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Xylene exposure assessment from tobacco smoke and diet: Analysis of NHANES 2005-2006 and 2011-2012

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Statement of the Problem: Xylene is a ubiquitous volatile organic compound (VOC) used in various products and industries. It is also a known neurotoxicant and respiratory irritant. Xylene is a constituent of tobacco smoke; inhalation of tobacco smoke causes xylene exposure. Two xylene metabolites can be measured in urine, 2-methylhippuric acid (2MHA, o-xylene), and 3- & 4-methylhippuric acid (34MH, m- & p-xylene). The metabolic conversion of xylene to its methylhippuric acid metabolites is carried out by glycine-N-acyltransferase (GLYAT). This pathway is known to play a role in the metabolism of fatty acids and flavonoids. We aim to assess the general U.S. population exposure to xylene, and to examine how diet and tobacco smoke may influence these biological marker levels.

Methodology & Theoretical Orientation Findings: Urine specimens were obtained during the National Health and Nutrition Examination Survey 2005-2006 and 2011-2012 cycles from participants ≥6 years-old (N = 5,815) and analyzed for 28 VOC metabolites, including 2MHA and 34MH using ultra-high-performance liquid chromatography/tandem mass spectrometry. Participants who exclusively used combusted tobacco products ("smokers") were distinguished from non-users through a combination of self-report and serum cotinine measurement data. Sample-weighted median urinary 2MHA levels among non-users were 27.21 μg/g creatinine versus 84.87 in exclusive smokers, and 169.25 μg/g creatinine to 685.56 μg/g creatinine in 34MH, respectively. Multiple regression models characterized the association of urinary 2MHA and 34MH with serum cotinine and other factors of interest. Dietary consumption of vegetables and was found to have significant decrease on 2MHA and 34MH levels with chocolate consumption significantly increased 2MHA and 34MH levels among exclusive tobacco smokers (p=0.0065,0.0034 and 0.0014,0.002 respectively).

Conclusion & Significance: We confirm that tobacco smoke is a significant source of xylene. The observed significant findings among dietary factors may be related to smoking behaviors or potentially related to the shared metabolic pathway among xylene and chocolate.

Biography

Daniel Milan is a current PhD student at Mercer University College of Pharmaceutical Sciences, and an ORISE Fellow at the Centers for Disease Control and Prevention, Tobacco and Volatiles Branch, Volatile Organic Compounds Laboratory. His academic focus is the development of mass spectrometry-based assays to conduct biomonitoring studies.

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