



CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

Name(s) Rebekah J. Park	Project Number 38428
Project Title The Biological Function of Menthol, a Urinary Odor Compound Specific to Chronic Inflammation in Interstitial Cystitis	
Abstract Objectives/Goals Interstitial cystitis (IC) is a serious bladder syndrome characterized by frequent urination, bladder discomfort, and pelvic pain. A potential systemic risk factor for IC is chronic inflammation; however, the underlying odor-mechanisms through which a healthy bladder is able to protect itself from inflammatory triggers remains largely unknown and relatively unstudied. Gas chromatography-mass spectrometry has become increasingly attractive in the detection of odor in skin, tissue, breath, feces, and bodily fluids, with several previous studies showing well-trained dogs capable of detecting specific volatile compounds and distinguishing cancer patients from healthy controls. Urine has long been one of the most attractive biomarker sources for such disease detection. The goals of this study are to profile urinary odor compounds of IC patients and healthy controls, and to understand the biological function of the IC-specific volatile organic compounds in the urine. Methods/Materials Comprehensive solid phase micro extraction-gas chromatography-time-of-flight mass spectrometry profiling combined with comprehensive bioinformatics analyses were used to analyze the levels of urinary volatile metabolites in IC patients compared to those in healthy controls. Various biochemical analyses such as cytokine profiling, western blot analysis, and microarray were performed for further functional validation. Results Among the metabolites, menthol, in particular, showed a significantly reduced level in IC patients. To understand this mechanistic meaning of menthol, I performed cytokine profiling and DNA microarrays. The findings were suggestive of inflammatory events and the activation of signaling networks being suppressed by urinary menthol in immune cells resident in bladder. Further validation by biochemical experiments and western blot analyses confirmed that menthol reduced the expression of cytokines and activation of signaling pathways closely associated with inflammation. Conclusions/Discussion These detailed findings deepen our knowledge on the role of urinary menthol in suppressing inflammatory events, suggesting new potential strategies for the alleviation of the odor, inflammation, and pain associated with IC.	
Summary Statement This study aimed to identify IC-associated urinary odor compounds and further examine their biological meaning in the bladder epithelium using comprehensive and unbiased metabolomics and bioinformatics analyses.	
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