Neural Response to Reward in Young Men with Cannabis Use Disorders

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Introduction

- Cannabis
  - one of the most widely used drugs, especially among adolescents
  - adult studies indicate cannabis use disorders influence reward related brain function by attenuating the responding in the striatum
  - little is known about the neural response to reward in younger cannabis users
  - hypothesized that cannabis use disorders would be associated with an altered neural response to monetary reward

Method

Participants
- 19 young men with lifetime cannabis use disorders
- 44 young men with no history of psychiatric or substance use disorders
  - M age =20, 51% European American, 44% African American, 5% Other
  - Cannabis Use disorders were measured using the Structured Clinical Interview for the DSM (SCID; First et al., 1997) with AUD/SUD module
  - functional magnetic resonance imaging study with event-related card guessing with monetary reward task engaged typical reward-related areas such as striatum and medial prefrontal cortex (mPFC)

fMRI
- 3T Siemens Allegro scanner
- task: event-related card guessing with monetary reward
- SPM8 preprocessing and analysis
- 2 regions of interest: ventral striatum and medial prefrontal cortex (mPFC)
- analysis constrained by main effects results

Cannabis Use
- age of initiation measured using Lifetime History of Drinking and Drug Use (Skinner, 1982)
  - n = 30, M = 14.91, SD = 1.76
  - frequency of current use measured using Alcohol and Drug Consumption Questionnaire (Cahalan et al., 1969)
  - n = 25, M = 4.4 (1-2 times/month), SD = 3.18

Main Effects of Task

- Anticipation Striatum
- Anticipation Medial PFC

- Outcome Striatum
- Outcome Medial PFC

Group Differences in Neural Response to Outcome

- Thalamus: (10,-9,16), 16 voxels, t = 1.89, puncorrected < .05
- anterior cingulate: (12,40,14), 478 voxels, t=5.25, pFDR < .005
- anterior cingulate: (15,28,22), 3436 voxels, t=6.69, pFDR < .005
- BA32: (5,38,22), 41 voxels, t= 2.45, puncorrected < .01
- frontal gyrus: (8,31,38) 18 voxels, t= 3.97, puncorrected < .05
- caudate: (5,15,6), 1057 voxels, t=5.5, pFDR < .005
- caudate: (6,13,4), 520 voxels, t = 3.99, puncorrected < .05
- anterior cingulate: (12,40,14), 478 voxels, t=5.25, pFDR < .005
- anterior cingulate: (15,28,22), 3436 voxels, t=6.69, pFDR < .005

Result

- task engaged typical reward-related areas such as striatum and medial prefrontal cortex (mPFC)
- cannabis disorder group had more activity in medial PFC and thalamus during reward outcome
- early age of initiation associated with greater response in the striatum and medial PFC during reward outcome
- also, greater frequency of use was associated with greater mPFC response to anticipation of reward (medial frontal gyrus: (8,31,38) 18 voxels, t= 3.97, puncorrected < .05)

Conclusions

- this large study of high-risk young men allows the examination of reward circuitry function in relation to cannabis use in participants with
  - fairly recent initiation of use
  - ongoing brain development
  - greater response to reward outcome in thalamus/caudate in those with cannabis use disorders suggests that cannabis use disorders early in the lifespan could reflect greater sensitivity to reward
- future studies should use prospective designs and consider developmental factors and duration of exposure when examining reward function in cannabis addiction

Early Age of Initiation Is Associated with Greater Striatal and Medial PFC Activity

References


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