

Effect of sex, age, and blood-feeding status on thermal tolerance of *Anopheles arabiensis* Patton

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INTRODUCTION & AIM

Thermal tolerance influences the survival, distribution, and vectorial capacity of mosquitoes. In mosquito biology, survival and blood feeding are strongly influenced by temperature (Lyons et al., 2016).

Anopheles arabiensis Patton is a major malaria vector in Africa and is characterised by its ecological adaptability and ability to utilise both human and animal hosts. However, little is known about how intrinsic physiological factors such as sex, age, and blood-feeding status influence its thermal tolerance.

Understanding how these physiological traits shape thermal tolerance is increasingly important under current climate change scenarios, as variations in heat tolerance may influence mosquito survival, population persistence, and ultimately malaria transmission.

Problem statement and study aim

Because *An. arabiensis* exhibits phenotypic plasticity, and because thermal tolerance may vary with sex, age, and blood-feeding status, this study aimed to determine how these physiological traits influence the species' tolerance to thermal extremes.

METHODS

Rearing



South African strain. Origin: Kruger National Park, larval collection from a hot spring. Housed at Botha de Meillon insectary, Johannesburg.

Grouped by:

Sex:



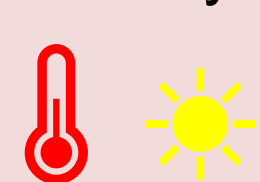
Age:

- 3-day-old
- 15-day-old

Blood meal:



Thermal tolerance assays



Knock down recorded hourly

Data analysis

- Kaplan Meier estimator
- ANOVA

RESULTS & DISCUSSION

- Sex did not have a significant influence on the thermal tolerance of *An. arabiensis* ($\chi^2 = 0.005$, $df = 1$, $p = 0.9$) (Figure 1A & B).
- Younger female mosquitoes that were blood-fed experienced heat knockdown more quickly than the other treatments, with $LT_{50} = 2.05^\circ\text{C}$ (Figure 1D), which contrasts with previous research that states that younger mosquitoes are more tolerant to extreme heat (Lyons et al., 2014). Older mosquitoes showed greater tolerance to temperature across both blood-meal treatments (blood-fed and unfed) than younger mosquitoes (Figure 1D), with 15-day-old blood-fed mosquitoes showing the highest LT_{50} ($LT_{50} = 28.45^\circ\text{C}$).
- The increased thermal tolerance of older female mosquitoes that experienced multiple blood meals, which is a physiological characteristic of potentially infected females, suggests that pathogen-exposed mosquitoes have greater temperature tolerance.

