



# Human Antibody Response Against *Anopheles gambiae* Salivary Proteins

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## Introduction

Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female *Anopheles* mosquitoes. There are more than 400 different species of *Anopheles* mosquitoes; however only 30 are major malaria vectors. *Anopheles* vector species bite between dusk and dawn. During blood feeding, the female mosquito injects saliva into the human skin to facilitate meal intake. The salivary proteins (mSP) stimulate immune responses that may lead to antibody production. It is hypothesized that in endemic settings, after repeated mosquito bites, human hosts develop an immune response against mSP that correlates with the level of exposure.

## Purpose

We attempted to establish whether people residing in non-endemic areas for Malaria develop antibodies against *Anopheles* salivary gland extract (SGE) and gSG6-P1 salivary protein. These findings will help to understand host-mosquito interaction in the absence of the disease.

## Questions, Hypotheses, and Predictions

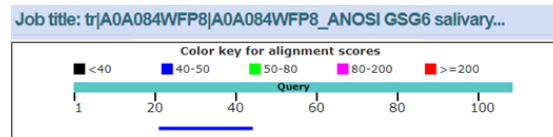
**Question:** What are the levels of antibody response against SGE and gSG6-P1 salivary protein in healthy individuals in Kansas?

**Hypothesis:** The antibody response against *An. gambiae* saliva is directly correlated with the level of exposure to mosquito bites.

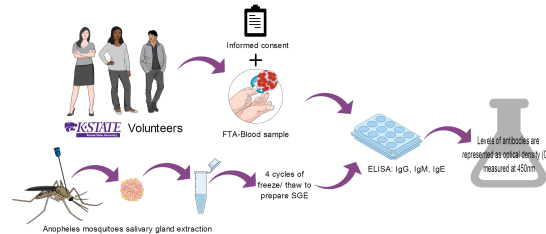
**Prediction:** People engaged in outdoor activities with no use of protective strategies such as repellent will present higher antibody levels against *An. gambiae* proteins than people using repellent or staying indoors during vacations.

## Study System

We evaluated the whole salivary gland extract (SGE) and one salivary protein, gSG6, from *An. gambiae* mosquitoes. Those two components were used as antigen in an ELISA test to measure IgG, IgM and IgE antibodies from human blood.

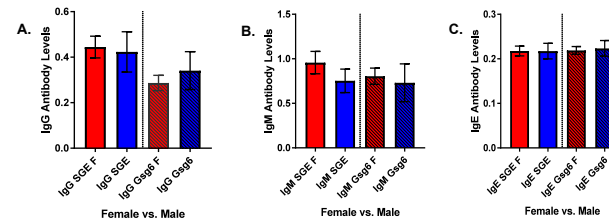


## Methods and Experimental Design



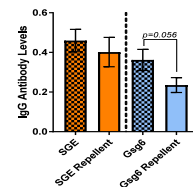
## Results

We enrolled 15 healthy volunteers (7 females and 8 men) living in Manhattan, KS, with ages between 19 and 42 years old (mean age = 24.08). The average time residing in the city was 3.3 semesters (calculated based on the number of semesters attending KSU). All participants were engaged in any type of outdoor activity (i.e. gardening, hiking, camping); however, only 7 out of 15 (54.9%) reported the use of repellent.



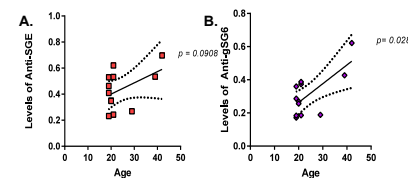
**Figure 1: Antibody levels of IgG (A), IgM (B), and IgE (C) in males and females.**

We compared level of exposure and response in males vs. females and found that **IgG antibodies against gSG6 were significantly higher in males**; as well as female IgM antibody levels for SGE. We did not find significant differences for IgE antibodies.



**Figure 2: IgG levels in relation with the use of repellent.**

When we compared the levels of antibodies against each protein, we found that **higher IgG antibodies are associate with the non-use of use repellent.**



**Figure 3: Correlation between participants age and levels of Anti-SGE (A) and Anti-gSG6-P1 (B).**

We found a significant **positive correlation between age and Anti-SGE/gSG6**; which means that the older the person the higher the level of IgE antibodies against both Anti-SGE and Anti-gSG6-P1.

## Conclusion

Mosquito saliva plays an important role in vector-borne disease transmission and pathology. Here we show that IgG antibody levels against gSG6-P1 are higher in people that does not use repellent, which suggest that gSG6-P1 proteins might be useful markers to measure human-mosquitoes contact. We also found that males and females respond differently to mosquito salivary antigens; males showed higher levels of IgG for gSG6 and females presented higher IgM levels for SGE. Since mSP have a profound impact on pathogen transmission, additional studies characterizing factors that may influence immune response against salivary proteins are needed.

## Future Directions: Malaria Transmission Level and immunity against Saliva

### Low and Non-endemic

Exposure to mosquito bites will induce immunity that accumulates with time.



### Seasonal/Travelers

High antibody levels will wane after ceasing exposure for long periods of time.



### Hyper/Holoendemic

Chronic natural exposure to mSP and Plasmodium antigens induce natural busting and protection against symptoms.



## Acknowledgements

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## References

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