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New Study Shows Vaping Suppresses Immune Cell Activity

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STORY AT-A-GLANCE

- Exposure to e-cigarette vapor essentially froze neutrophils in place, leaving then unable to protect the body; neutrophils are white blood cells that your immune system uses as a first line of defense
- Even occasional e-cigarette users may be at risk, as the effect was seen with short, low-level exposure
- Neutrophils exposed to vapor from e-cigarettes had high concentrations of the microfilament F-actin, which resulted in the cells being less able to move and function
- The findings suggest e-cigarette users could be at increased risk of respiratory disease
- The long-term effects of vaping are unknown, but research has linked e-cigarette use to an increased risk of reproductive problems, heart attack, mental health conditions and more

Using electronic cigarettes (e-cigarettes), or vaping, could be putting your immune system function at risk, according to a research team from the U.K.'s University of Birmingham.[1] The study adds to growing concern that vaping isn't any safer than conventional smoking, even though it's been passed off that way.

Even when it doesn't contain nicotine, "Vaping renders immune cells unable to move to meet threats," the University of Birmingham warned in a news release.[2] The effect was seen with short, low-level exposure, suggesting that even occasional e-cigarette users may be at risk.

Vaping Interferes With Immune System Activity

Neutrophils are white blood cells that your immune system uses as a first line of defense.[3] They travel throughout your body, trapping and neutralizing bacteria or other pathogens that may cause disease. The University of Birmingham team collected neutrophils via blood samples from healthy volunteers who had never smoked or vaped.

They then exposed the neutrophils to 40 puffs of unflavored vape, which is considered a low daily exposure amount.[4] Half of the samples were exposed to vape that contained nicotine while the other half received nicotine-free vape.

The exposures didn't kill the cells, but it essentially froze them in place, leaving them unable to protect the body. Lead study author Aaron Scott, associate professor in respiratory science at the University of Birmingham, explained:[5]

> *"We found that after short, low-level exposure to e-cigarette vapor, the cells remain alive but can no longer move as effectively and are unable to carry out their normal protective functions. Interestingly, vapor from e-liquids which did not contain nicotine also had the same negative effects as vapor from e-liquids which did contain nicotine.*
>
> *E-cigarettes are a proven, lower harm, tool to help smokers quit smoking but our data adds to current evidence that e-cigarettes are not harmless and highlights the need for to fund longer-term studies in vapers."*

The phenomenon may be due to a buildup of microfilament, specifically F-actin. Neutrophils exposed to vapor from e-cigarettes had high concentrations of F-actin, which resulted in the cells being less able to move and function.[6] Conventional smoking is also known to affect neutrophils.

The findings could have significant implications for lung health in e-cigarette users. According to study author David Thickett, professor in respiratory medicine at the University of Birmingham:[7]

> *"In health neutrophils normally protect the lungs by moving from the blood to the site of possible harm before using a number of protective functions to protect the lung. The observed impact that e-cigarette vapor had on their mobility is therefore of significant concern, and if this were to happen in the body would make those who regularly use e-cigarettes at greater risk of respiratory diseases."*

Liz Sapey, study coauthor and director of the Institute of Inflammation and Ageing at the University of Birmingham, added, "This study further shows the impact that e-cigarettes still have on the immune system. Neutrophils are heavily implicated in aging and chronic obstructive disease and their relationship with tissue damage, and the impact of vaping in suppressing neutrophil activity regardless of nicotine could have long term implications for health."[8]

Vaping Linked to Shrunken Testicles, Lower Sperm Count

It took decades before the full harms of cigarette smoke became known to the public. E-cigarettes are, comparatively, still in their infancy, but the health concerns are already mounting. While the long-term effects remain unknown, young men may want to think twice before partaking.

In a study on rats, exposure to e-cigarette vapors led to multiple reproductive effects.[9] In addition to smaller testicles, sperm counts declined. While rats not exposed to the vapor had a sperm count of 98.5 million sperm per milliliter, this dropped to 95.1 million after exposure.[10]

"Cigarette and EC [e-cigarette] liquid can increase oxidative stress as well as cause morphological changes in the testicle. To be a safe option in smoking cessation studies, its effect on people needs to be enlightened," the researchers concluded.[11] Increased oxidation is known to cause cellular damage and cell death, and is involved in many chronic diseases, including cancer, diabetes, metabolic disorders, atherosclerosis and cardiovascular problems.[12]

A study on young men revealed similar findings. Those who used e-cigarettes daily had significantly lower sperm count than nonusers — 147 million versus 91 million.[13] Daily cigarette smokers also had reduced sperm count. In another study that reviewed e-cigarettes' impact on reproductive health, it's suggested they may lead to "pathological alterations of reproductive functions."[14]

In addition to potentially increasing the risk of miscarriage and altering hormone levels and sexual function, it's possible e-cigarettes may lead to decreased testosterone levels and intratesticular inflammation and oxidative stress.[15] There's also evidence that exposure to e-cigarette vapor in utero may lead to lower fertility, body weight and length in offspring.

