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 its own fitness such as carrying eggs or fighting an infection.
- Equation for Vector Capacity, shown below, is most heavily impacted by Extrinsic Incubation Period (EIP) and Vectoral Survival Probability (VSP).

\[ C = m \times a^2 \times p^3 \times b \times -\ln s \]

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

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 Vectoral 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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