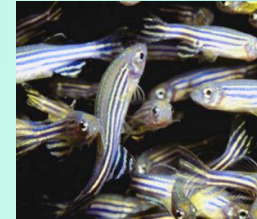




<http://visualcatholic.com/boomia/images/73/prozac.jpg>

The impact of fluoxetine hydrochloride on aggression in Zebrafish (*Danio rerio*).

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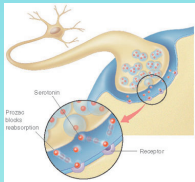


http://www.cosmomagazine.com/files/imagecache/news/files/news/20090116_zebrafish_0.jpg



Introduction

✧ Fluoxetine hydrochloride (Prozac) has been identified as the most widely prescribed anti-depressant. It was the 19th most prescribed generic drug in 2007 with 22,266,000 prescriptions.
✧ Fluoxetine hydrochloride is a selective serotonin reuptake inhibitor (SSRI), which blocks the re-absorption of serotonin into the 5-HT_{1A} receptor causing a build-up in the synapse. This build-up is responsible for a decrease in aggression.



<http://www.tshwiter.com/backgrounds/DrugAddiction/receptors.jpg>

✧ 80% of the United States' streams sampled positive for drugs including anti-depressants, hormones, and steroids in 2002.
✧ Samples of Wastewater have been found to contain 3 and 6 µg/mL of Fluoxetine hydrochloride (Lynn et al. 2007).

Question Asked

Do these environmental concentrations of Fluoxetine hydrochloride have an impact on aggressive behaviors in Zebra fish (*Danio rerio*)?

Methods

15 male zebrafish separated into 3 tanks.

The various treatment groups were placed into a breeder tank filled with 1000mL of appropriate concentration (0, 3, 6 µg/mL).
-Baselines were recorded for all test groups prior to experimental testing.

3 hour exposure.

Fish were individually tested for aggression (mirror test) in separate breeder tank for 5 minutes.

- 7 behaviors were quantified.
- Time in opposite side of tank (s).
- Time spent swimming relaxed (s).
- Time to first attack (s).
- Time spend chasing (s).
- Broadside display (s).
- Frequency of attacks.
- Number of searches.
- All breeder tanks were white walled.

Results

✧ 6 of 8 behaviors showed decreased aggression with increased concentrations of fluoxetine hydrochloride.
✧ 6 significant interaction p-values were recorded (figures 1-6).

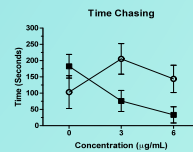


Fig. 1 Mean time spent chasing (seconds) (n=15). Error bars represent a 95% confidence interval. Analyzed with a two-way ANOVA (p<.0001).

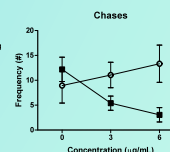


Fig. 2 Mean number of chases (n=15). Error bars represent a 95% confidence interval. Analyzed with a two-way ANOVA (p<.0001).

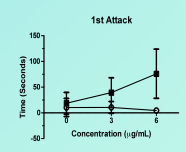


Fig. 3 Mean time to the first attack (seconds) (n=15). Error bars represent a 95% confidence interval. Analyzed with a two-way ANOVA (p=.0325).

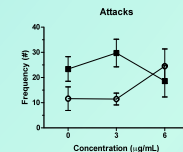


Fig. 4 Mean number of attacks (n=15). Error bars represent a 95% confidence interval. Analyzed with a two-way ANOVA (p<.0001).

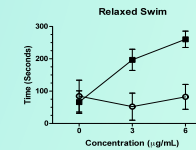


Fig. 5 Mean time spent in relaxed swimming (seconds) (n=15). Error bars represent a 95% confidence interval. Analyzed with a two-way ANOVA (p<.0001).

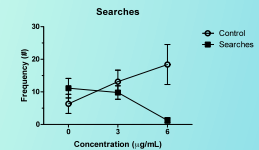


Fig. 6 Mean number of searches (n=15). Error bars represent a 95% confidence interval. Analyzed with a two-way ANOVA (p<.0001).

Conclusions

✧ The environmental concentrations of fluoxetine hydrochloride did decrease aggressive behavior in Zebrafish (*Danio rerio*).
✧ The largest changes and sometimes the only changes in behavior occurred at the highest concentration (6µg/mL).
✧ These concentrations are being recorded in water sampling and therefore may be impacting not only other species, but ecosystems as a whole.

Future Research

✧ Local water could be environmentally sampled for applicable concentrations.
✧ These concentrations could be applied to other species for a greater understanding of the impact of "drug flushing" on natural ecosystems.

Literature Cited

Lynn, S.E., Egour, J.M., Walker, B.G., Sperry, T.S. and Ramenofsky, M. 2007. Fish on prozac: a simple, noninvasive physiology laboratory investigating the mechanisms of aggressive behavior in *Betta splendens*. *Advances in Physiology Education*. 31:358-363.

Acknowledgments

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