# Blood-feeding frequency impacts fitness of malaria parasites and their mosquito host

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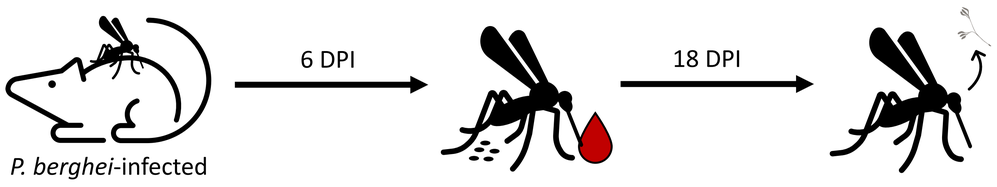
## Background

- Female mosquitoes feed on vertebrate blood to acquire nutrients for egg production and can feed multiple times to generate multiple egg clutches (1)
- Malaria (*Plasmodium* spp.) is transmitted by *Anopheles* mosquitoes (2)
- *Plasmodium* must transition from gametocyte stage ingested by the mosquito to the sporozoite stage that invades the salivary glands to become infectious to the next vertebrate host (2-3 weeks)
- *Plasmodium* uses resources mobilized for mosquito egg production to facilitate its development (3)
- Additional blood meals after infection can affect parasite development (4, 5)
- Effect of infection on mosquito fitness depends on parasite and mosquito species (6, 7)

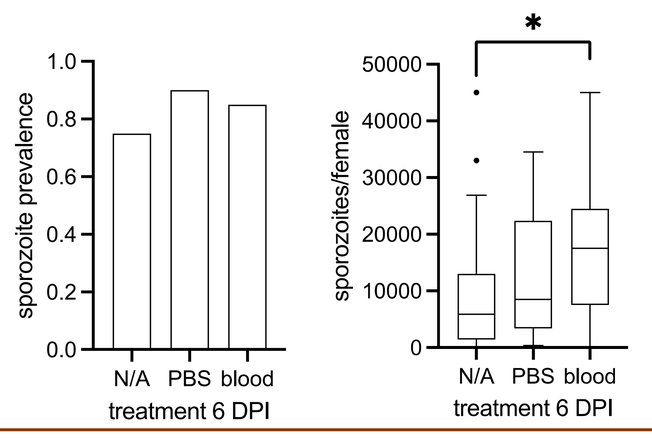
## Research Questions

- How is the relationship between *P. berghei* and *A. stephensi* modulated by an additional blood meal?
- Can a blood meal before infection impact parasite development?
- How does the parasite affect *A. stephensi* egg production?

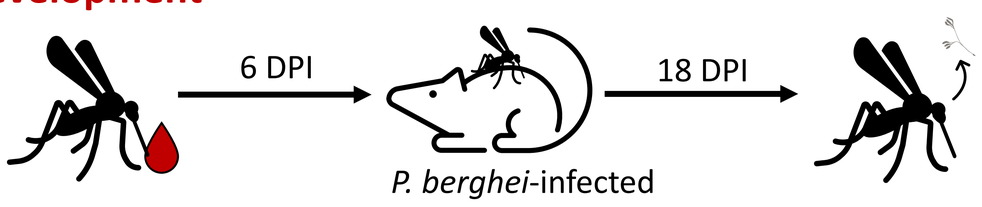
## 1. An additional blood meal 6 DPI increases sporozoite load



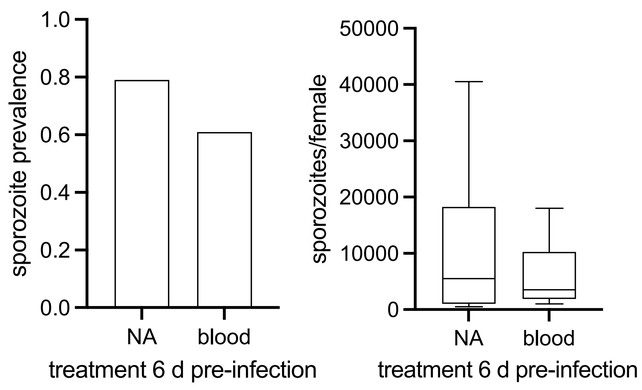

Sporozoite prevalence (left) and intensity (right) 18 DPI in mosquitoes fed PBS or a naïve blood meal at 6 DPI compared to those that received only the infectious meal



