Testing the Impacts of Prey-Size on a Gape Limited Predator

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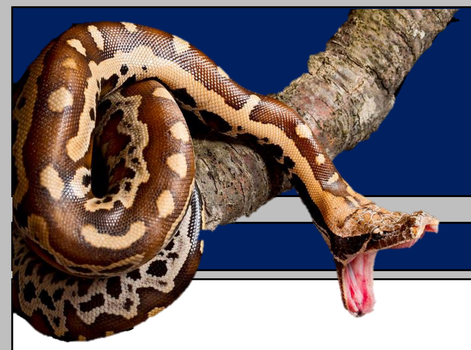

Introduction

- Snakes are a well-known group of elongated, limbless reptiles. Snakes are also well known for being gape-limited predators; they cannot chew food but instead, swallow it whole.
- Despite this limitation, many snakes are capable of ingesting considerably large prey. For constricting snakes, this presents an increased challenge for subduing and ingesting prey as they get larger and larger.
- As prey size increases, snakes face increasing risks of injury or failure. Further, as prey size increases, snakes are likely to face exponentially increasing ingestion durations as they approach the limitation of their ingestion capabilities.
- To test this, we presented Borneo Pythons (*Python breitensteini*) with two different prey sizes (2 and 15% relative prey mass) in order to quantify the constriction pressures that they exert on their prey.
  - Further, we tested the overall time to ingest each prey item. The ingestion duration is from the first swallow to the time the tail is gone.

Materials and Methods

Juvenile Borneo Pythons (*Python breitensteini*)
- Body Mass: 2165-3185 grams

Prey: cadaveric Norway rats (*Rattus norvegicus*)
- Cadaveric rodents warmed to normal body temperatures
- "small" = 2% relative snake mass
- "large" = 15% relative snake mass

Each snake was randomly chosen for one of the two feeding groups

When offered prey, we recorded:
- Maximum constriction pressure (mm Hg)
- Ingestion duration (in seconds)

Statistical Analyses

Independent Variable: Prey size

Dependent Variables: maximum constriction pressure, ingestion duration, and number of jaw cycles
- For comparisons between each set of variable we used 2-sample t-test.

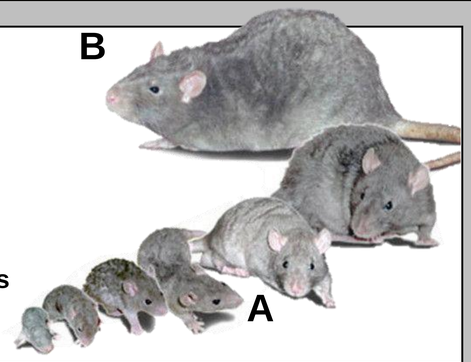

Figure 1– Ontogenetic size-series of *Rattus norvegicus* showing the relative size difference of prey offered to *Python breitensteini*. Small prey were 109 grams (A) while large prey were 374 grams (B).

Results

In general, all *P. breitensteini* did not display any differences in approaching prey, striking, or forming their constriction coils.
- All snakes struck the anterior portions of their prey and quickly retracted it into their coil (Fig 2).
  - All snakes feeding on small prey used only one loop in their coil (Fig 2).
  - 3 of the 5 snakes used 1.5 loops when feeding on large prey

Constriction Performance:
- Snakes constricting large prey constricted with similar pressures (278±94 mm Hg) as snakes constricting small prey (315±98 mm Hg; t_8=0.6, p>0.57).

Ingestion Duration:
- Snakes feeding on large prey took significantly longer (844±382 seconds) to ingest their prey compared to snakes feeding on small prey (284±123 seconds; t_8=3.11, p<0.02).

Figure 2. Typical constriction postures from Python breitensteini. Snakes hold prey within their coil and typically apply 1 loop around their prey using the lateral side of their body.

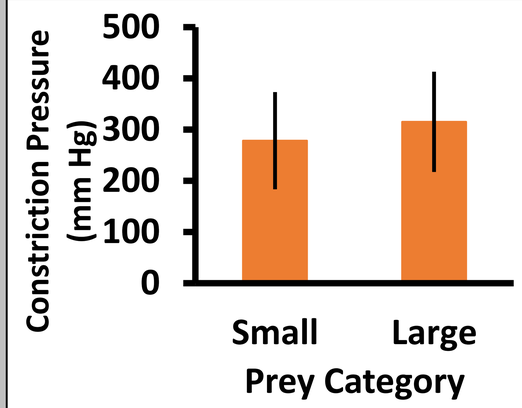

Figure 3. Maximum constriction pressure (average ± 1 standard deviation) for 10 *P. breitensteini* fed small (n=5) and large (n=5) *R. norvegicus*.

Figure 4. Ingestion duration (average ± 1 standard deviation) for 10 *P. breitensteini* fed small (n=5) and large (n=5) *R. norvegicus*.

Discussion

Larger prey are more dangerous, however, our snakes did not squeeze them any harder
- Perhaps already using maximal performance?
- Moderate squeezing is good enough?

Eating larger prey takes longer than smaller prey
- Takes more time and energy
- Higher chance to be attacked while feeding

Larger prey were 7.5 times heavier but took only 3 times the duration to ingest.
- Large food might be the safest prey?

References and Acknowledgments

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References

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2. Penning, David. (2017). The gluttonous king: the effects of prey size and repeated feeding on predatory performance in kingsnakes. Journal of Zoology. 302. 10.1111/jzo.12437.