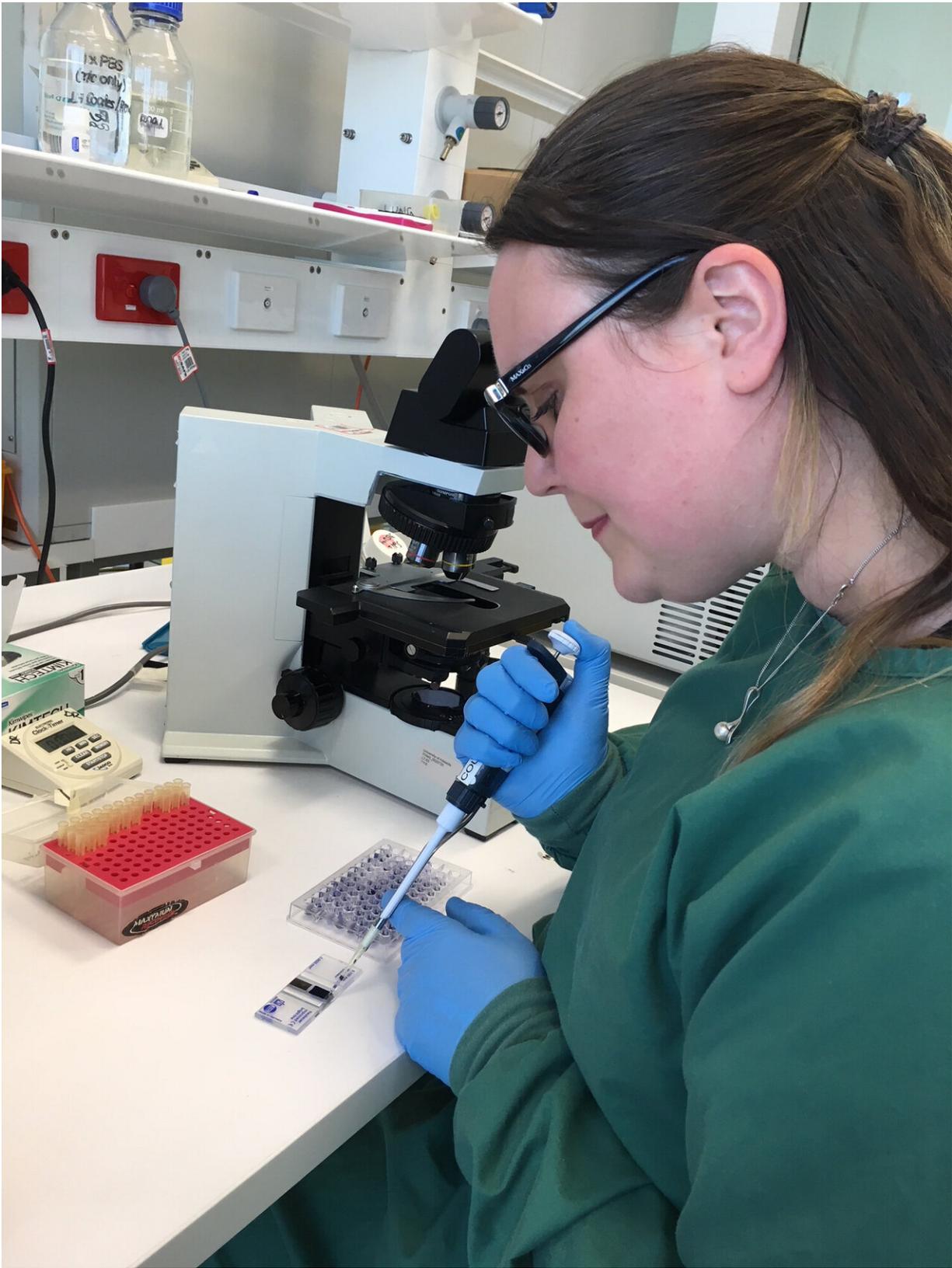


Names of vape flavors obscure toxic ingredients

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Miranda Ween. Credit: University of Adelaide

The flavor on the bottle of E-liquids is no indication of the potentially harmful effects of one compared with another.