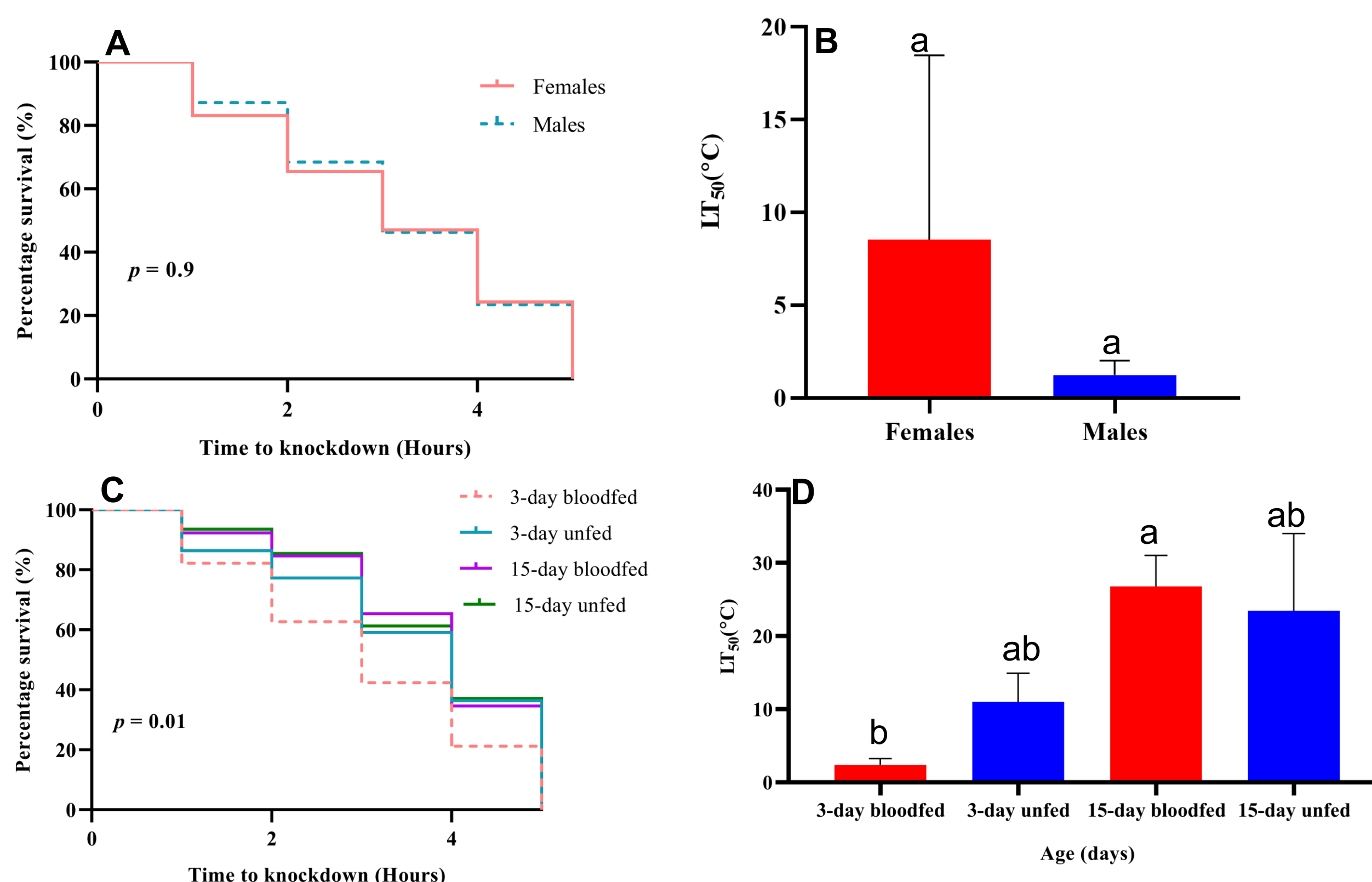


Figure 1: **A.** Survival percentage between females and males, **B.** Mean knockdown time (LT_{50}) of male and female *Anopheles arabiensis* exposed to heat stress (41°C), **C.** Survival percentage comparing age and bloodmeal status, **D.** Mean knockdown time (LT_{50}) of *Anopheles arabiensis* exposed to heat stress (41°C) among different age and blood-feeding groups.

CONCLUSION

In conclusion, this study demonstrates that thermal tolerance in *An. arabiensis* is dynamically shaped by age and bloodmeal status rather than by sex, contradicting previous published data. This suggests that instead of undergoing typical senescence, this malaria vector develops progressive thermal resilience over time, which is possibly driven by age and the physiological stimulus of multiple blood meals. This nuanced physiological development must be integrated into climate-driven models to accurately predict future malaria transmission dynamics.

REFERENCES

- Lyons, C.L., Oliver, S.V., Hunt, R.H. & Coetzee, M. 2016. The influence of insecticide resistance, age, sex, and blood feeding frequency on thermal tolerance of wild and laboratory phenotypes of *Anopheles fenustus* (Diptera: Culicidae). *Journal of Medical Entomology*, 53(2), 394-400.
- Lyons, C.L., Coetzee, M., Terblanche, J.S. & Chown, S.L. 2014. Desiccation tolerance as a function of age, sex, humidity, and temperature in adults of the African malaria vectors *Anopheles arabiensis* and *Anopheles fenustus*. *The Journal of Experimental Biology*, 217, 3823-2833.