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The Effects of the SSRI Paroxetine on Feeding Rates of the Larval Mosquito *Aedes aegypti*

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Abstract

Paroxetine is an antidepressant drug that is found in aquatic habitats. It is a serotonin specific reuptake inhibitor (SSRI) that increases the amount of serotonin in synapses, mimicking increased activity of serotonergic pathways. Studying the effects of the SSRI paroxetine in freshwater animals such as *Aedes aegypti* larvae (mosquito larva) may help us see what physical and behavioral impact the drug may have on these animals and how it may affect the ecosystem. The testing of feeding rates of mosquito larvae exposed to paroxetine was conducted because of the known influence of serotonin on appetite. In order to see the influence of serotonin on appetite *Aedes aegypti* were exposed to different concentrations of paroxetine ($1x10^{-5}$, $1x10^{-6}$, and $1x10^{-7}$ mmol/L). The effect of paroxetine on feeding rates are expected to affect growth and development of mosquitoes, suggesting ways that paroxetine and other SSRIs in the environment will likely alter the ecosystem.

Experimental design

Aedes aegypti were exposed to different concentrations of paroxetine ($1x10^{-5}$, $1x10^{-6}$, and $1x10^{-7}$ mmol/L) in a 12-well plate. This experiment consisted of mosquito larvae that were starved and larvae that were fed Tetra Min for 24 hours. A control treatment consisting of deionized water was used. After 24 hours, mosquito larvae were fed kaolin (hydrated aluminum silicate) which provided a color contrast from the Tetra Min. that was visible through the cuticle. Feeding rates were measured by the length in abdominal segments of the kaolin column within the midgut consumed during 30 minutes of exposure.

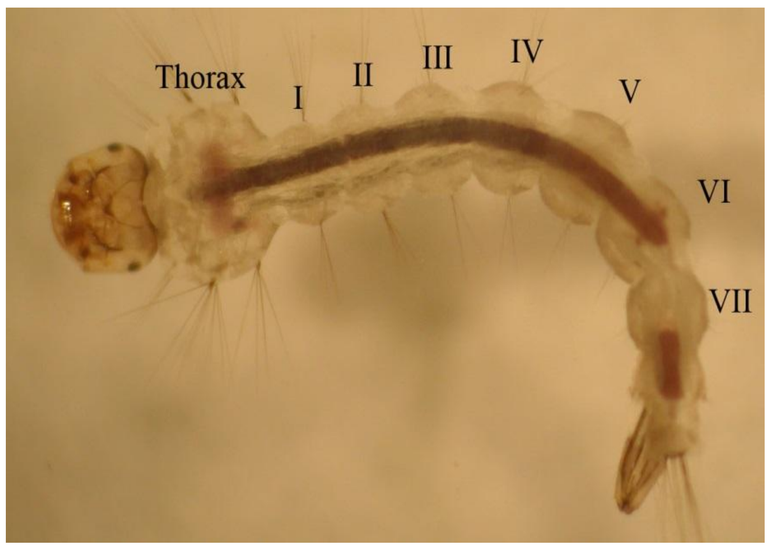

Figure 1: Larva illustrating thorax and abdominal segments.

