Medical Xpress

One e-cigarette with nicotine leads to adrenaline changes in nonsmokers' hearts

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A new UCLA study found that healthy nonsmokers experienced increased adrenaline levels in their heart after one electronic cigarette (e-cigarette) with nicotine but there were no increased adrenaline levels

when the study subjects used an a nicotine-free or empty e-cig.

The findings are published in *Journal of the American Heart Association*, the Open Access Journal of the American Heart Association/American Stroke Association.

Unlike cigarettes, e-cigs have no combustion or tobacco. Instead, these electronic, handheld devices deliver nicotine with flavoring and other chemicals in a vapor instead of smoke.

"While e-cigarettes typically deliver fewer carcinogens than are found in the tar of tobacco cigarette smoke, they also usually deliver nicotine. Many believe that the tar—not the nicotine—is what leads to increased cancer and heart attack risks," said Dr. Holly R. Middlekauff, senior study author and professor of medicine (cardiology) and physiology at the David Geffen School of Medicine at UCLA. "So, we asked the question, are e-cigarettes safe?"

The researchers had previously reported that chronic e-cig users have elevated sympathetic nerve activity which increases adrenaline directed to the heart and are more susceptible to oxidative stress. Both are risks factors for heart attack. This study aimed to find out if nicotine caused these events.

Middlekauff and her team used a technique called "heart rate variability" obtained from a prolonged, non-invasive heart rhythm recording. Heart rate variability is calculated from the degree of variability in the time between heartbeats. This variability may be indicative of the amount of adrenaline on the heart.

Prior studies have used a heart rate variability test to link increased adrenaline activity in the heart with increased cardiac risk. People with known heart disease and people without known heart disease who have

this pattern of high adrenaline levels in the heart have increased risk of death, Middlekauff said.

In the first study to separate the nicotine from the non-nicotine components when looking at the heart impact of e-cigarettes on humans, researchers studied 33 healthy adults who were not current e-cigarette or tobacco cigarette smokers. On different days, each participant used an e-cigarette with nicotine, an e-cigarette without nicotine or an empty 'sham' device. Researchers measured cardiac adrenaline activity by assessing heart rate variability and oxidative stress in blood samples by measuring the enzyme plasma paraoxonase (PON1).

They found:

- Exposure to e-cigarettes with nicotine, but not e-cigarettes without nicotine, led to increased adrenaline levels to the heart, as indicated by abnormal heart rate variability.
- Oxidative stress, which increases risks for atherosclerosis and heart attack, showed no changes after exposure to e-cigarettes with and without nicotine. The number of markers they studied for oxidative stress were minimal, however and more studies are warranted, according to Middlekauff.

"While it's reassuring that the non-nicotine components do not have an obvious effect on adrenaline levels to the heart, these findings challenge the concept that inhaled nicotine is benign, or safe. Our study showed that acute electronic cigarette use with nicotine increases cardiac adrenaline levels. And it's in the same pattern that is associated with increased cardiac risk in patients who have known cardiac disease, and even in patients without known cardiac disease," Middlekauff said. "I think that just seeing this pattern at all is very concerning and it would hopefully discourage nonsmokers from taking up electronic cigarettes."

Future studies should look more closely at oxidative stress and e-cigarette use, using a broader number of cardiac markers, in a larger population of people, researchers said.

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