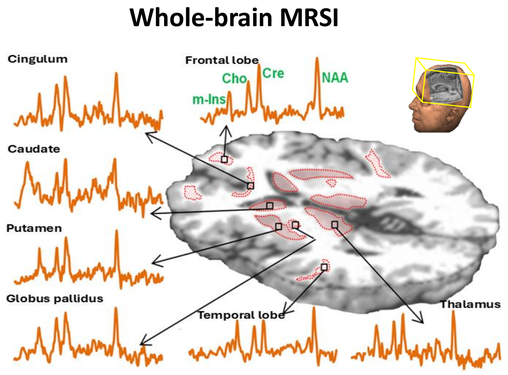


Figure 1. Spectra shown are from a voxel in the cingulum, caudate, putamen, globus pallidus, frontal lobe, temporal lobe, and thalamus.

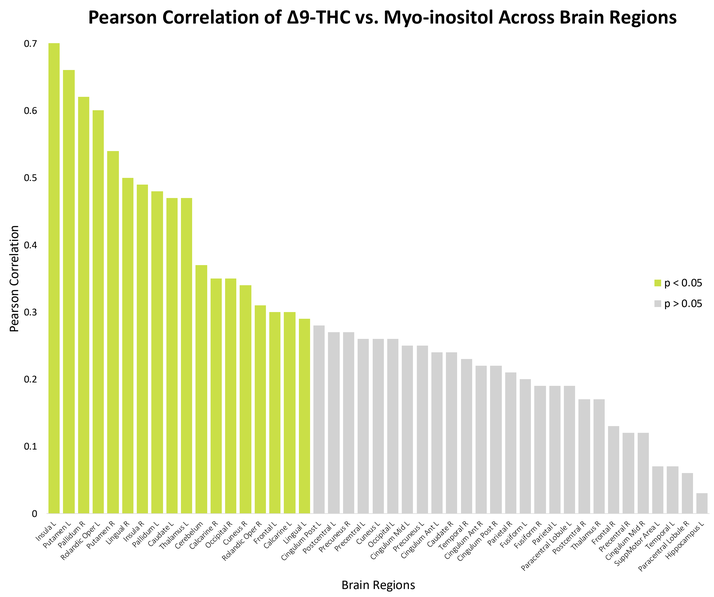


Figure 3. Pearson correlation of Δ9-THC in blood plasma and Myo-inositol across brain regions.

Figure 5. Mean PSS-10 scores across all study groups.

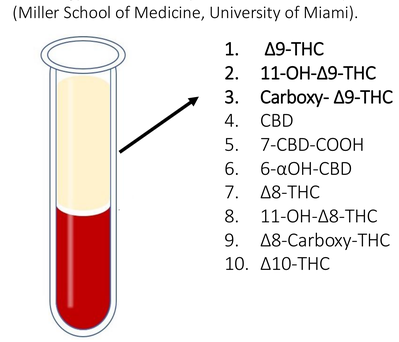


Figure 2. Quantified cannabis metabolites in plasma using a method established by Lisa Jayne Reidy, M.D., at the Pathology and Laboratory Medicine Laboratory (Miller School of Medicine, University of Miami).

1. Δ9-THC
2. 11-OH-Δ9-THC
3. Carboxy- Δ9-THC
4. CBD
5. 7-CBD-COOH
6. 6-αOH-CBD
7. Δ8-THC
8. 11-OH-Δ8-THC
9. Δ8-Carboxy-THC
10. Δ10-THC

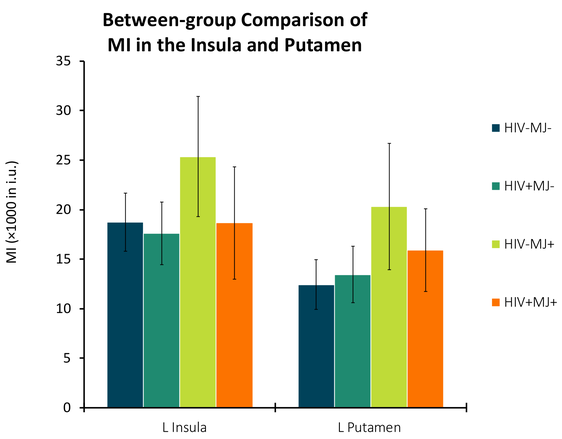
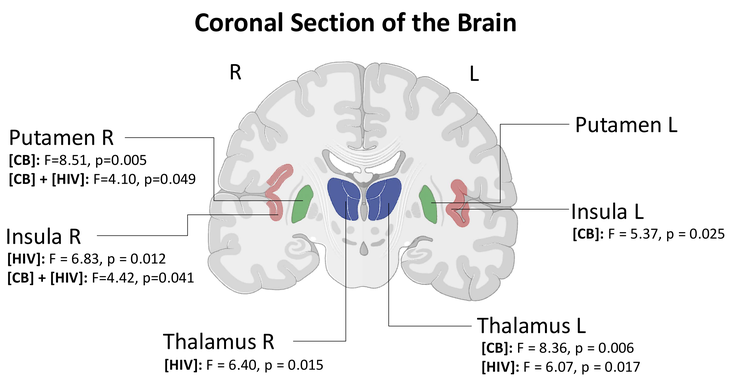


Figure 4. Myo-inositol levels comparison in the L-insula and L-Putamen across all groups.



Conclusions

Cannabis use and HIV status were associated with changes in brain MI levels, particularly in the insula and putamen. The HIV-/MJ+ group exhibited higher MI, with plasma Δ9-THC levels showing a positive correlation with MI. These findings suggest that cannabis use may enhance neuroinflammation among users. Furthermore, those with both conditions reported increased levels of perceived stress, which may reflect or contribute to underlying neural changes. Additional research is necessary to examine the clinical implications and the role of cannabis in modulating neuroimmune function.

Takeaways

- HIV and Cannabis Use have both independent and interactive impact on brain MI levels which suggest increased glial activity and consequently altered neuroinflammation in these populations.
- THC plasma levels were correlated with MI in brain regions associated with emotion, sensory processing, cognition, and motor control, which may affect cognitive performance and other behavioral/clinical outcomes.
- CB+ and HIV+ groups reported moderate stress levels on the PSS-10, suggesting a possible link between cannabis use, neuroinflammation, and perceived stress.

Limitations

Socioeconomic Status (SES): Differences in SES across participants may have influenced both cannabis use patterns and brain health outcomes, but SES was not directly controlled for in analyses.

Limited Statistical Power: The relatively small sample size, particularly within subgroup comparisons, may limit the generalizability of findings and reduce the ability to detect smaller effect sizes.

Cannabis User Bias: Participants who use cannabis may differ systematically from non-users in ways not fully captured (e.g., personality traits, coping mechanisms), potentially introducing selection bias.

Confounders: Factors such as medication use, lifestyle behaviors (e.g., diet, sleep, exercise), and other substance use could have influenced brain metabolites but were not fully accounted for in this analysis

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References For complete list of references please follow this link https://tinyurl.com/HBS-CCORC2025

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