Results

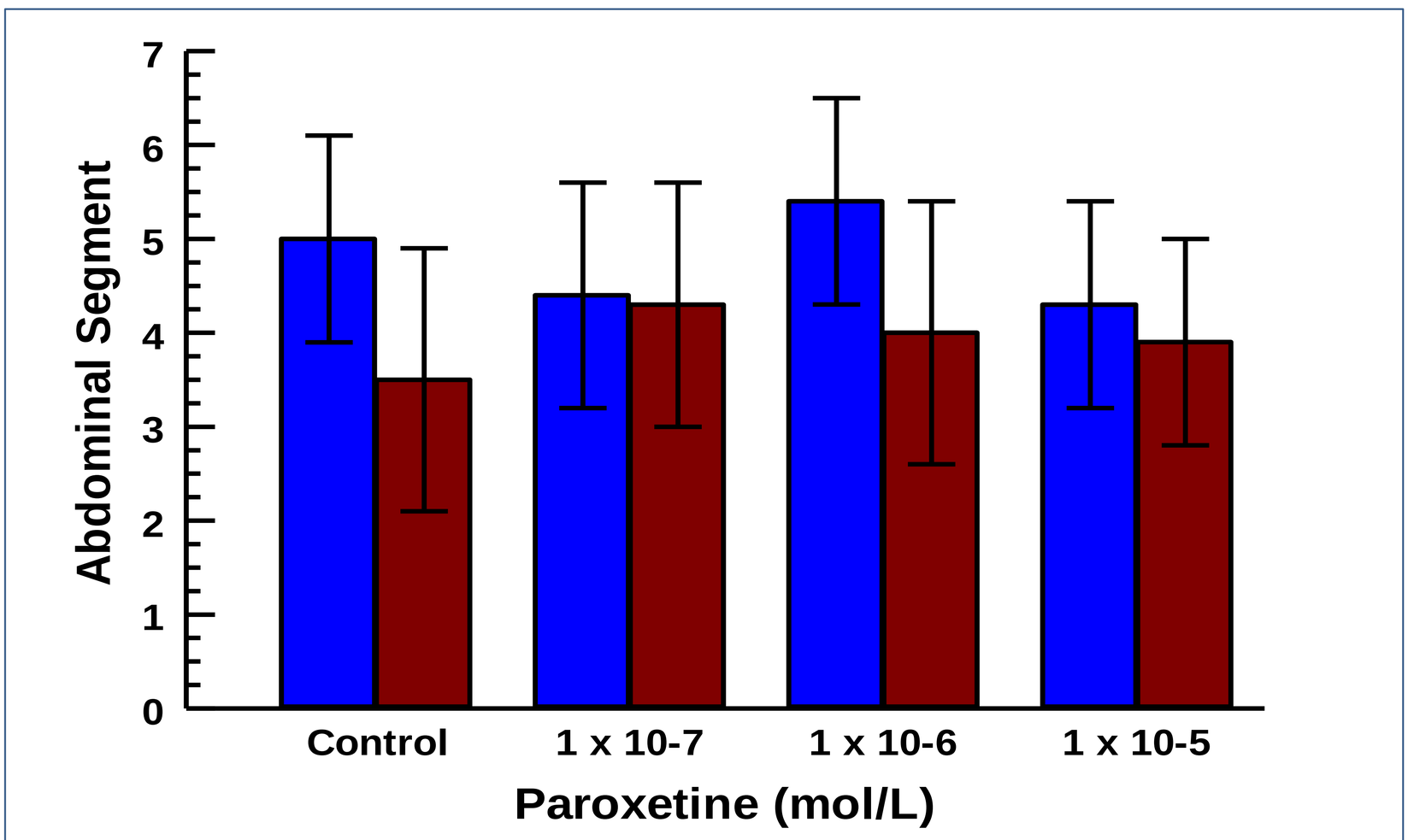

Figure 2. Effects of paroxetine on feeding rates. Larvae were exposed to kaolin for 30 minutes, and the abdominal segment reached by the kaolin determined from photos (see figure 3). Fed larvae are shown with blue bars, starved larvae with red bars. Data are presented as Mean ± St.Dev.

Within both fed and starved larvae, treatment groups differed in the length of the kaolin column ($P < 0.05$, two-way ANOVA). However, no clear dosage dependent pattern is observed. Fed controls consumed significantly more kaolin than did food-deprived larvae ($P < 0.0001$).

For fed larvae (blue bars) the SSRI paroxetine appears to reduce feeding rates at the low and high dosages but increase feeding rates at the intermediate dosage. The drug dosage (column effect) showed statistical significance ($P < 0.05$) whereas replicates (row effects) showed no statistical significance ($P > 0.05$). Overall, there was no difference between the controls and the pooled treatment groups (Controls 5.0 ± 1.09, pooled treatment groups 4.7 ± 1.22, Mean ± St.Dev, $P > 0.25$, t-test).

For starved mosquito larvae (red bars), all treatment groups showed increased feeding rates relative to controls (pooled treatment groups vs controls: Controls 3.5 ± 1.37, treatment groups 4.1 ± 1.22, Mean ± St.Dev.; $P < 0.05$, t-test). In starved larvae, both the drug dosage (column effects) and replicates (row effects) showed a statistical significance with P-values of < 0.05 (two way ANOVA). However, feeding rates did not increase with paroxetine dosage.

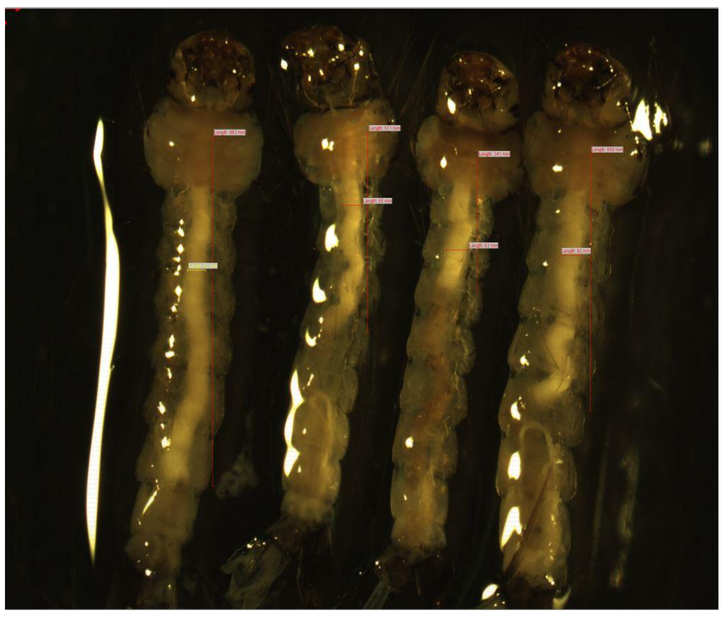

Figure 3: Paroxetine-treated *Aedes aegypti* after 30 minutes exposure to kaolin. The kaolin is visible through the body wall. Photos obtained using an Olympus SZX stereomicroscope.

Conclusions

The methods developed here using kaolin were able to detect differences in feeding rates in response to paroxetine. Fed controls consumed significantly more kaolin The SSRI paroxetine affects the feeding rate of food-deprived *Aedes aegypti* by overall decreasing appetite although dosage dependent effects were not observed. In contrast, fed larvae did not appear to respond to paroxetine with changes in feeding rates. Further studies would clarify the relationship between serotonergic pathways and feeding rates in fed and food-deprived larvae and the effects on growth and development.