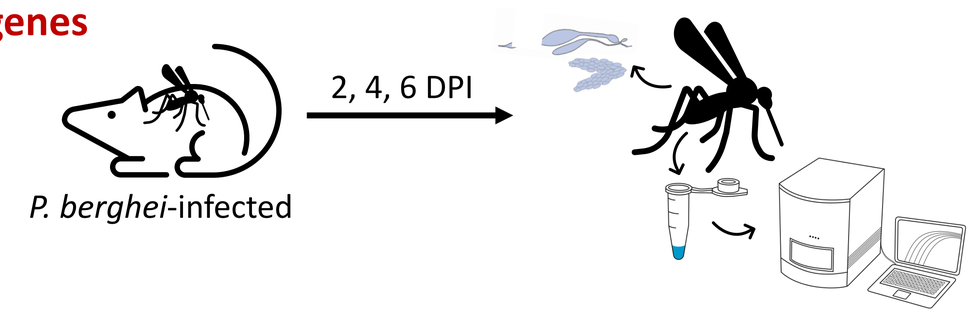

## 2. Pre-infection blood meals do not influence *P. berghei* development



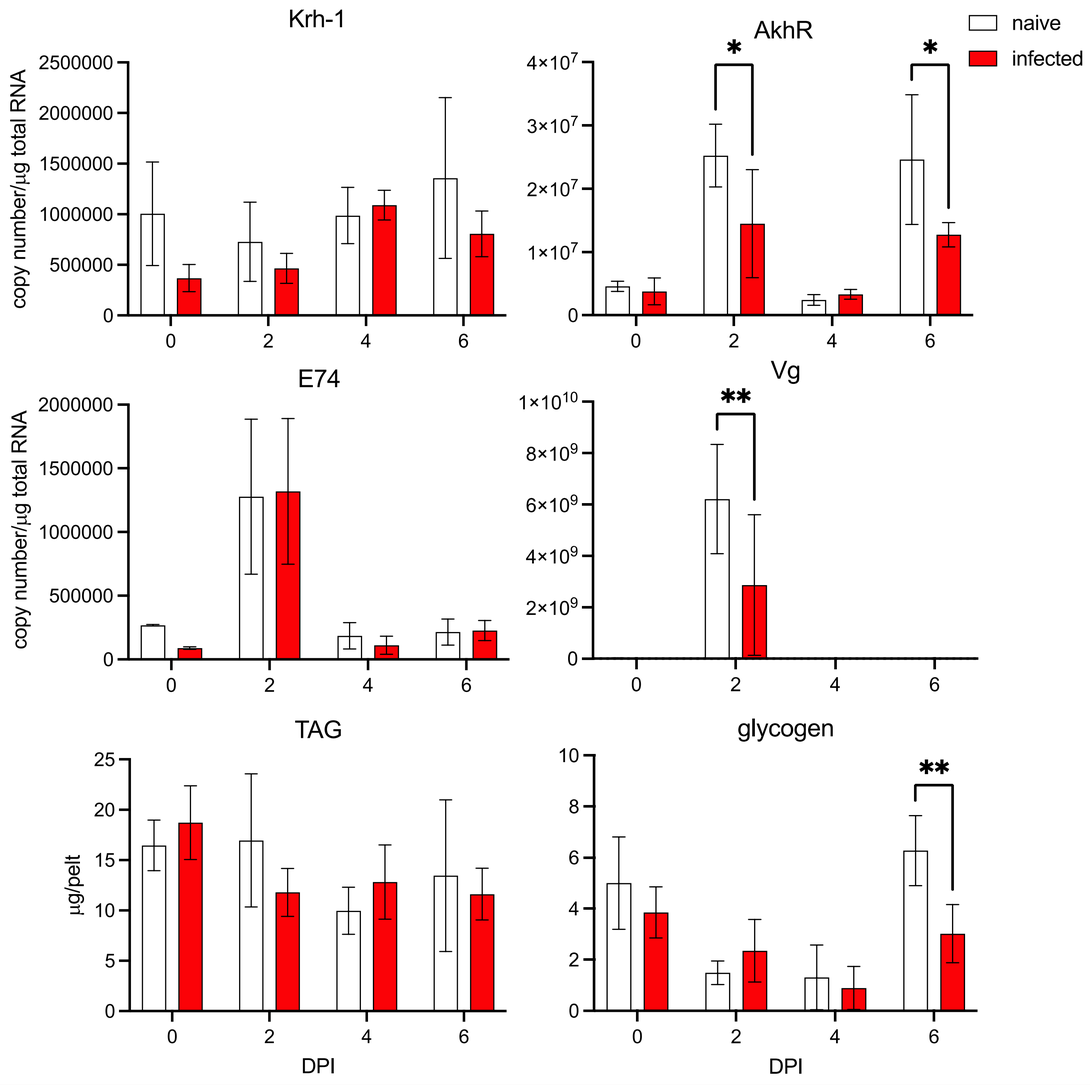

Sporozoite prevalence (left) and intensity (right) 18 DPI in females fed a naïve blood meal 6 d before infection compared to those that received only the infectious meal