Dr. Miranda Ween from the University of Adelaide and South Australia's Royal Adelaide Hospital led a study, in collaboration with Dr. Laura E. Crotty Alexander at the University of California San Diego, to investigate the lung health risks of E-cigarette vapor from a number of different flavored E-liquids.

"We studied the level of toxicity from 10 different flavored E-cigarette vapors to the cells that line the lungs and how lung [immune cells](#)—macrophages—cleared away bacteria from healthy non-smoking donors, replicating the possible harm to non-smokers who use E-cigarettes," said Dr. Ween.

"Lung cell toxicity and bacterial clearance by macrophages was affected by almost every flavor, but some such as mango and tobacco showed minimal toxicity and immune effects."

"Banana had moderate effects, and chocolate in particular had an unexpectedly high impact, killing almost all the cells and blocked the ability of macrophages to clear away bacteria almost entirely."

E-liquid is made up of propylene glycol, vegetable glycerine, and flavorings, and, outside Australia, often sold containing nicotine. Battery operated E-cigarettes heat the E-liquid to produce an aerosol, commonly known as vapor, that the 'vaper' inhales. They were designed to replace cigarettes and thus deliver aerosol vapor directly to the consumer's lungs. However, their popularity amongst never-smokers is increasing with 6.9

percent of non-smoking Australians having tried one by 2019. Ninety percent of E-cigarette products sold globally are made in China. In 2019, the global E-cigarette market was valued at US \$12.41 billion and is expected to expand.

"Ninety-nine percent of E-cigarette liquids are flavored. To create these flavor profiles, companies are adding multiple chemicals to achieve that 'perfect' taste," said Laura Crotty Alexander, MD, associate professor of medicine in the Division of Pulmonary, Critical Care and Sleep Medicine at University California San Diego and Section Chief of Pulmonary Critical Care at the VA San Diego Healthcare System. "These chemicals have been found to be toxic to the lungs. When inhaled, they wreak havoc on the lungs and affect specialized protein levels that help keep the body's immune system on track."

With thousands of different flavors ranging from the simple sounding banana and mango to the more ambiguous such as Unicorn Puke and Stoned Smurf, and ingredients not required to be listed on the bottle, it is impossible for users to know what they are inhaling.

"Our study demonstrated to us that the name on the bottle is not what is important, it is what goes into the E-liquids and put into E-cigarettes which matters," said Dr. Ween.

"The flavoring chemicals included, how many different ones are in the E-liquid, and how much of each goes into an E-liquid can all contribute to how much damage they may be doing to the lungs."

Further study into a number of chocolate and banana flavored E-liquids made by several companies showed that the toxicity and immune effects were not the same between brands, and mass spectrometry analysis showed that the flavoring chemical compositions and their concentrations were different.

"E-liquids with the highest levels of benzene-rich flavoring chemicals had the greatest toxicity and immune cell dysfunction, whilst those with no or low levels of benzene-rich flavoring chemicals tended to show minimal damage," said Dr. Ween.

"Both types of cells from the healthy donors also showed abnormal inflammation response markers when exposed to E-cigarette vapor. When vapers were recruited at UC San Diego to investigate this further, their saliva was found to also show an abnormal immune response markers compared with non-vaping/non-smoking controls."

This study points to vapers having possible difficulties responding to lung infections.

"We hear a lot about banning specific flavors of e-liquids as the way to move forward, but this study shows that the name on the bottle isn't what needs to be controlled to reduce the risks to vapers, and that allowed flavors need to be well defined," said Dr. Ween.

"This could easily be achieved by only limiting E-liquids to a single flavoring chemical which has had its effects in the [lung](#) tested and safe concentrations determined, instead of banning a particular flavor name."

"Most importantly, we need major funding for independent research into which flavors represent the lowest levels of risk, something Australia is currently lacking."

The study is published in the *American Journal of Physiology—Lung Cellular and Molecular Physiology*.

More information: Tina Bormann et al. Role of the COX2-PGE2 axis in *S. pneumoniae* induced exacerbation of experimental fibrosis, *American Journal of Physiology-Lung Cellular and Molecular Physiology*

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