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ASSESSMENT OF ELECTRONIC CIGARETTES AS A SOURCE OF EXPOSURE TO ACROLEIN

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Significance: Acrolein (also known as propylene aldehyde or 2-propenal) is a highly reactive chemical that causes irritation to the nasal cavity, and damage to the lining of the lungs and is thought to contribute to cardiovascular disease in cigarette smokers. Electronic cigarettes (e-cigarettes) are battery-powered devices that deliver vaporized nicotine, usually in propylene glycol or glycerin. Since acrolein may be formed as a result of heating glycerin, we examined the hypothesis that inhalation of e-cigarette vapor leads to exposure to acrolein. Aim of the study: The aim of this study was to assess exposure to acrolein from e-cigarette smoking.

Materials and methods: Vapors were generated from 12 brands of e-cigarettes in controlled laboratory conditions using modified smoking machine. Acrolein was extracted from aerosol to solid phase with 2,4-dinitrophenylhydrazine (DNPH) and analyzed with high-performance liquid chromatography with spectrophotometric DAD detector. To compare levels of acrolein in e-cigarette aerosol and mainstream smoke of conventional cigarette we assumed that 15 puffs from an e-cigarette (typical use pattern) would correspond to smoking one conventional cigarette. S-(3-hydroxypropyl)mercapturic acid (3-HPMA), a metabolite of acrolein, was measured in urine of 20 e-cigarette users and 20 tobacco cigarette smokers with liquid chromatography/tandem mass spectrometry method.

Results: The levels of acrolein in e-cigarette vapor ranged from 0.07 to 4.19 µg per 15 puffs, which about 4 times lower than levels in cigarette smoke. The average urine 3-HPMA concentration in e-cigarette users was 308 (IQR 134-516) ng/mg creatinine and was significantly lower than in tobacco cigarette smokers (822 (IQR 464-1,423) ng/ mg creatinine; p<0.05).

Conclusions: Our findings suggest that e-cigarette vapor is a source of acrolein, however the level of exposure is less than that from a conventional cigarette. Substituting tobacco cigarettes with electronic cigarettes may substantially reduce exposure to acrolein. Further research is needed to evaluate long term effects of inhalation exposure to acrolein from e-cigarettes.

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