



The Tradeoff of Nutrition in Malaria Transmission

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INTRODUCTION

- In 2019, 229 million people were infected with malaria and 409 thousand people died, most of which are children under the age of 5 years.
- Nutrition is limited in all biological systems.
- Parasite's development and fitness rely on its host.
- Hosts has limited resources and it "must" prioritize it must make a prioritize own fitness such as carrying eggs or fighting an infection.
- Equation for Vector Capacity, shown below, is most heavily impacted $n = \text{Extrinsic Incubation Period (EIP)}$ and $s = \text{Vectorial Survival Probability (VSP)}$.

$$C = \frac{m * a^2 * p^n * b}{-\ln s}$$

METHOD

- Sporozoite Prevalence will be the input to EIP.
- Mosquito Mortality will be the input to VSP.

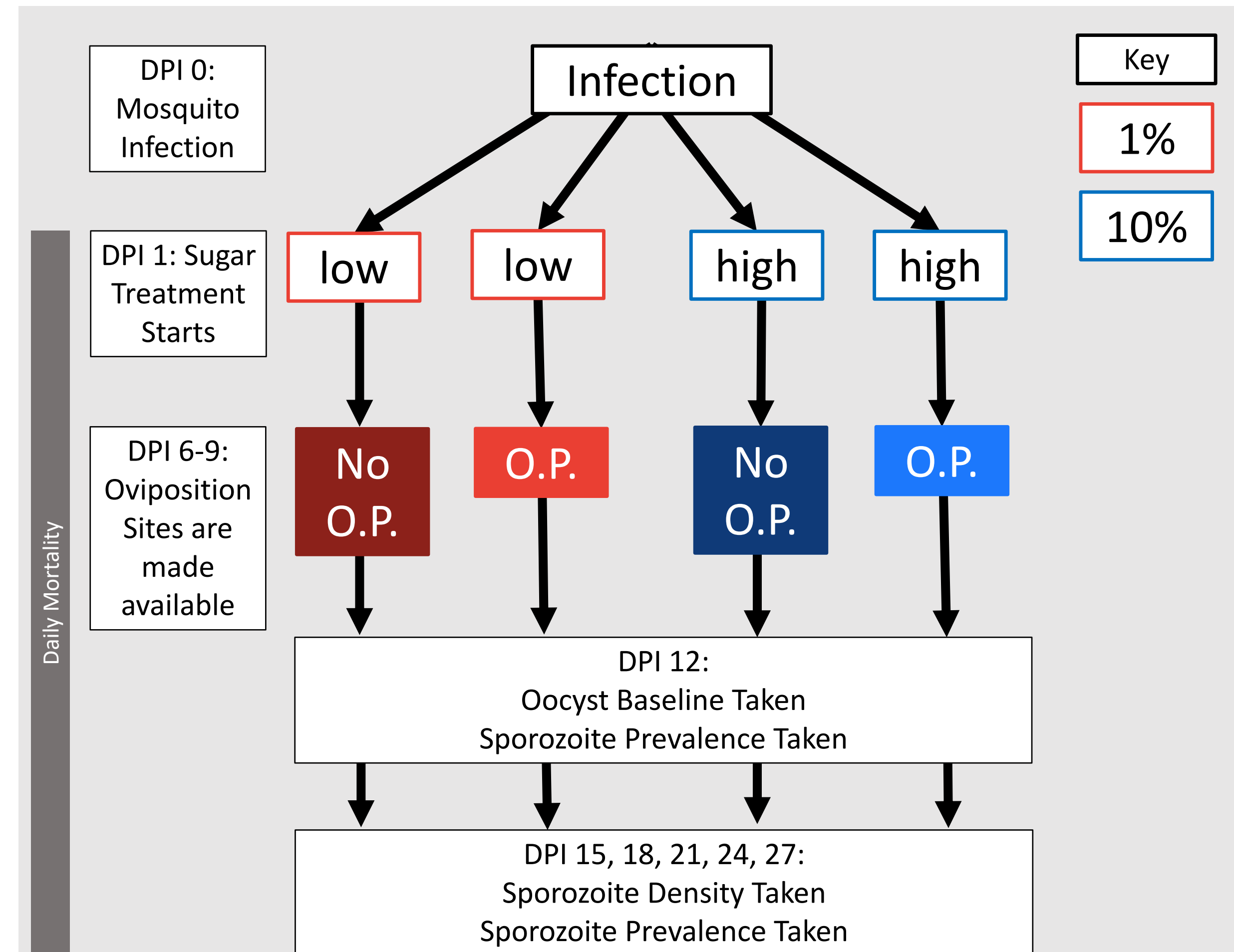


Fig. 1: Schematic overview of the methods.

