Struvite Stones and the Microbiome

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Introduction

Endogenously produced mineral concretions, form in concentric rings around a foreign object (nudus). Enteroliths occur in the right dorsal colon of horses while uroliths occur along the urinary tract of dogs and cats. The stones are the most common type of urinary stone in dogs, 2nd most common type in cats.

Purpose

• Urolithiasis occurs in a vast array of species
• Primary stones that occur in dogs and cats are struvite and CaOx
• Struvite is the common denominator, but stone characteristics have not been compared at depth
• Insight into the disease processes can be used in the clinical setting, optimizing treatment options
• Methods can be applied to other types of urinary stones.
• Translational applications exist for both humans and many veterinary species.

Methods

Sample Selection

Samples selected using the stone database of the Gerald V. Ling Urinary Stone Analysis Laboratory at UC Davis. For each sample, the mineral composition of the layers and the core had been determined by the lab using optical crystallography with polarizing light microscopy.

Results: RNA Extraction from Enteroliths and Uroliths

By optimizing the methods used for RNA extraction we were able to increase both the concentration and quality of the RNA extracted.

1. Eliminating step 2 preserves more sample RNA.
2. The acidic buffer likely degraded some of the RNA previously.
3. Each sample was crushed whole to detect the presence or absence of RNA within each stone.
4. Separating different urolith layers by hand is not feasible.

Results: RNA Extraction from Enteroliths and Uroliths

Results: RNA Extraction Optimization

Conclusion and Future Directions

Future Directions:

Deep RNA metagenomic sequencing is currently underway for the canine and feline urolith samples along with more enterolith samples.

1. Determine the relative abundance of struvite producers in both the canine and feline uroliths and compare to enterolith data.
2. Work to determine function using transcripts from the metagenome. The transcripts allow identification of genes associated with stone formation. The stones contain a microbial community that likely helps facilitate struvite formation both in the equine GI tract and the canine/feline urinary systems.

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