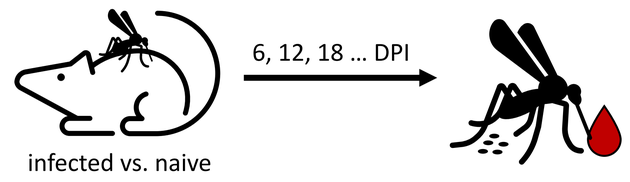

## 3. Infection results in transcriptional downregulation of vitellogenesis-related genes



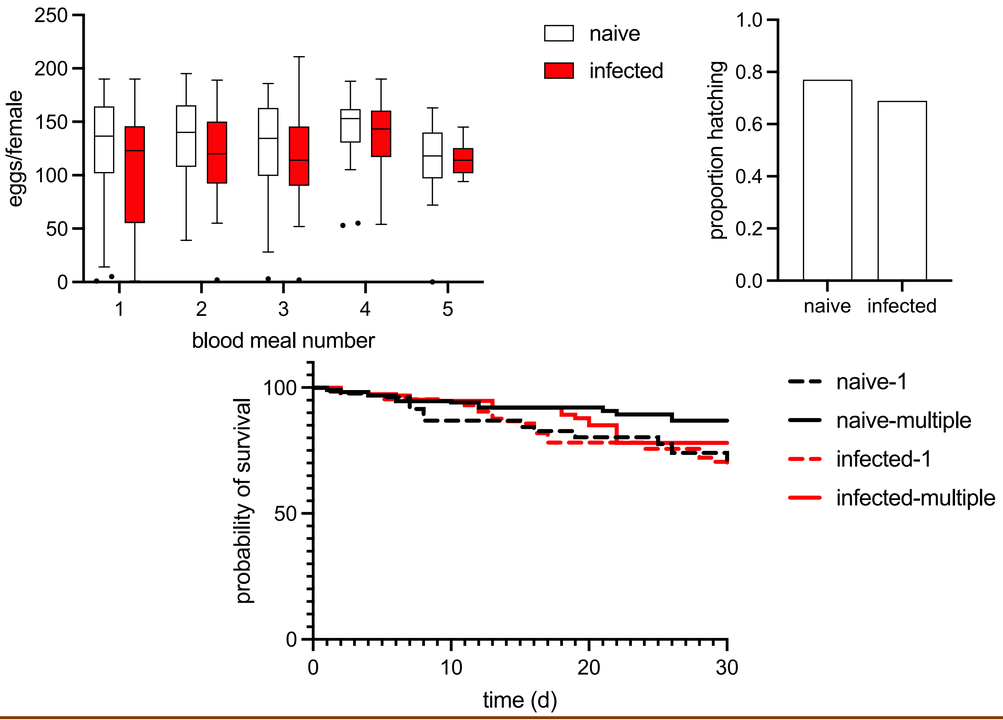

Kruppel homolog 1 (top left), adipokinetic hormone receptor (top right), transcription factor E74 (middle left), and vitellogenin (middle right) transcript abundance; triglyceride (bottom left) and glycogen (bottom right) titers in pelts throughout first gonotrophic cycle after infection




## 4. Neither blood meal number nor infection status affect mosquito fitness




Left: number of eggs laid per female six d post-blood meal; right: viability of eggs laid by infected and naïve females; bottom: longevity of infected and naïve females fed one or multiple (0, 6, 12, 18, 24 DPI) blood meals




## Conclusions

- Additional blood meals after infection can support increased sporozoite development, but timing is critical
- Transcriptional downregulation of genes controlling egg production during *P. berghei* infection does not translate to diminished fecundity
- *P. berghei* infection does not affect mosquito fecundity or survival even when infectious load is increased by a second blood meal

## Acknowledgements

- Rafael Freitas – mosquito rearing

## References

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