- Sporozoite Prevalence and Density were determined by mosquito salivary gland extraction.
- Oocyst baseline is a predictor of sporozoite density and prevalence.
- Oviposition (OP) sites results in "Not Gravid" status.
- No (OP) sites results in "Gravid" status.

In nutrient deficient settings, malaria infected mosquitoes will prioritize taking care off the eggs over fighting off an infection.

Fig. 2: Color coded key for the following figures.

- Low & Gravid
- Low & Not Gravid
- High & Gravid
- High & Not Gravid

Fig. 3: Infected Sporozoites in Salivary Glands

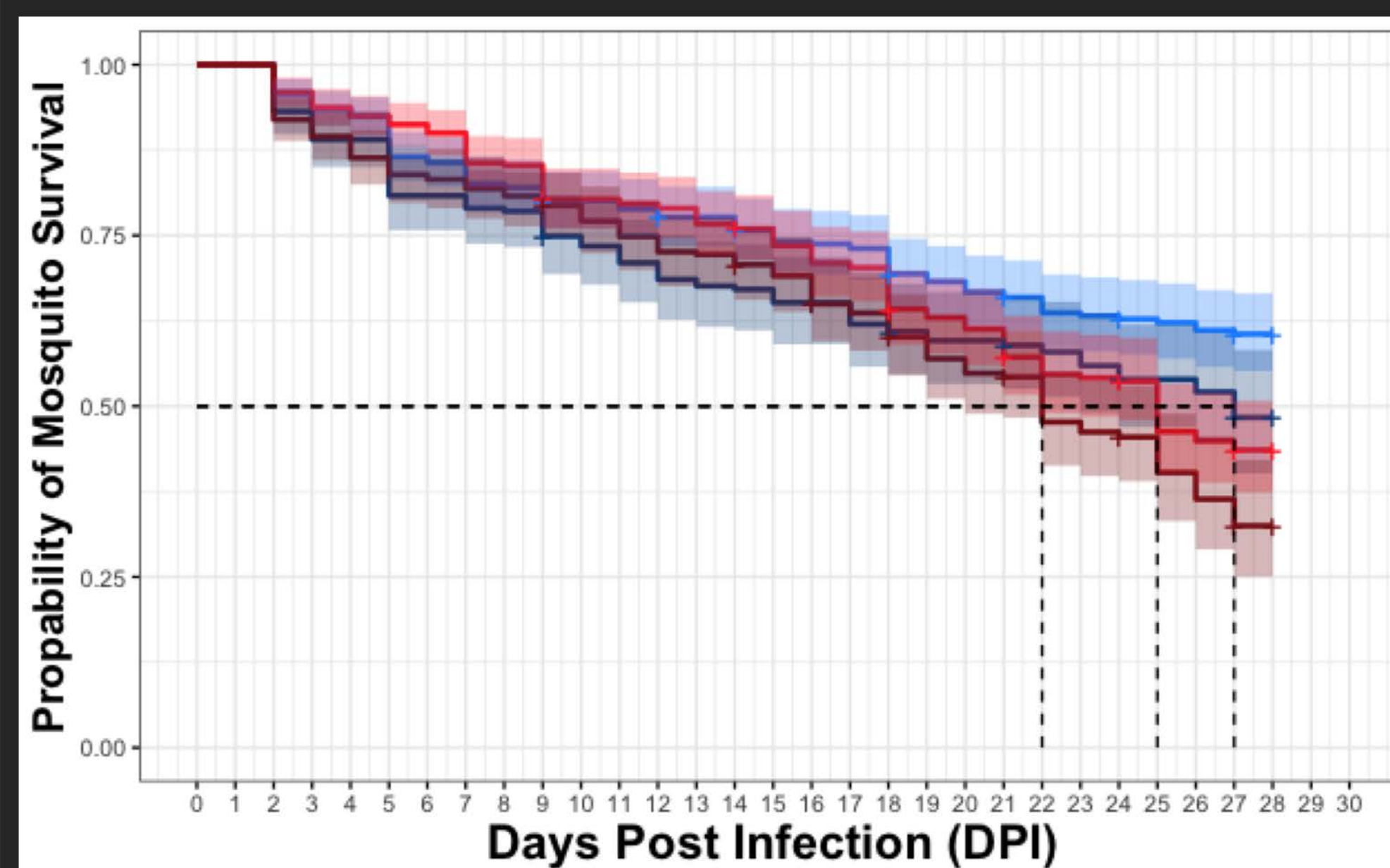


Fig. 4: Kaplan-Meier survival analysis graph illustrates the percentage of living mosquitoes over a period of time while being exposed to a specified conditions. Dotted line represents the medial survival pointer.

