Cannabis effects on driving lateral control with and without alcohol

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Abstract

We model cannabis’ effects on driving lateral control via sophisticated simulator. Models are based on blood THC and breath alcohol concentrations during driving. THC increased standard deviation of lateral position (SDLP); 0.26 cm per μg/L THC. Alcohol increased SDLP 0.42 cm per 0.01 g/210 L; additional lateral control measures. During-drive 7–10 μg/L blood THC produced similar SDLP to 0.05 g/210 L breath alcohol. Concurrent alcohol and cannabis produced additive rather than synergistic effects.

Abstract
Background

Effects of cannabis, the most commonly encountered non-alcohol drug in driving under the influence cases, are heavily debated. We aim to determine how blood $\Delta^9$-tetrahydrocannabinol (THC) concentrations relate to driving impairment, with and without alcohol.

Methods

Current occasional ($\geq1\times$/last 3 months, $\leq3$/days/week) cannabis smokers drank placebo or low-dose alcohol, and inhaled 500 mg placebo, low (2.9%)-THC, or high (6.7%)-THC vaporized cannabis over 10 min *ad libitum* in separate sessions (within-subject design, 6 conditions). Participants drove (National Advanced Driving Simulator, University of Iowa) simulated drives ($\sim0.8$ h duration). Blood, oral fluid (OF), and breath alcohol samples were collected before (0.17 h, 0.42 h) and after (1.4 h, 2.3 h) driving that occurred 0.5–1.3 h after inhalation. We evaluated standard deviations of lateral position (lane weave, SDLP) and steering angle, lane departures/min, and maximum lateral acceleration.

Results

In $N=18$ completers (13 men, ages 21–37 years), cannabis and alcohol increased SDLP. Blood THC concentrations of 8.2 and 13.1 $\mu$g/L during driving increased SDLP similar to 0.05 and 0.08 g/210 L breath alcohol concentrations, the most common legal alcohol limits. Cannabis-alcohol SDLP effects were additive rather than synergistic, with 5 $\mu$g/L THC + 0.05 g/210 L alcohol showing similar SDLP to 0.08 g/210 L alcohol alone. Only alcohol increased lateral acceleration and the less-sensitive lane departures/min parameters. OF effectively documented cannabis exposure, although with greater THC concentration variability than paired blood samples.

Conclusions

SDLP was a sensitive cannabis-related lateral control impairment measure. During drive blood THC $\geq8.2$ $\mu$g/L increased SDLP similar to notably-imparing alcohol concentrations. Despite OF's screening value, OF variability poses challenges in concentration-based effects interpretation.

Keywords:

Cannabis, Alcohol, Driving, Lateral control, THC, Oral fluid