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Untargeted metabolomics reveals smokers' characteristic profiles

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Smoking-related biomarkers for lung cancer and other diseases are needed to enhance early detection strategies and to provide a science base for tobacco product regulation. An untargeted metabolomics approach by ultra-performance liquid chromatography-quadrupole-time of flight mass spectrometry (UHPLC-Q-TOF MS) totaling 957 assays was used in a novel experimental design where 105 current smokers smoked two cigarettes one hour apart. Blood was collected immediately before and after each cigarette allowing for within-subject replication. Dynamic changes of the metabolomic profiles from smokers' four blood samples were observed and biomarkers affected by cigarette smoking were identified. 31 metabolites were definitively affected by acute effect of cigarette smoking, uniquely including menthol-glucuronide, the reduction of glutamate, oleamide and 13 glycerophospholipids. This first time identification of a menthol metabolite in smokers' blood serves as proof-of-principle for using metabolomics to identify new tobacco-exposure biomarkers, and also provides new opportunities in studying menthol-containing tobacco products in humans. Gender and race differences were observed. Network analysis revealed 12 molecules involved in cancer, notably inhibition of cAMP. Furthermore, boost of plasma methyl metabolite was investigated in relation to smoking behavior and metabolomic profiles. It is a new smoking behavior biomarker that may provide specificity over self-reported use of menthol cigarettes by integrating different smoking measures for understanding smoking behavior and harm of menthol cigarettes. These novel tobacco-related biomarkers provide new insights to the effects of smoking which may be important in carcinogenesis but not previously linked with tobacco-related diseases.

Biography

Ping-Ching Hsu is currently an Assistant Professor at University of Arkansas for Medical Sciences. Her research focuses on biomarker discovery using multi-omics to evaluate the biological effect of tobacco products including cigarettes and e-cigarettes smoking in the population in order to develop cancer prevention strategies. She received Post-doctoral training at Ohio State University and her PhD from Georgetown University.

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