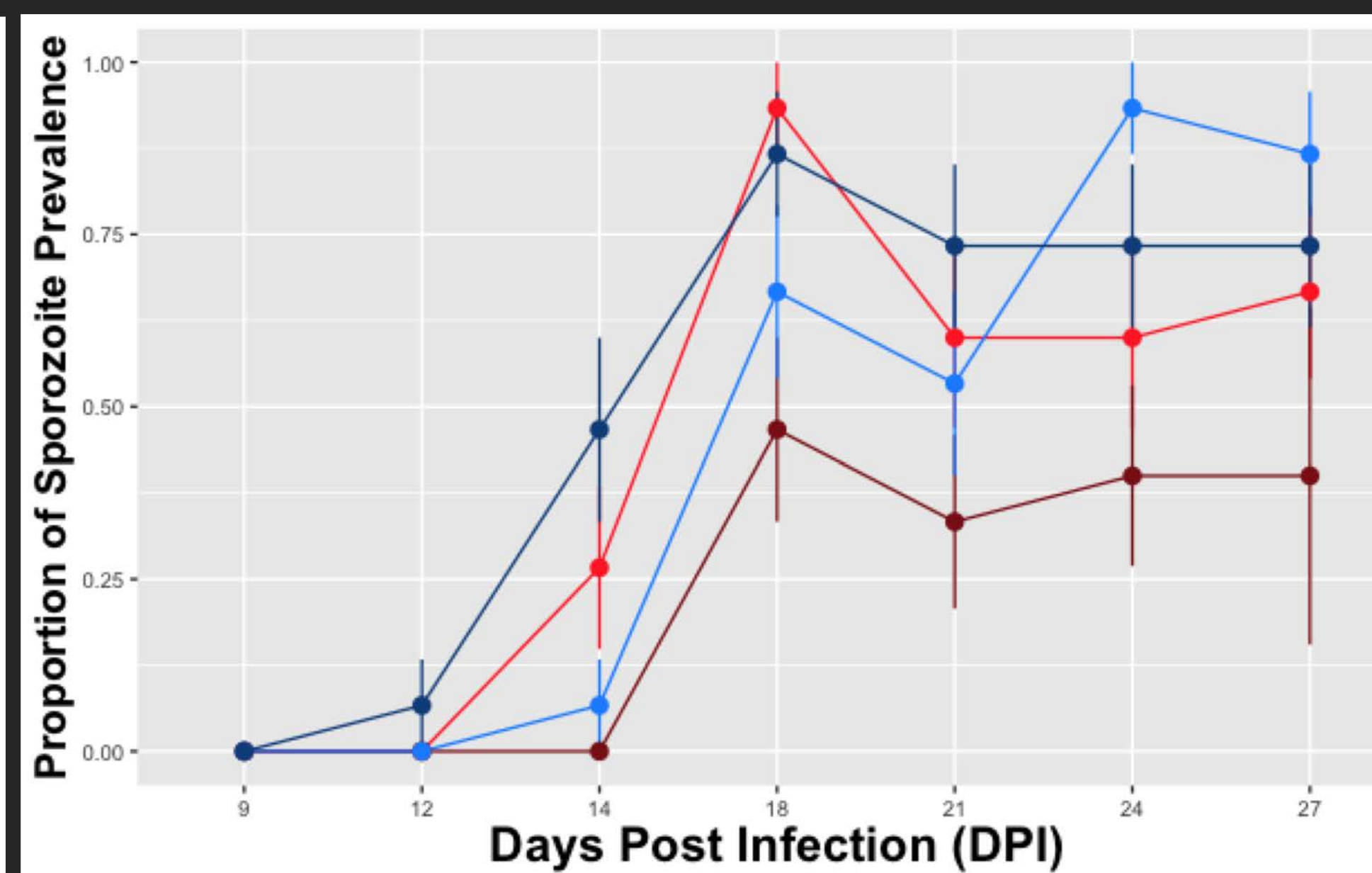


Fig. 5: The proportion of sporozoites prevalence per mosquito across designated conditions.

