

A few months of vaping puts healthy people on the brink of oral disease

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Scientists who've taken the first look at bacteria in young and healthy vapers' mouths say that the potential for future disease lies just below the surface.

The collection of oral bacteria in daily [e-cigarette](#) users' mouths is teeming with potent infection-causing organisms that put vapers at substantial risk for ailments ranging from [gum disease](#) to cancer, researchers found.

Though they didn't have active disease, participants' oral bacteria composition resembled that of people with periodontitis, a gum infection that can lead to tooth loss and, left untreated, is a risk factor for heart and lung disease.

The damaging effects were seen with or without nicotine, leading the scientists to believe that the heated and pressurized liquids in e-cigarette cartridges are likely the key culprit in transforming vapers' mouths into a welcoming home for a dangerous combination of microbes.

"Vaping is such a big assault on the oral environment, and the change happens dramatically and over a short period of time," said Purnima Kumar, professor of periodontology at The Ohio State University and senior author of the study.

Even longtime current and former cigarette smokers in the study, whose tobacco habit would have given disease-causing microbes easier access to the mouth, had the more damaging oral profiles linked to vaping after only three to 12 months of e-cigarette use. Kumar said this finding calls into question claims that vaping reduces the harm caused by smoking.

"If you stop smoking and start vaping instead, you don't move back toward a healthy bacterial profile but shift up to the vaping profile," she said. "Knowing the vaping profile is pathogen-rich, you're not doing yourself any favors by using vaping to quit smoking."

The research is published today in the journal *Science Advances*.

The researchers collected plaque samples from under the gums of 123 people who showed no current signs of oral disease: 25 smokers, 25 nonsmokers, 20 e-cigarette users, 25 former smokers using e-cigarettes and 28 people maintaining both cigarette smoking and vaping habits at the same time.

The bacteria below the gums are the last line of defense against disease because they are the least likely to be disrupted by environmental changes in the mouth, such as food, toothpaste and tobacco.

Kumar and colleagues conducted DNA deep sequencing of the bacteria genomes to identify not just the types of microbes living in those mouths, but also what their functions were.

The profile of the oral microbiome in the vapers who had never smoked, who were young (age 21-35) and healthy and had used e-cigarettes for four to 12 months, was startling to the researchers.

The most concerning characteristics were the levels of stress in the microbial community, which were detected by the activation of genes that contribute to the creation of a mucus-like slime layer surrounding bacterial communities. The immune system is used to seeing assembled bacteria look like clearly defined communities, but Kumar said that in e-cigarette users, these communities cloaked in slime look like foreign invaders and trigger a destructive inflammatory response.

She said this change in the microbial landscape—accompanied by higher levels of proteins in vapers' mouths that signaled the immune system was on standby to activate and produce inflammation—exponentially increases the likelihood for disease.

"The reason we're all healthy is because our immune system has recognized these bacteria and their functions since birth and has

established a sense of harmony," Kumar said. "The problem is when you throw a curve ball with an environmental shift like this, your [immune system](#) doesn't recognize the bacteria as friends anymore. You have to call the police on them, and that causes a huge inflammatory response."

After that finding, Kumar and colleagues hoped to find that people who had replaced or supplemented cigarette smoking with vaping might be better off using e-cigarettes. Instead, they found that people who had traded cigarettes for a vape pen had a more vape-driven microbial profile.

"And if you smoked and vaped at the same time, which of these two effects overwhelms your system? It was vape," Kumar said.

A longer duration of the vapers' habit, with or without the use of nicotine or flavoring agents, made the oral conditions more severe.

Knowing the bacteria samples represented a snapshot of a person's oral environment, the scientists used a "fake mouth" to validate what they had found in the human participants. They created conditions simulating normal oral [bacteria](#) in artificial saliva and introduced a vape cloud or clean air to the fake [mouth](#).

The presence of e-cigarette aerosol set in motion development of the more harmful bacterial profile seen in human vapers' mouths. And the nicotine-free aerosol consisting of glycerol and glycol, viscous sugar alcohol fluids that generate the cloud when vapers exhale, functioned as a nutrition source to fuel the altered oral environment.

"To mimic a smoking effect, the glycerol-glycol combination holds the nicotine to your throat to give you that sensation of a nicotine hit, and it produces a giant vapor cloud. It's a very essential component of vaping," Kumar said. "I'm not saying nicotine is good for you. But even without

the nicotine, [vaping](#) has a pretty large impact on the bacterial communities our bodies have regarded as friends."

More information: S.M. Ganesan et al., "Adverse effects of electronic cigarettes on the disease-naïve oral microbiome," *Science Advances* (2020). advances.sciencemag.org/content/6/22/eaaz0108

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