Investigating the Effects of Kidney Stones on our Microbiome: Lactobacilli Growth in the Presence of Oxalate

Rayan Haque, Layla Jeries, Tatyana Sysoeva
Department of Biological Sciences

Overview
Lactobacillus is a genus of bacteria that might play an important role in the prevention of urinary tract infections via uropathogen inhibition in humans. Oxalate is a compound that causes kidney stones via formation of insoluble calcium oxalate forms in the urinary tract. Research into the effects of oxalate on the growth of urinary lactobacilli could provide vital insights regarding the relationship between kidney stones formation and UTIs as well as possible probiotic treatments to kidney stones. We aimed to determine the effect of oxalate on the growth of two strains of lactobacilli isolated from human urine (L. gasseri and L. delbrueckii).

Methods

Growth media:
- Light MRS (LMRS) and Dark MRS (DMRS) broth prepared and autoclaved for 20 min and 35 min respectively (Fig. 1)

Starter cultures:
- Liquid cultures of L. gasseri and L. delbrueckii grown in either broth for 48 hours under static conditions

Recorded growth in 96-well plates in plate reader:
- Inoculated lactobacilli cells at 1:10 and 1:100 dilutions (Fig. 2)
- 24 hours at 37° C with readings taken every 15 min
- Plate shaken in a double orbital pattern prior to each read
- Sodium oxalate to the final concentration of 10 mM or water added to the growth media (Fig. 3-4)

We thank Dr. Vogler and David Cook of the RCEU staff, the UAH office of the President, UAH Office of the Provost, UAH Office of the Vice President for Research and Economic Development, Dean of the College of Science, Dean of the College of Engineering, and the Alabama Space Grant Consortium for funding this project. We also thank the members of the Sysoeva Lab for all their guidance and support.

References
2. Images created with BioRender.com

Conclusions
We saw some inhibition of growth in the presence of oxalate for both strains of lactobacilli. However, there were exceptions to this trend in wells that were prepared with 1:100 dilutions of starter culture. This could suggest that the initial density of lactobacilli in a urinary microbiome determines the effect oxalate will have on lactobacilli growth. Future experiments could observe the growth over longer times to ensure the entire growth curve is being accounted for. The unusually long lag phase for many of the samples could also addressed in the future.

Results

- There are differences in urinary lactobacilli growth between LMRS and DMRS as well as with and without oxalate (Fig. 5)
- Continuous measurement of urinary lactobacilli growth is complicated by cell-cell aggregation at different growth stages (Fig. 6) that affects measurements of turbidity

Acknowledgements
We thank Dr. Vogler and David Cook of the RCEU staff, the UAH office of the President, UAH Office of the Provost, UAH Office of the Vice President for Research and Economic Development, Dean of the College of Science, Dean of the College of Engineering, and the Alabama Space Grant Consortium for funding this project. We also thank the members of the Sysoeva Lab for all their guidance and support.