Brain Reward Function in Young People with a Cannabis Use Disorder: an fMRI Study

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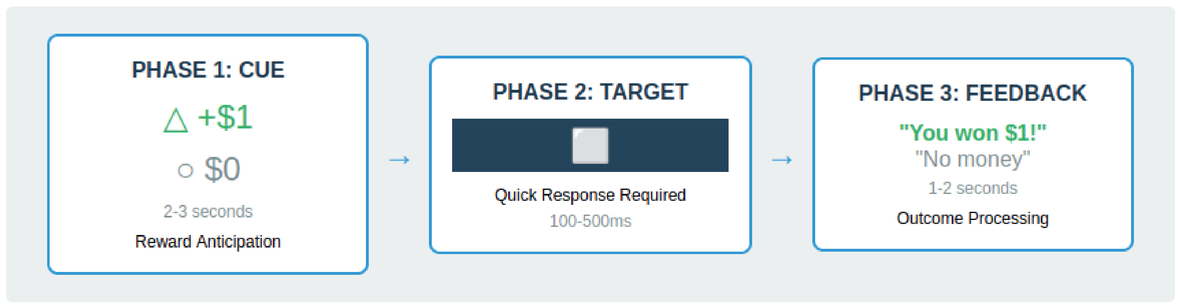
Introduction

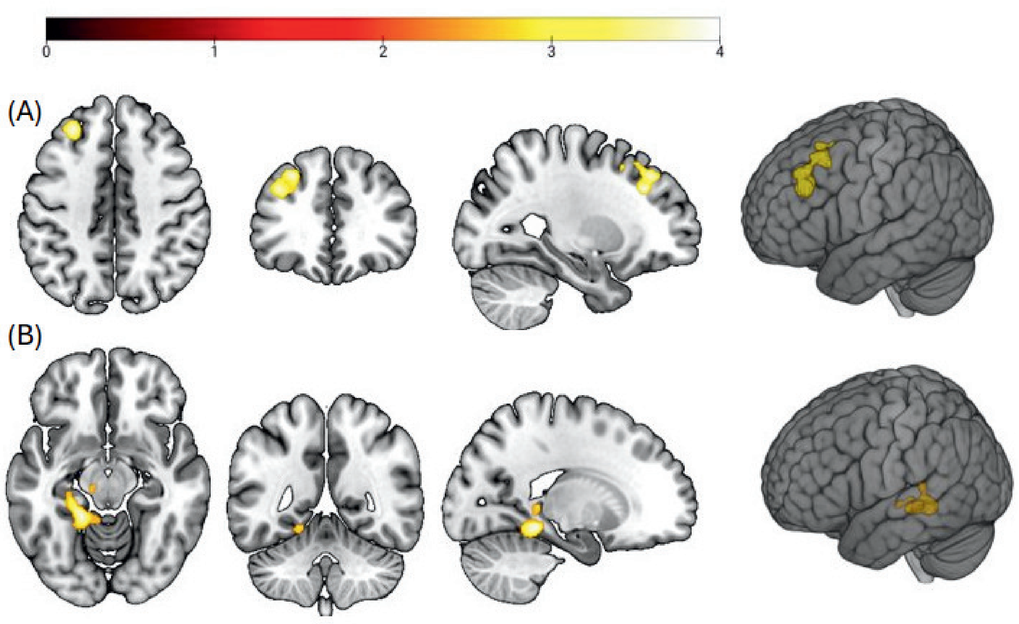
- Cannabis Use Disorder (CUD) is associated with blunted responses to non-drug rewards
- Altered prefrontal-striatal function has been observed in cannabis users, but no studies to date have specifically examined these circuits in people with a clinical diagnosis of CUD
- This study investigates reward-related brain activation in adults with CUD during anticipation and outcome phases

Methods

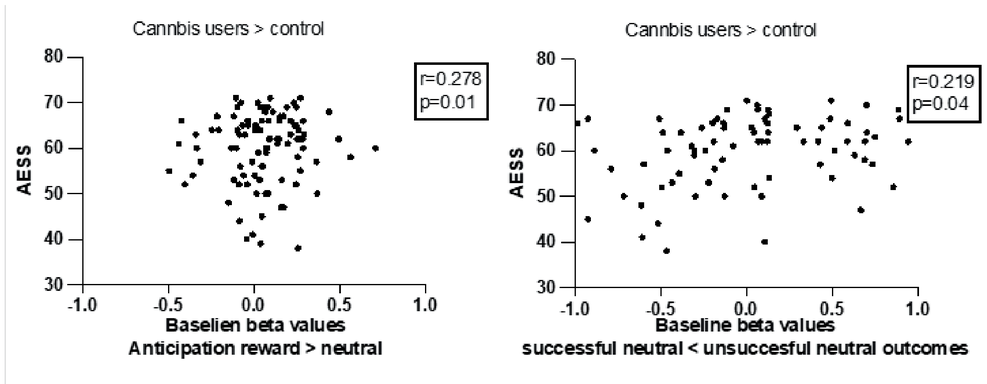
- **Participants:**
  - CUD Group: 66 participants (46 female)
  - Control Group: 29 participants (20 female)
- **Experiment Task- MIDT:**
  - Cue Phase: Visual cue indicates potential reward/ neutral outcome
  - Target Phase: Quick response to target stimulus
  - Feedback Phase: Performance and outcome information
- **MRI acquisition Parameters:**
  - 3T GE Architect with 48-channel head coil
  - fMRI: TR=1600ms, TE=20ms, 4mm slices
- **fMRI processing and analyses:**
  - Analysis: fMRIPrep → SPM12
  - Contrasts of interest:
    - Anticipating rewards > neutral outcomes
    - Receiving rewards > neutral outcomes
    - Successful > unsuccessful neutral trials
- **Thresholding**: Cluster-level inference with a voxel-wise threshold of $p<0.001$ (uncorrected) and a cluster-level threshold of $p<0.05$ (FWE-corrected).
- **Correlation Analysis**: Beta values from significant clusters were extracted and correlated with behavioral and clinical measures (Apathy Evaluation Scale, Marijuana Withdrawal Checklist).



Results



- **Anticipation Phase:** Greater activation in left superior and medial frontal cortices in the CUD group (Figure A).
- **Outcome Phase (neutral trials):** Higher activity in fusiform gyrus, precuneus, and parahippocampal regions in CUD during successful vs. unsuccessful trials (Figure B).



Brain-behavior correlations in cannabis users: Positive brain-behavior correlations reveal that greater apathy is associated with increased neural activation during reward processing in cannabis users.

Conclusion

- Individuals with CUD exhibit heightened prefrontal activity during reward anticipation–possibly reflecting inefficient or altered recruitment of motivational circuits.
- Unexpected activation during neutral trials suggests broader impairments in reward processing–not limited to monetary outcomes.
- Brain-behavior correlations indicate these disruptions are meaningfully tied to apathy and withdrawal symptoms.

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