Interaction between brain networks at rest is altered in regular cannabis users

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Background: Regular cannabis use has been associated with attention deficits, reduced memory performance and perceptual alterations, which may remain several days after consumption. Such cognitive and perceptual deficits are believed to be associated with altered patterns of brain connectivity. However, there are only few studies characterizing the brain's functional connectivity changes associated with cannabis use. The aim of this work was to explore if brain's network interactions are altered in a group of regular cannabis users, compared to non-users.

Methods: Resting state fMRI (TR=2s, 300 volumes, 4x4x4 mm³ voxel size) and T1 high-resolution images (1x1x1 mm³) were acquired in a 3T MR scanner for 17 regular cannabis users (12 males, average age ± s.d: 27.2±5.4 years; at least 4 joints/week in the previous 6 months), and 17 non cannabis users (10 males, average age ± s.d: 27.6±4.7 years). Users abstained for at least 12 hours previous to the scanning session in order to avoid the most acute effects of cannabis. Subjects were instructed to stay relaxed with their eyes open looking at a fixation cross. Standard preprocessing and imaging analyses were performed using FSL (v4.1.9), Matlab (R 2013b) and in-lab developed routines. For each subject, the average signal from 32 spherical regions of interest (ROI; 8 mm radius) was extracted and the Pearson correlation between all possible pairs of regions was obtained. The ROIs were selected as being part of 6 different networks: dorsal attention (DA), salience, executive control, default mode (DM), visual and sensorimotor. After Fisher-z transformation, average matrices were defined for each group and two-tailed t-tests were performed to compare intra- and inter-network connectivity values between group matrices.

Results: Cannabis users showed: reduced anti-correlation between the DA and DM networks (t(33)=2.25, p=0.028); reduced anti-correlation between DM and visual networks (t(33)=3.64, p=0.0005); and higher correlation between visual and sensorimotor networks (t(33)=2.54, p=0.014).

Conclusions: Regular cannabis users showed significant differences in brain's network interactions compared to non-users. The normally anti-correlated relation between DA and DM seems to reflect their contrasting (competing) functions, being the DA related to attention to external stimuli and the DM associated with internal, self related thinking. The results here presented suggest decreased switching between both states, which might be associated to the attention deficits commonly described in regular cannabis users. The reduced anticorrelation between DM and the visual network also supports a more internally driven state, while the highest correlation between visual and sensorimotor networks might be associated with sensory enhancement described under the effects of