

# Aspirin-Induced Mortality in *Aedes aegypti* Mosquitoes

Cody Haeker<sup>1,2</sup>, Reagan Fischer<sup>1,2</sup> and Kris Silver<sup>1</sup>

<sup>1</sup>Department of Entomology, College of Agriculture, Kansas State University

<sup>2</sup>Department of Animal Sciences and Industry, College of Agriculture, Kansas State University



## Abstract

The *Aedes aegypti* mosquito is a vector for many dangerous diseases including yellow fever, Zika, Chikungunya, and Dengue viruses<sup>1</sup>. Currently, the best method for suppressing infection with these viruses is by controlling their arthropod vectors, however the continual use of conventional insecticides to control *Ae. aegypti* mosquitoes has led to the development of significant levels of resistance to these chemicals<sup>2</sup>. Accordingly, new methods are needed.

Anecdotal evidence has suggested that mosquitoes may be sensitive to treatment with aspirin or its metabolites in a blood meal. Previous studies with aspirin in insects have mainly focused on the ability of aspirin to enhance longevity and lifespan in *Drosophila melanogaster* and crickets<sup>3,4</sup>, but one study showed that aspirin in water where larvae are developing causes significant mortality and signs of neurotoxicity<sup>5</sup>. While treating larvae in this manner is not practical for vector control, this result, in addition to the anecdotal evidence, prompted the question of whether aspirin consumed in a blood meal can cause mortality in adult mosquitoes.

Accordingly, we fed adult female *Ae. aegypti* mosquitoes differing concentrations of aspirin in human blood and measured mortality for four days following the blood meal. The concentrations chosen correspond to plasma concentrations of aspirin in humans who have consumed 100 mg (a baby aspirin), 1 g (normal adult dose), or 10 g (overdose), respectively<sup>6</sup>. Our results indicate that these concentrations of aspirin are insufficient to cause significant mortality in the mosquitos. Although unsuccessful, modification of our methods, use of a different mosquito species, or use of aspirin metabolites in our bioassays may yet show a significant impact of aspirin consumption on mosquito survival.

## Purpose

The purpose of this research is to evaluate the ability of aspirin to cause mortality in mosquitoes, and ultimately to develop new control methods for mosquito vectors.

## Question, Hypothesis, and Predictions

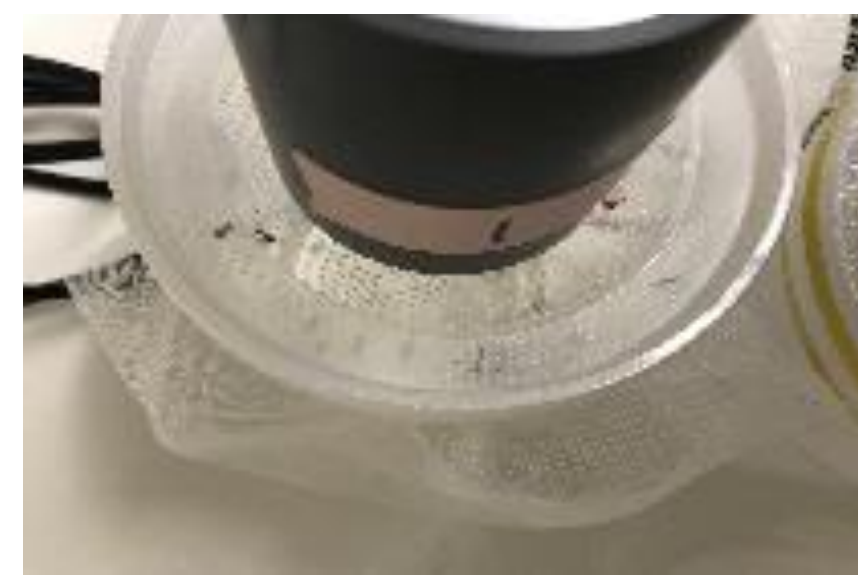
**Question:** What is the effect of different concentrations of aspirin solutions on *Ae. aegypti* mosquitoes?

**Hypothesis:** If we feed the *Ae. aegypti* mosquitos blood mixed with increasing concentrations of aspirin solution will result in increasing mortality.