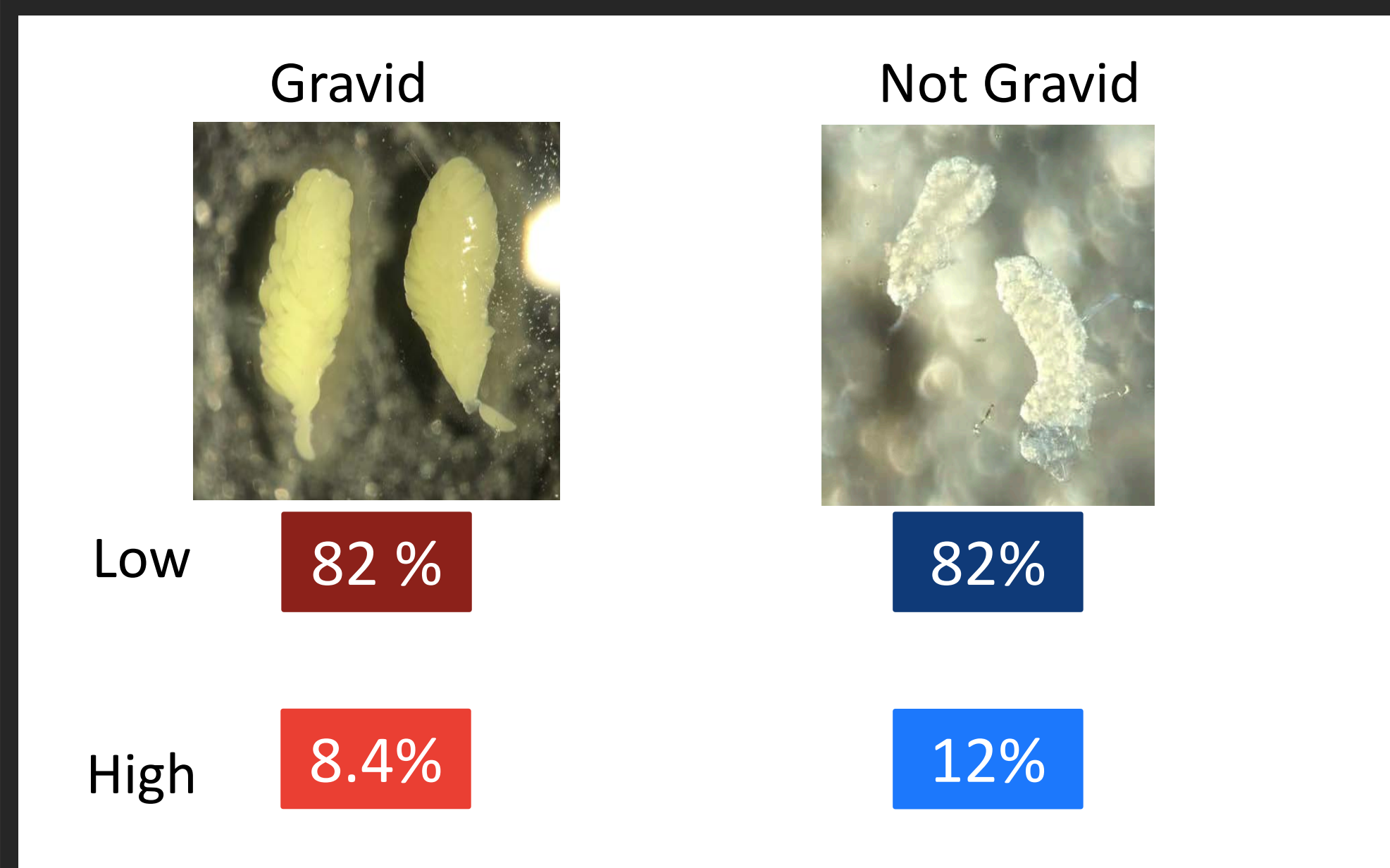


Fig. 6: Mean Gravid status for each condition for the duration of the experiment.

