Integrated Exposure Assessment of Sewage Workers to Genotoxicants: An Urinary Biomarker Approach and Oxidative Stress Evaluation

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Abstract:

Background: Sewage workers are exposed to multiple chemicals among which many are suspected genotoxicants. Therefore, they might incur DNA damage and oxidative stress. We aimed to explore integrated biomarkers of exposure and of early effects, respectively, among sewage workers, assessing the overall urine genotoxicity by *in vitro* comet and micronucleus assays and measuring urinary 8-oxo-2'-deoxyguanosine (8-oxodG).

Methods: During three consecutive working days, polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs) were sampled in workplace air of 34 sewage and 30 office workers, as indicators of airborne exposure. The last day, subjects collected their 24hr urine. Genotoxicity of urinary extracts was assessed by comet and micronucleus assays on a HepG2 cell line. Using competitive enzymatic immunoassay we evaluated the 24hr urinary 8-oxodG excretion. Benzo(a)pyrene [B(a)P] toxicity equivalent factors and inhalation unit risk for B(a)P and benzene were used to give an estimate of cancer risk levels.

Results: Workplace air concentrations of PAHs (e.g. 23.7 [range 2.4-104.6] ng.m⁻³ for fluoranthene) and VOCs (e.g. 19.1±2.9 [standard error] μ .m⁻³ for benzene) were elevated in sewage compared to office workplaces (*P*<0.01) and corresponded to an increased lifetime cancer risk. The urinary extracts of sewage workers showed higher genotoxicity (*P*<0.001) than office workers. Although not statistically greater than among office workers, the 24hr urinary 8-0xodG mean levels among sewage workers were associated (*P*=0.04) with years of work in the sewage system.

Conclusions: The integrated and non-specific urinary biomarkers showed that sewage workers experience exposure to mixtures of genotoxicants in the workplace, and suggest a DNA oxidative stress that might increase with work seniority.