**Prediction:**



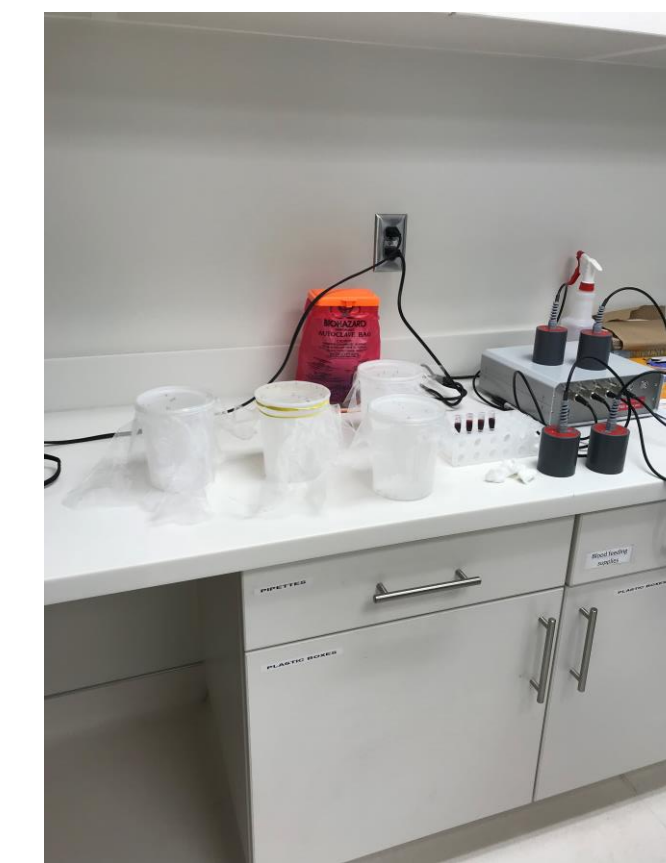
[https://en.wikipedia.org/wiki/Aedes\\_aegypti#/media/File:Aedes\\_aegypti.jpg](https://en.wikipedia.org/wiki/Aedes_aegypti#/media/File:Aedes_aegypti.jpg)



## Study System

Our study system is the yellow fever mosquito, *Ae. aegypti*. This mosquito species is occurs in warmer latitudes worldwide. In the United States, its range spans from coast to coast, mainly in the southern part of the country, though it does occur as far North as Washington and New York.

