Modulation of Mediotemporal and Ventrostriatal Function in Humans by ∆9-Tetrahydrocannabinol

A Neural Basis for the Effects of Cannabis sativa on Learning and Psychosis

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Arch Gen Psychiatry. 2009;66(4):442-451

**eFigure 1.** Effect of ∆9-tetrahydrocannabinol and cannabidiol on negative symptoms, general psychopathologic conditions, and Positive and Negative Symptom Scale (PANSS) total score over time. Plots showing changes in negative symptoms as indexed by PANSS negative symptom subscale score (A), general psychopathologic conditions as indexed by PANSS general psychopathologic subscale score (B), and total PANSS score (C) under the effect of ∆9-tetrahydrocannabinol (square), cannabidiol (triangle), and placebo (circle) over time (x-axis). Error bars show SEM. ∆9-Tetrahydrocannabinol caused significant increase in PANSS negative symptom and PANSS general psychopathologic ratings and total PANSS score (P < .01, repeated-measures analysis of variance), while there was no significant effect of cannabidiol on any of these measures. Drug capsules were given soon after obtaining baseline measures, and subsequent ratings were obtained after 1, 2, and 3 hours. There was no statistically significant effect of session order or drug × session-order interaction on behavioral symptoms.
Figure 2. Effect of cannabidiol on brain activation during verbal learning over repeated encoding and recall blocks. The left side of the brain is shown on the left side of the images. A, Administration of cannabidiol modulated change in activation across repeated presentations of word pairs during the encoding condition in a wide network of brain regions ($P=0.02$, uncorrected cluster) (Talairach coordinates are given in the Table and the numbers in the upper left corner of each brain segment represent the $z$ coordinate of the corresponding segment). B, Administration of cannabidiol modulated change in activation across repeated presentations of word pairs during the recall condition in the right hippocampus (crosshair at peak focus $x=28$, $y=-22$, and $z=-13$ coordinates in Talairach space; $P=0.02$, uncorrected cluster).