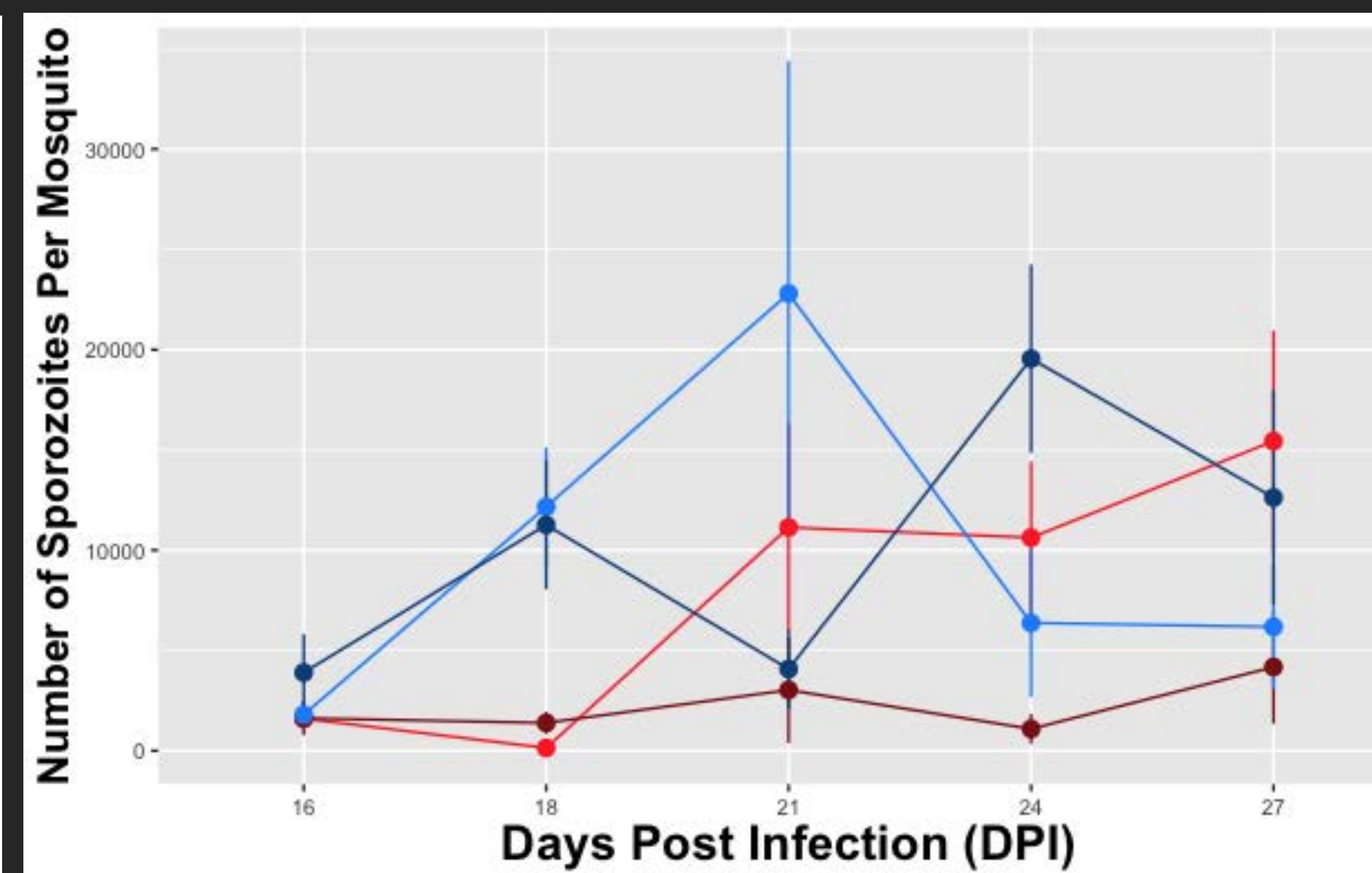


Fig. 7: The mean number of sporozoites per mosquito across designated conditions.

RESULTS

Mosquito Survival

- Nutrient surplus increases mosquito survival.
- Not being gravid decreases mosquito survival.

Mosquito Infectivity

- When in a nutrient deficit state, parasite density is lower when the mosquito is not gravid and higher when it is gravid.
- When in a nutrient deficit state, parasite prevalence in lower when the mosquito is not gravid and high when the mosquito is gravid.
- When in a nutrient surplus state, not gravid mosquitoes reach their peak density before the gravid mosquitoes.

DISCUSSION

- With low nutrient treatment, mosquitoes are allocating more resources its progeny rather than an immunological response.
- The same mosquitoes are dying from the the low nutrient treatment rather than parasite induced death due to sporozoite density.
- Further supporting the notion that parasite development and fitness are reliant on the host as both prevalence and density are at its lowest when VSP is low.
- From a trade-off perspective, mosquitoes with high nutritional resources could be more densely infection, however the increased parasite load could have lead to the death of the mosquito.

Future Work

- Quantify the Vectorial Capacity using EIP and VSP collected from this experiment.
- Further compare EIP's across treatments to quantify determine Public Health significance.

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