# Health and Disease in a Declining Population of Blue Monkeys (*Cercopithecus mitis*)

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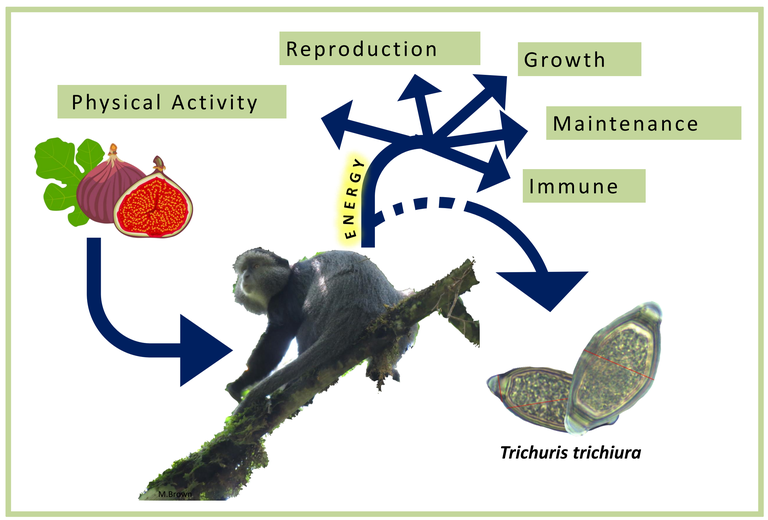
## Background

A basic tenet of life history theory is that all organisms have finite energy reserves and must make trade-offs in how they allocate energy between key fitness-related behaviors[1,2]. Gastrointestinal parasites impact host fitness by increasing morbidity and mortality, for instance by diverting energy away from growth, maintenance, or reproduction to mounting an immune response[1,3,4,5,6].

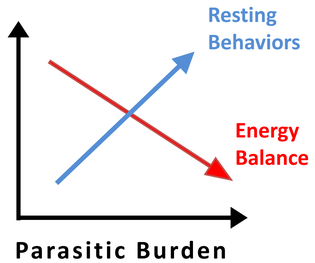
We expect that costly immune responses will cause a reduction in energy balance, resulting in a cascade of behavioral effects[6,7]. In the short term, individuals with heavy parasite burden should attempt to conserve energy. In the long term, chronic and intense infection should result in reductions in fertility and decreased survivorship[6,7].

Here, we investigate the possible role of parasitic infection to explain the recurring population declines in blue monkeys (*Cercopithecus mitis*) in Kibale National Park, Uganda.



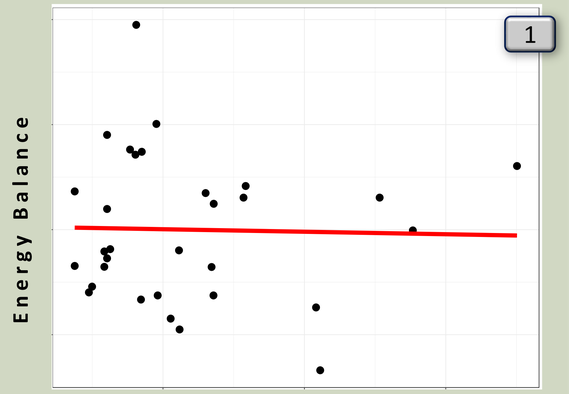

## Prediction:

Increased gastrointestinal parasite burden corresponds with decreased energy balance and increased resting behaviors




## Results

**Figure 1**. Summed abundance of parasite species per monkey against levels of urinary C-peptide of insulin. **RESULT: no relationship between overall parasite burden and energy balance.**



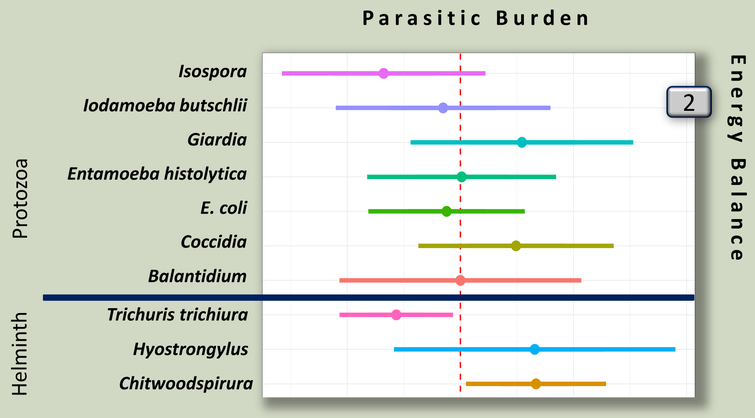




**Figure 2**. ***Trichuris trichiura*** **(whipworm) correlates negatively with energy balance, while *Chitwoodspirura* correlates positively with energy balance.**

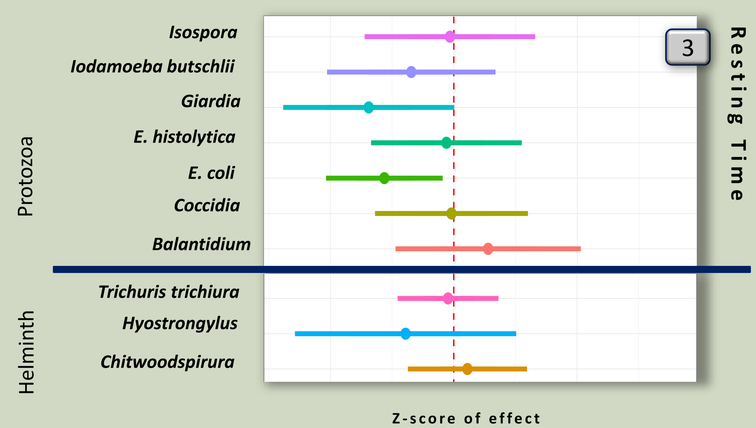



**Figure 3**. ***Giardia*** **and *E. coli* correlate negatively with resting time.**

## Conclusions

**Whipworm negatively correlates with energy balance.** We think this is due to the fact that this parasite removes nutrients from the blood, which would mean that it has a direct effect on energy balance. In contrast, eight other parasite species did not correlate while one, *Chitwoodspirura*, correlated positively with energy balance for unknown reasons. **Summed parasite burden does not predict changes in energy balance,** perhaps because the effects of these various parasites might negate each other.

**Parasitic infection did not increase blue monkey resting time. Instead, *Giardia* and *E. coli* infection correspond with decreased resting.** Further analysis will determine whether resting, infection status, and energy balance are confounded by varying degrees of food availability.

## Methods

To isolate parasite species from 51 formalin-preserved fecal samples, we used sedimentation and direct smear techniques with microscope-assisted visualization. We assayed C-peptide of insulin from 260 urine samples, and recorded resting behavior during focal follows on 22 individual animals from four groups of blue monkeys at two sites in Kibale National Park, Uganda.

**Future research**

- What factors influence energetic balance?
- How does parasitic infection affect host behavior?
- Can parasitic infection decrease reproductive success?


## Acknowledgements

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