Effect of Cannabidiol and Δ9-Tetrahydrocannabinol on Driving Performance
A Randomized Clinical Trial

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Key Points

**Question** What is the magnitude and duration of driving impairment following vaporization of cannabis containing varying concentrations of Δ9-tetrahydrocannabinol (THC) and cannabidiol (CBD)?

**Findings** In this crossover clinical trial that included 26 healthy participants who underwent on-road driving tests, the standard deviation of lateral position (SDLP, a measure of lane weaving, swerving, and over-correcting) at 40 to 100 minutes following vaporized consumption was 18.21 cm for CBD-dominant cannabis, 20.59 cm for THC-dominant cannabis, 21.09 cm for THC/CBD-equivalent cannabis, and was 18.26 cm for placebo. At 240 to 300 minutes, the SDLP was 19.03 cm for CBD-dominant cannabis, 20.59 cm for THC-dominant cannabis, 19.88 cm for THC/CBD-equivalent cannabis, and 19.37 cm for placebo. Compared with placebo, SDLP with THC-dominant and THC/CBD-equivalent cannabis was significantly greater at 40 to 100 minutes but not 240 to 300 minutes after consumption; there were no significant differences between CBD-dominant cannabis and placebo.
have excluded clinically important impairment, and the doses tested may not necessarily represent common usage.

**Abstract**

**Importance** Cannabis use has been associated with increased crash risk, but the effect of cannabidiol (CBD) on driving is unclear.

**Objective** To determine the driving impairment caused by vaporized cannabis containing Δ⁹-tetrahydrocannabinol (THC) and CBD.

**Design, Setting, and Participants** A double-blind, within-participants, randomized clinical trial was conducted at the Faculty of Psychology and Neuroscience at Maastricht University in the Netherlands between May 20, 2019, and March 27, 2020. Participants (N=26) were healthy occasional users of cannabis.

**Interventions** Participants vaporized THC-dominant, CBD-dominant, THC/CBD-equivalent, and placebo cannabis. THC and CBD doses were 13.75 mg. Order of conditions was randomized and balanced.

**Main Outcomes and Measures** The primary end point was standard deviation of lateral position (SDLP; a measure of lane weaving) during 100 km, on-road driving tests that commenced at 40 minutes and 240 minutes after cannabis consumption. At a calibrated blood alcohol concentration (BAC) of 0.02%, SDLP was increased relative to placebo by 1.12 cm, and at a calibrated BAC of 0.05%, SDLP was increased relative to placebo by 2.4 cm.

**Results** Among 26 randomized participants (mean [SD] age, 23.2 [2.6] years; 16 women), 22 (85%) completed all 8 driving tests. At 40 to 100 minutes following consumption, the SDLP was 18.21 cm with CBD-dominant cannabis, 20.59 cm with THC-dominant cannabis, 21.09 cm with THC/CBD-equivalent cannabis, and 18.28 cm with placebo cannabis. SDLP was significantly increased by THC-dominant cannabis (+2.33 cm [95% CI, 0.80 to 3.86]; \(P < .001\)) and THC/CBD-equivalent cannabis (+2.83 cm [95% CI, 1.28 to 4.39]; \(P < .001\)) but not CBD-dominant cannabis (−0.05 cm [95% CI, −1.49 to 1.39]; \(P > .99\)), relative to placebo. At 240 to 300 minutes following consumption, the SDLP was 19.03 cm with CBD-dominant cannabis, 19.88 cm with THC-dominant cannabis, 20.59 cm with THC/CBD-equivalent cannabis, and 19.37 cm with placebo cannabis. The SDLP did not differ significantly in the CBD (−0.34 cm [95% CI, −1.77 to 1.10]; \(P > .99\)), THC (0.51 cm [95% CI, −1.01 to 2.02]; \(P > .99\)) or THC/CBD (1.22 cm [95% CI, −0.29 to 2.72]; \(P = .20\)) conditions, relative to placebo. Out of 188 test drives, 16 (8.5%) were terminated due to safety concerns.

**Conclusions and Relevance** In a crossover clinical trial that assessed driving performance during on-road driving tests, the SDLP following vaporized THC-dominant and THC/CBD-equivalent cannabis compared with placebo was significantly greater at 40 to 100 minutes but not 240 to 300 minutes after vaporization.
Effect size for CBD-dominant cannabis may not have excluded clinically important impairment, and the doses tested may not represent common usage.

**Trial Registration** EU Clinical Trials Register: 2018-003945-40

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