Interactions of commensal urinary lactobacilli with urinary pathogens

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Urinary tract infection (UTI)

• 170 Mil worldwide and 6-7 Mil cases in the U.S. annually

• 15% of all antibiotic prescriptions

• increasingly multidrug resistant

• 20% of hospital-associated infections

Öztürk&Murt, 2020, Epidemiology of urological infections: a global burden
Urinary tract infection (UTI)

- UTIs are caused by enteric bacteria

- main causative bacteria (uropathogens):
  - uropathogenic *Escherichia coli* (UPEC)
  - *Klebsiella pneumoniae*
  - *Enterococcus faecalis*
Urinary microbiome and UTI

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Urinary microbiome and UTI

- Urine is not sterile!
- Bladder microbiome contains a variety of bacteria
- Lactobacilli frequently dominate
Urinary microbiome and UTI

• urinary microbiome is variable among people; changing with time

• associated with benign urinary conditions and cancers
Urinary microbiome and UTI

- UTIs might depend on urinary microbiome

Can bladder microbiome interfere with urinary tract infections?
Urinary microbiome

- We collected a repository of urinary bacteria using EQUC method

- Have 27 *Lactobacilli strains* from 7 different species

Lactobacilli – lactic acid forming bacteria
Food, probiotics, our microbiome
Lactobacilli as ‘good bugs’

- food fermentations
- food preservation from spoilage
- probiotic for ‘gut health’
- feed additives for livestock
- test for vaginal health ‘probiotics’
Lactobacilli as ‘good bugs’

Why?

• lactic acid forming bacteria -> acidify the environment -> inhibit growth of other microbes

• form hydrogen peroxide -> inhibit growth of other microbes

• produce various toxins (bacteriocins) -> inhibit growth of other microbes
Can bladder microbiome interfere with urinary tract infections?

Can urinary lactobacilli inhibit urinary pathogens?
Inhibition assay

lawn (full growth of target bacterium)

test solution (drug, other bacteria)

zone of inhibition (killing or inhibition of target bacterium)
Inhibition assay

lawn of uropathogen

lactobacillus culture

zone of inhibition (killing or inhibition of target bacterium)

zone of inhibition
Unpublished data (not shown)

• Testing first urinary lactobacilli shows a wealth of interactions between urinary commensal bacteria and uropathogens, including multidrug resistant pathogens

• The interactions are not unique to selected isolates and appear to be more general amongst urinary lactobacilli
What will come out of this research?

• establishing functional interactions within urinary microbiome and potential impact of these interactions on UTI development

• analysis of the mechanisms of urinary bacterial interactions

• in a long run, these microbiological studies will identify whether it is possible to detect people predisposed to recurrent UTIs and find novel ways to prevent and treat UTIs via microbiome modulation
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