## Methods and Experimental Design



1. 4 cups received 20 mosquitoes each



2. Mosquitoes were fed on human blood containing increasing concentrations of aspirin



3. Mosquitos were fed for 1 hour



4. Mosquitoes that had taken a blood meal were sorted and returned to the cups for observations

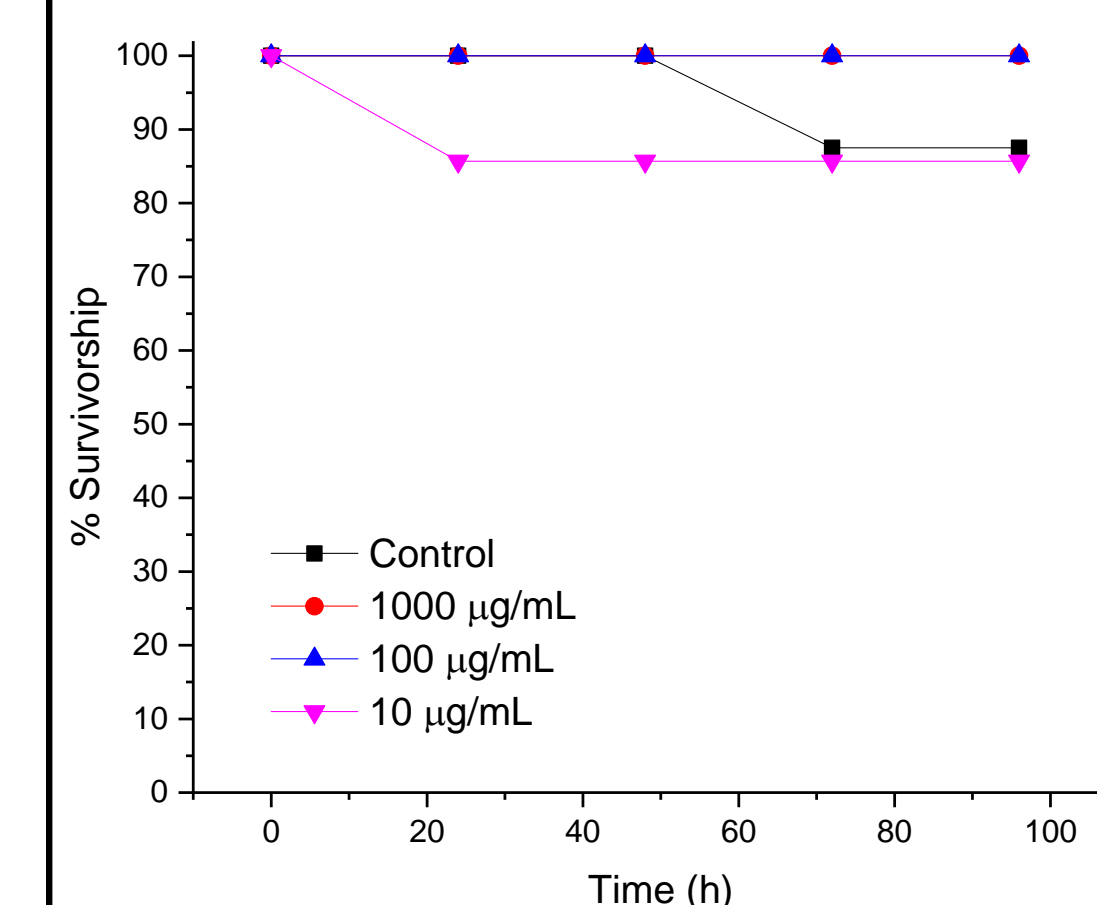


5. Mortality was recorded every 24 h for 96 h

## Results

**Table 1:** Mosquito mortality over time following feeding on aspirin-containing blood

Treatment Group	Start	Fed	24h	48h	72h	96h	% mortality
Control	20	8	8	8	7	7	12.5
100 µg/mL	20	6	6	6	6	6	0.0
10 µg/mL	20	10	10	10	10	10	0.0
1 µg/mL	20	7	6	6	6	6	14.3



**Figure 1:** Mosquito survivorship following feeding on aspirin-containing blood

Unfortunately, no significant mosquito mortality was observed following feeding of any concentration of aspirin in a blood meal

## Conclusions

In our experiments, aspirin had no effect on mosquito mortality, and so we cannot confirm our anecdotal evidence that aspirin is toxic to adult female mosquitoes. Not all of the mosquitoes fed in our study, nor did we test the effect of metabolites of aspirin, which is quickly broken down in blood, on the survivorship of mosquitoes. In addition, modification of our methods and use of other mosquito species may also yield different results along with further experimentation.

## Future Directions

Future experiments the toxicity of aspirin to *Ae. aegypti* mosquitoes might include:

1. Using typical metabolites of aspirin in our ex vivo bioassays
2. Starving mosquitoes prior to blood feeding to help ensure that feeding behavior occurs
3. Testing aspirin in species of mosquito other than *Ae. aegypti*
4. Testing the toxicity of aspirin (or metabolites) to adult mosquitoes (male and female) delivered in sucrose

## References

1. Souza-Net, *et al.* (2018) *Infect Genet Evol* **67**: 191-209.
2. Moyes, *et al.* (2017) *PLoS Negl Trop Dis* **11**: e0005625.
3. Hans, *et al.* (2015) *Age* **37**: 31.
4. Danilov, *et al.* (2015) *Oncotarget* **6**: 19428-44.
5. Rathore and Swarup (1978) *Indian J Exp Biol* **16**: 823.
6. Higgs, *et al.* (1987) *Proc Natl Acad Sci USA* **84**: 1417-20.

## Acknowledgements

We would like to thank Sapna Menghwar and Berlin Londono for providing the mosquitoes and helping feed them. We would also like to thank Dr. Silver for helping us and guiding us through the whole project. Finally thank you to Dr. Marshall for presenting us with this research opportunity