Effects of Acute Exposure to Cannabinoids on Zebrafish Behaviour

Lyndsay Pinder and Melike Schalomon, PhD.

MacEwan UNIVERSITY

Introduction

- Zebrafish (*Danio rerio*) neurochemistry closely resembles human neurochemistry[1]

- Cannabinoid research is important for human society: the addictive potential of cannabinoids is significantly lower than that of other psychoactive substances, and there is clear indication of beneficial effects[2]

- For example, cannabinoids may be effective in the treatment of anxiety[3]

- Testing will be done to determine which doses of the cannabinoids, **9-Δ-tetrahydrocannabinol (THC)** and **cannabidiol (CBD)**, cause behavioural changes in the fish

*Wildtype zebrafish* (Danio Rerio)

Methods

Design

- 200 zebrafish will be divided into 5 treatment groups:

  Control

  THC low dose

  THC high dose

  CBD low dose

  CBD high dose

- Effects of acute exposure to THC and CBD determined by light/dark test, shoaling test, and novel tank dive test

Cannabinoid Exposure

- Previous research suggests THC dose range is 30-50 mg/L and CBD is 4.5 – 7.14 mg/L

- Fish treated with THC or CBD for 20 minutes[4]

- Then placed in the tank for 6 minutes of observation[5]
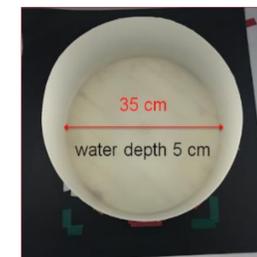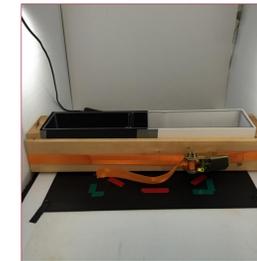
Light/Dark Test

- Single fish

- Anxiety indicated by time spent in dark side compared to light side
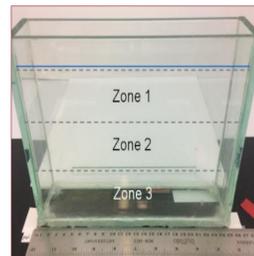

Shoaling Test

- 5 fish from the same condition

- Anxiety indicated by fish swimming more closely together (shoaling) and spent in close proximity to outer wall (thigmotaxis)
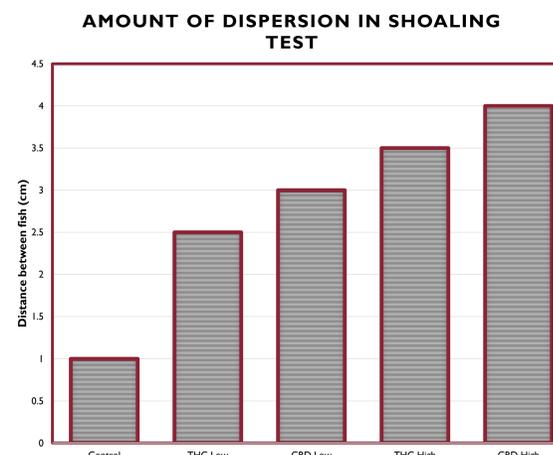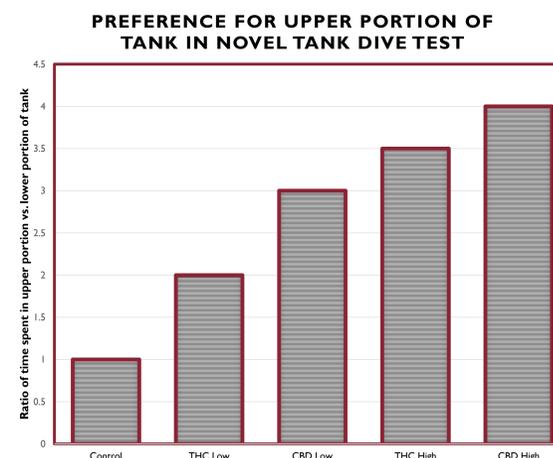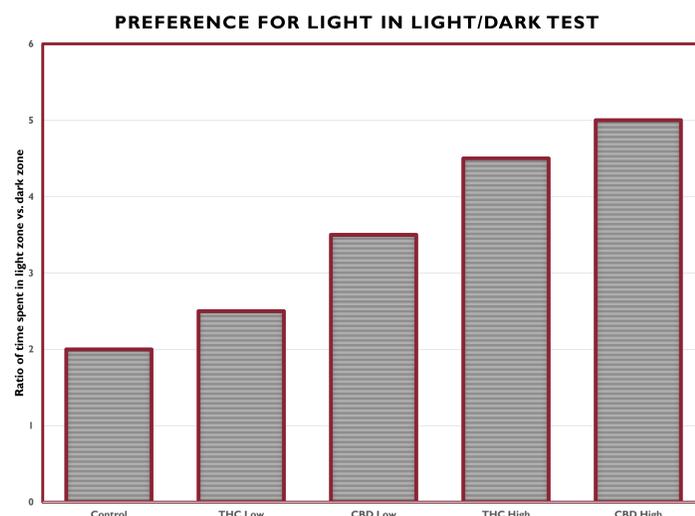

35 cm

water depth 5 cm

Novel Tank Dive Test

- Single fish

- Anxiety indicated by time spent swimming near the bottom of the tank

Anticipated Results

- Previous research has suggested THC and CBD may have anxiolytic effects[4][5] implying these cannabinoids may alter zebrafish behaviour during the tests, as compared to behaviour of zebrafish in the control condition

PREFERENCE FOR UPPER PORTION OF TANK IN NOVEL TANK DIVE TEST

AMOUNT OF DISPERSION IN SHOALING TEST

PREFERENCE FOR LIGHT IN LIGHT/DARK TEST

Conclusions

- Zebrafish are a robust model organism for testing the anxiolytic effects of cannabinoids

- Potential exists for studying therapeutic and toxic effects of THC and CBD

- This study allows us to examine different manifestations of zebrafish anxiety through three different tests

- Future studies could expand to include more cannabinoids of interest, such as cannabigerol (CBG), cannabichromene (CBC), or cannabigerivarin (CBGV)

References

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3. Korem, N., Zer-Aviv, T. M., Ganon-Elazar, E., Abush, H., & Akirav, I. (2015). Targeting the endocannabinoid system to treat anxiety-related disorders. Journal of Basic and Clinical Physiology and Pharmacology, 27(3), 193–202.
4. Nazario, L. R., Antonioli, R., Capiotti, K. M., Hallak, J. E. C., Zuardi, A. W., Crippa, J. A. S., … da Silva, R. S. (2015). Caffeine protects against memory loss induced by high and non-anxiolytic dose of cannabidiol in adult zebrafish (Danio rerio). Pharmacology, Biochemistry, and Behavior, 135, 210–216.
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