Does dietary nitrogen intake impact microbial nitrogen handling in the Pacific spiny dogfish?

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BACKGROUND

Marine elasmobranchs have high nitrogen requirements due to their use of urea as an osmolyte (1).

Urea-N recycling through the vertebrate gut microbiome has proven efficient in other vertebrates with high nitrogen requirements and is regulated by dietary nitrogen intake (2).

Microbial amino acids contribute significantly to total amino acid absorption in nitrogen deficient birds and mammals (3,4).

METHODS

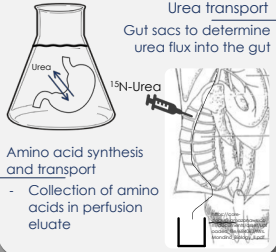
Treatment groups:
- High N diet
- Low N diet

Urea synthesis:
- Tissue samples for ornithine-urea cycle enzyme activities

Urea hydrolysis:
- Rate of breakdown from ^{15}N-Urea → ^{15}N-ammonia in the gut

Urea transport

Gut sacs to determine urea flux into the gut



Amino acid synthesis and transport
- Collection of amino acids in perfusion eluate

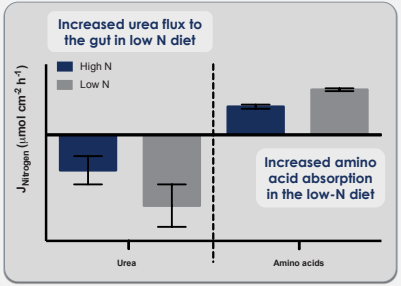
OBJECTIVE

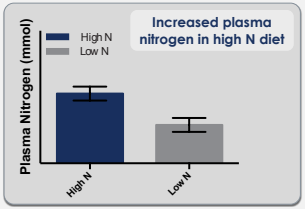
To determine how dietary nitrogen (N) intake influences cooperative nitrogen handling between an elasmobranch host and microbial gut symbionts

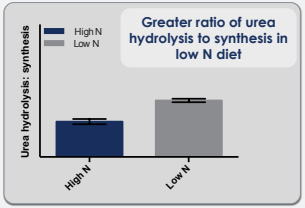
HYPOTHESIS

1. Microbial amino acid synthesis occurs in the elasmobranch gut
2. Changes in dietary nitrogen intake will result in altered nitrogen transport across the gut
   - Prediction 1: ↑ nitrogen intake = ↑ nitrogen transport into the lumen
   - Prediction 2: ↑ nitrogen intake = ↑ microbial amino acid uptake

EXPECTED RESULTS

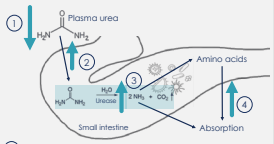






CONCLUSIONS

Low N diet:



1. Whole body circulating N will decrease
2. ↑ N transport to the gut
3. ↑ Urea hydrolysis: synthesis ratio
4. ↑ Amino acid absorption

Impacts

This research will contribute to our current understanding of nitrogen handling in elasmobranchs, the role of the fish microbiome in nutrient partitioning and the idea of a universal nitrogen recycling mechanisms in vertebrates.

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References

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