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Ramping up e-cigarette voltage produces more formaldehyde -study

BY **TONI CLARKE**

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Jan 21 (Reuters) - People who smoke high-voltage e-cigarettes have greater exposure to formaldehyde, a suspected carcinogen, than those who keep the voltage low, according to a study published in the New England Journal of Medicine on Wednesday.

The study, which critics say is misleading and lacks context, is the latest contribution to a debate on the safety of e-cigarettes that has so far has yielded little long-term data, though most experts believe they are less toxic than

combustible cigarettes.

Researchers from Portland State University took flavored nicotine liquid made by Halo Cigs, a private company, and tested it in a personal vaporizer from Innokin. The vaporizer allows consumers to adjust the voltage from 3.3V to 5.0V. The higher the voltage the greater the nicotine kick, but also the greater the amount of formaldehyde.

E-cigarette liquids typically contain propylene glycol, which when heated is known to release formaldehyde gas. "Vaping" at high voltage also produced formaldehyde-containing compounds known as hemiacetals, the researchers found.

Formaldehyde inhaled as a gas been associated with an increased risk of leukemia and nasopharyngeal cancer, which affects the upper part of the throat behind the nose.

It is not known exactly where formaldehyde contained in hemiacetals gets deposited in the body or whether it is similarly toxic, said James Pankow, one of the study's authors.

"There has never been a cancer study with hemiacetals," Pankow said in an interview.

Absent such a study, the authors estimated the formaldehyde-related cancer risk associated with e-cigarettes by extrapolating from data on formaldehyde in cigarettes.

They concluded that the life-time risk of developing formaldehyde-related cancer at roughly 1 in 200 for high-voltage e-cigarettes versus 1 in 1,000 for cigarettes - at least five times higher. They found no increased risk for people vaping at a low voltage.

Dr. Neal Benowitz, a nicotine expert at the University of California, San Francisco, said the study could prove useful to the U.S. Food and Drug Administration as it prepares to regulate e-cigarettes, potentially including limits on formaldehyde.

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But he questioned the legitimacy of comparing the effect of formaldehyde delivered in a cigarette to that delivered via hemiacetal, in droplet form, in an e-cigarette. The effect on organs could be entirely different, he said.

Other critics said that in the real world most "vapers" do not push the voltage to the levels seen in the study as the taste would become unpalatable. They also noted that the overall health risk of conventional cigarettes, which contain 70,000 toxins in addition to formaldehyde, is far greater than any formaldehyde risk associated with e-cigarettes.

"Lifelong smokers face a greater than 1 in 2 chance of dying from smoking-related diseases, including a roughly 1 in 10 chance of dying from lung cancer," said Jed Rose, director of the Center for Smoking Cessation at Duke University Medical Center.

Pankow conceded that the study could have contained more context about overall relative risk, but said the authors "just wanted to get it out."

They submitted it to the NEJM in the form of a letter, which a spokeswoman for the journal said was peer-reviewed. Pankow said letters tend to be less detailed than other studies.

David Abrams, executive director of the Schroeder Institute for Tobacco Research and Policy Studies at the anti-tobacco group Legacy, said he was concerned the study would be taken out of context "in the worst possible way."

For most vapers who use e-cigarettes as intended, he said, the findings show "there are non-detectable levels of formaldehyde ... which means people can use them to help them quit smoking lethal cigarettes."

(Reporting by Toni Clarke in Washington; Editing by Michele Gershberg and Richard Chang)

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