SERTRALINE INDUCES ACUTE TOXICITY IN COPEPODS (*Acartia tonsa*)

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Sertraline

Sertraline (SRT) is an SSRI used to treat depressive disorders. Like most pharmaceuticals, it is regularly discharged into aquatic systems due to extensive use and incomplete removal in wastewater treatment *[1]*. Studies have reported the negative effects of antidepressants on vertebrates and invertebrates at different biological levels, and interrupt biological processes such as growth, reproduction, behavior and genetic functions *[2]*. However, the toxicological effects of SRRIs (like SRT) on lower tropic organisms (copepods) have not yet been fully investigated.

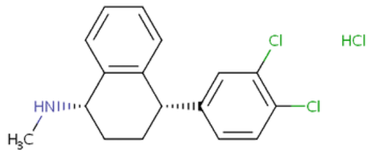

Figure 1. Molecular structure of Sertraline HCl (pharmaceutically active compound) *[3]*.

Objective

Assess the acute toxicity of SRT at minimal exposure times (24h and 48h) using *Acartia tonsa.*

How?

- Five copepods exposed to varying SRT concentrations (0, 100, 300, 500, 700, 900, 1100, 1300, and 1500 µg/L).
- 4.5 mL volume per well, in triplicates.
- Copepods monitored and counted every 24h.

Analysis

- Calculation of percent mortalities for each concentration.
- ANOVA to compare mortalities between concentration followed by Dunnett´s test for multiple comparisons with the control *[4]* (in R).
- Time-dependent mortality comparisons using Bonferroni-adjusted paired t-test *[4]* (in R).
- Probit analysis to calculate LC50 (in SPSS).

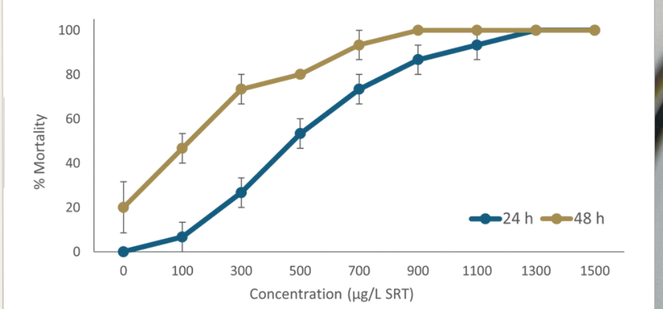

Figure 2. Mortality of *Acartia tonsa* exposed to varying concentrations of SRT over 24 and 48 hours.

Mortality of Acartia tonsia

- There is a significant difference in mortality among treatments for both 24h and 48h exposure time (α=0.05).
- Percent mortality was significantly higher than the control at concentrations of 300 µg/L and above after 24 hours, and at 100 µg/L and above after 48 hours (α=0.05).
- Mortality for each treatment generally increased with exposure time: 24h to 48h (Fig.2).
- This increase was statistically significant at lower concentrations (100, 300, and 500 µg/L) and not statistically significant at higher concentrations (700-1100 µg/L) (α=0.05).

Median Lethal Concentration and 95% Confidence Interval

- 24h exposure: 529.8 (462.1~596.6) µg/L
- 48h exposure: 179.6 (109.3~238.8) µg/L

Conclusion and Highlights

- Anti-depressants in aquatic systems have adverse effects on survival of copepods.
- SSRIs like sertraline exert toxic effects at low concentrations (≥300 µg/L and ≥100 µg/L for *Acartia tonsa*) and short exposure times (24h and 48h, respectively). Lethality (LC50) increases from 24h to 48h.
- Current study proposes regular monitoring and assessment of antidepressants in aquatic environments.
- Further investigations are needed to understand the interactions of multiple anti-depressants (cocktail effect) on aquatic organisms.

Figure 3. Snapshot of a well displaying 100% mortality

Results were in agreement with studies on effects of SRT on freshwater crustacean:

- Daphnia magna (Water Flea): 48h LC50= 0.92mg/L (920µg/L) [5]
- Ceriodaphnia dubia (Daphnid): 48h LC50= 0.12mg/L (120µg/L) [6]
- Thamnocephalus platyurus (Shrimp): 24h EC50= 0.6 mg/L (600µg/L) [7]

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References

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