"This raises the question of the potential impact of e-cigarettes on nonusers that are passively exposed to the vapor during pregnancy," the team noted.[16]

What's in an E-Cigarette?

E-cigarettes and their aerosols contain more than 80 compounds, including flavorings, which "increase the toxicity of e-cigarette vapor in s significant manner."[17] Among them are nanoparticles in the range of 11 to 600 nanometers, which enter the respiratory system and "can be deposited within the lungs as far as the alveolar region,"[18] with unknown long-term effects.

Adding to the complexity, there are many types of e-cigarettes, each with a different composition that's not always disclosed by manufacturers, or may be advertised incorrectly.[19] A review published in the journal Life outlined some of the toxic compounds in e-cigarettes and their potential consequences to humans:[20]

Glycols — Propylene glycol and glycerol, also known as vegetable glycerin, are among the most common compounds in e-cigarette liquid. Propylene glycol typically makes up the base, which is then mixed with flavorings, coloring and other chemicals. When glycols are heated during vaping, they become oxidized and decompose, leading to toxic breakdown products that are inhaled.

A University of North Carolina study found that when propylene glycol and vegetable glycerin are inhaled via e-cigarettes, it led to decreased glucose transport and metabolism in airway cells. “We propose that repeated/chronic exposure to these agents are likely to contribute to airway damage in e-cigarette users,” researchers explained.[21]

Nicotine — Nicotine was detected even in nicotine-free e-cigarettes. One inhale may expose users to up to 35 milligrams of the compound.

Metals — Multiple toxic metals are found in e-cigarette vapor, including lead, chromium, tin, silver, nickel, cadmium, aluminum and even mercury.

Tobacco-specific nitrosamines — These highly toxic compounds may be carcinogenic and are found in e-cigarettes that contain tobacco flavoring.

Carbonyls — These compounds, which include formaldehyde and acetaldehyde, are carcinogenic and, one study found, “detected in the vapors of almost all ECs.”[22]

Volatile organic compounds (VOCs) — Benzene, styrene, ethylbenzene and toluene are examples of VOCs found in e-cigarettes. In addition to causing cancer, they can lead to headaches and damage to the liver, kidneys and central nervous system.

Phenols — Long-term exposure to phenols may lead to anorexia, liver damage, weight loss and diarrhea, while inhalation may lead to irritation of the eyes, skin and mucous membranes.

Acrolein — This weedkiller, which was used as a chemical weapon during World War I, causes lung injury and chronic obstructive pulmonary disease. It may also cause asthma and lung cancer.[23]

Vaping Linked to Increased Risk of Heart Attack

One of the largest studies conducted on the health effects of vaping, presented at the 2019 American College of Cardiology's Annual Scientific Session, found that adult e-cig smokers have a significantly higher risk of heart disease and mental health problems than nonsmokers, even after controlling for known risk factors such as body mass index and high blood pressure. Compared to nonsmokers, vapers were:[24]

- 34% more likely to have a heart attack
- 25% more likely to have coronary artery disease
- 55% more likely to suffer from depression or anxiety than nonsmokers with the same risk factors

Study author Dr. Mohinder Vindhyal, assistant professor at the University of Kansas School of Medicine Wichita, said in a news release:[25]

> *"When the risk of heart attack increases by as much as 55% among e-cigarettes users compared to nonsmokers, I wouldn't want any of my patients nor my family members to vape. When we dug deeper, we found that regardless of how frequently someone uses e-cigarettes, daily or just on some days, they are still more likely to have a heart attack or coronary artery disease."*

E-cigarette or vaping use-associated lung injury, known as EVALI, is also possible. It refers to severe lung illness that occurs in those using e-cigarettes, possibly due to vitamin E acetate and other compounds in the products.[26] In the U.S., at least 2,807 EVALI cases have been reported in the U.S., most requiring hospitalization, and deaths have been reported.[27]

The findings are especially concerning given e-cigarettes' popularity. It's estimated that 1 in 20 Americans use them, and sales have increased nearly 14-fold in the last 10 years.[28]

A Better Way to Quit Smoking

If you're an adult looking to quit smoking, remember that e-cigarettes are also designed to get you to keep using them — much like cigarettes. If you're trying to quit, rather than swapping one poison for another, work on other aspects of your health first, which will make quitting mentally and physically easier.

Regular daily movement and exercise, including strength training,[29] are helpful, as is healthy eating. An emotional outlet, such as the Emotional Freedom Techniques, meditation or relaxation techniques, will also help restore your mind-body balance while helping you break the addiction and avoid cravings.

If you're a parent, be sure to talk to your kids about e-cigarettes, just as you would the combustible kind, as the easiest path to avoiding vaping is to not try it in the first place.

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