Cigarette Smoking is Associated with an Altered Metabolomic Profile in the Vaginal Tract

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Annual Global Number of Cigarettes Smoked Per Person:

- 21% of global population age ≥15 smoke tobacco

Global Percentage of Female Smokers:

- 250 million women world wide smoke daily

Tobacco Use Negatively Impacts Health:

- Impaired sense of smell
- Cancer of lips and mouth
- Lung cancer
- Asthma
- Chronic obstructive pulmonary disease
- Esophageal cancer
- Stomach cancer
- Larynx cancer
- Heart disease
- Cervical cancer
- Early menopause
- Reduced fertility

WHO, 2014

The Vaginal Microbiome & Bacterial Vaginosis (BV):

- Most common vaginal disorder amongst reproductive aged women
- Amsel Criteria
  - Fishy odor
  - Vaginal pH >4.5
  - Discharge
  - Clue cells
- Associated with:
  - Pre-term birth (PTB)
  - Miscarriage
  - Pelvic inflammatory diseases

Vaginal Microbiome

- Community of native bacteria that colonize the vaginal tract
- First line of defense against contracting vaginal diseases
The Vaginal Microbiome: Community State Types (CST)

- CST I: 27%
- CST II: 6%
- CST III: 35%
- CST IV: 27%
- CST V: 5%

The low Lactobacillus Community State - CST IV:

CST IV is characterized by:
- Higher diversity of anaerobic Species
- Prevotella
- Dialister
- Streptococcus
- High pH – 5.3
- Associated with increased risk for common urogenital disorders & STIs

Smoking and the Vaginal Microbiome:

- Part 1 – How does smoking impact the vaginal microbiome?
- Part 2 – How does smoking affect the vaginal metabolome?

Smoking Negatively Affects the Microbiome:

50% of smokers versus 15% of non-smokers were classified to vaginal CST-IV (low-Lactobacillus)

Smoking and Reproductive Health:

- How does smoking impact the vaginal tract and women’s reproductive health?
- Part 1 – How does smoking impact the vaginal microbiome?
- Part 2 – How does smoking affect the vaginal metabolome?
Metabolome: Complete set of small-molecule chemicals found within a biological sample

Metabolome is Closely Tied to Phenotype: The central dogma of biology

Sampling Method for Metabolomics: 619 metabolites were detected

Tobacco Constituents are Much Higher in Smokers

Accumulation of TCA Related Compounds in CST IV Smokers:
Accumulation of Vitamin B Compounds in CST IV Smokers

- Pyridoxate (Vitamin B6)
- Riboflavin (Vitamin B2)
- Pantothenate (Vitamin B5)

Log Relative Concentration of Vaginal Metabolites +/- SE

Biogenic Amines are Increased in CST IV Smokers

- L-Lysine
- Cadaverine
- Putrescine
- Agmatine
- Ornithine
- Putrescine
- Tyramine
- Tyrosine

Key:
- Non-smoker
- Smoker


Conclusions:
- Smoking associated with a disrupted microbiota
- Increases odds of being categorized as CST IV
- Smoking directly affects the vaginal metabolome
- Nicotine and breakdown compounds present in vagina
- Vitamin B is increased in smokers vs non-smokers suggesting uptake deficiencies
- Biogenic amines are increased in smokers vs non-smokers

Acknowledgements

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Dr. Carl Yeoman, Montana State University
Dr. Tiffanie Nelson, Montana State University
Dr. Jacques Ravel, University of Maryland
Dr. P Gajer, University of Maryland
Questions?

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Amino acids

Shifts in Amino Acid Metabolism – Implications for Health:

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