Tetrahydrocannabinol Produces Locomotor Hyperactivity and Disrupts Circadian Rhythmicity in Pregnant or Nursing Long-Evans Rats

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Background

Studies have demonstrated that exposure to cannabis during development impairs cognitive processes in humans, as well as locomotor activity and learning in animals. This extends to pregnant women and those caring for newborns. The legalization of marijuana can confer an underestimation of the effects of the more potent cannabinoids such as tetrahydrocannabinol (THC). This can lead to increased in utero exposure and postnatal exposure via breastfeeding (Campolongo et al., 2007). Newborns can also be affected if maternal care is compromised during an acute high. The present study examined how the effects of THC influence motor activity in maternal rats, and thus maternal care.

Methods

Gavage dosing technique All mother rats used in the study had recently given birth. They were dosed with either control oil, 1 mg/ml, 2 mg/ml, 5 mg/ml, or 10 mg/ml THC oil. Because rodents do not have gag reflexes, a rounded gavage needle was used with ease to dose the animals orally.
Our Vitalview software used a cage-top infrared activity monitor. Motor activity was quantified through beam breaks of a laser.

Figure 5. The gavage technique is shown above. The rounded needle is inserted down the esophagus, where the oil is injected into the stomach.

Figure 6. Pictured is the VitalView cage top monitor laying on top of a typical rat cage topper.

Results

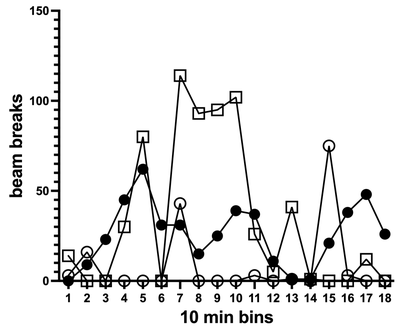
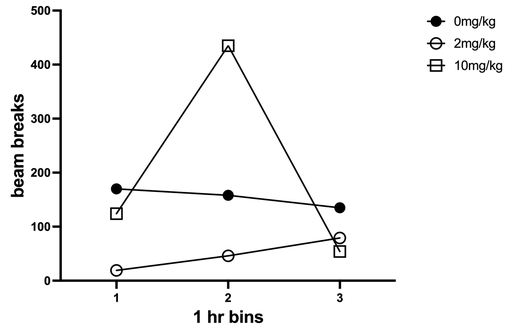


Figure 1. Rat activity 1 hour pre-dosing and 2 hours post dosing for control, 2mg/kg, and 10mg/kg rats. 10-minute increments were used.

Figure 2. Rat activity 1 hour pre-dosing and 2 hours post dosing. This figure shows the sum of activity for each hour with 1-hour increments



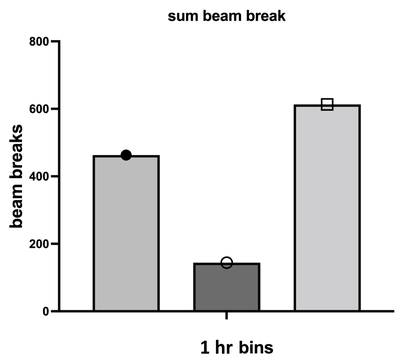
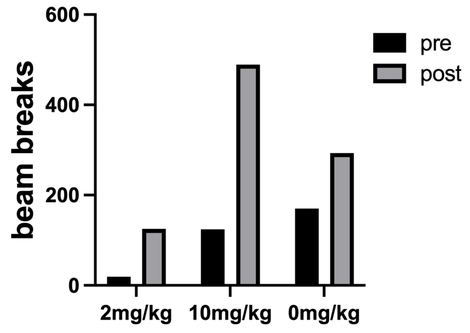


Figure 3. Rat activity 1 hour pre-dosing and 2 hours post dosing. 1-hour increments summed across 3 hours total.

Figure 4. Total sum of rat motor activity 1 hour pre-dosing, and 2 hours post-dosing.



Discussion

In Figure 1, an increase in activity occurs immediately proceeding dosing at the 1-hour mark for both 2mg/kg, and 10mg/kg dosing groups.
The preliminary results show a significant difference between groups (p-value = 0.035) for Figure 3. This suggests, there is a relationship between higher doses of THC, and increased motor activity in maternal rats.

Future Directions

In a future study, we can expand our sample size to include intermediate dose-level groups to find further relationships. Currently with examining three animals, we can only provide preliminary results.
A separate study can gather 24-hour increment time periods to examine rest and wake periods in the rats. With this, the effects of THC dosing on circadian rhythmic cycles can undergo inspection to determine if there are disruptions in sleep in some animals.

References

Campolongo, P., Trezza, V., Cassano, T., Gaetani, S., Morgese, M. G., Ubaldi, M., Soverchia, L., Antonelli, T., Ferraro, L., Massi, M., Ciccocioppo, R., & Cuomo, V. (2007). Perinatal exposure to delta-9-tetrahydrocannabinol causes enduring cognitive deficits associated with alteration of cortical gene expression and neurotransmission in rats. *Addiction Biology*, *12*(3-4), 485–495. https://doi.org/10.1111/j.1369-1600.2007.00074.x