

## ARE E-CIGARETTES A BETTER COUNTERPART OF SMOKING?

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Injurious impact of tobacco smoking on human health holds no doubts, as it adversely affects almost all vital organs of the body<sup>1</sup>. World Health Organization has evinced that tobacco use is one of the biggest public health threats the world has ever faced, killing 8 million people every year. Out of these, more than 7 million are the result of direct tobacco use; whereas, around 1.2 million are the result of passive smoking<sup>2</sup>. Health histories have informed that all forms of tobacco use are harmful, and there is no safe level of exposure to tobacco. Based upon the extent of the problem and its serious consequences, the global health community has rated it as a tobacco epidemic.

When the worldwide campaigns are ongoing to quit all forms of smoking, many anti-smoking products have gained hype and the industries of such products are rapidly proliferating. One of such products is 'Electronic Nicotine Delivery Systems (ENDS)' that is becoming popular, particularly among the younger generation<sup>3</sup>. E-cigarettes (also known as vaping) is one of its prime products and has been overtly claimed in helping smokers to quit smoking. A number of research works have proved that many of them contain varying amounts of nicotine and other toxic substances, which are harmful to both users and those who are secondhand exposed to the vapors. Recently, the e-cigarette brand 'JUUL' has become popular among youth<sup>4</sup>.

Fundamentally, the e-cigarettes are battery-operated devices, which function by heating a liquid solution to a high temperature for producing aerosols to inhale. The solutions used in these devices are also called as 'e-liquids' and mostly contain nicotine, flavoring agent and a humectant, such as propylene glycol, to retain moisture and create the aerosol when heated. Their main objective is to create a sense of tobacco smoke for the user without any tobacco smoking. Unlike vapor that is simply a substance in a gas form, the aerosol produced in an e-cigarette contains tiny chemical particles from both the liquid solution and the device itself (such as: metals because of heating coil).

The most recent generation of e-cigarettes include pre-filled pod systems like JUUL and refillable systems like Suorin Drop and Kandypens, use nicotine salts in the e-liquids. These salt formulas allow much higher levels and efficient delivery of nicotine with less irritation, compared to earlier generations of e-cigarettes.

Initially claimed to be a safe alternative to tobacco product, e-cigarettes have actually proved to be posing harmful effects on human health. There is yet an insufficient data to understand the full breadth of their impact on health; however, the available evidence is clear that the aerosols of the majority of the e-cigarettes contain nicotine and other toxic chemicals that can cause irreversible organ damage and various cancers.

American Lung Association, based upon multiple research studies, has listed harmful constituents in e-cigarette aerosols, which include Nicotine, Glycols, Carbonyls, Particles, Metals, Tobacco-specific nitrosamines (TSNAs), Volatile organic compounds (VOCs), Phenols and flavoring agents.

- Glycols are the major components. High amounts of propylene glycol (also called 1,2-propanediol), used as an antifreeze agent
- Carbonyls is a potential human carcinogen. Carbonyls like formaldehyde, acetaldehyde and acrolein were detected in the vapors of e-cigarettes in studies.
- Particles of variable size and features are generated in the vapors. The particles pollution is particularly harmful and increase the risk of heart disease, lung cancer and asthma attacks and can interfere with the growth and work of the lungs.
- Metals are of major public concern due to potential toxicity. The heavy metals have been detected in varying concentrations in the aerosols of e-cigarettes, including: lead, tin, silver, nickel, aluminum, copper, chromium, cadmium, mercury and arsenic.
- Tobacco-specific nitrosamines (TSNAs). These are probably the most important compounds associated with negative health effects in tobacco cigarettes, due to a combination of abundance and strong carcinogenicity. N-nitrosornicotine (NNN) and nicotine-derived nitrosamine ketone (NNK) are classified as IARC group 1 carcinogens. Studies have found irregular concentrations of total TSNAs in the vapour

of most e-fluids, sufficiently high in some case to cause an elevated risk of tumor development.

- Volatile organic compounds (VOCs) are harmful substances, the longer-term exposure to which increases the risk of cancer and of damage to the liver, kidney and central nervous system. Studies found VOCs like benzene (carcinogenic, group 1), styrene and ethyl-benzene (group 2B carcinogens), toluene and pm-xylene in many vapors.

- Phenols are highly irritating to the skin, eyes and mucous membranes after acute inhalation or dermal exposures, and is toxic if oral exposure. A study found five phenolic compounds in refill solutions posing the health risks.

- Favour chemicals are mostly of toxicological concern due to high aldehyde levels.

Children and adolescents having exposure to nicotine can have long-lasting, negative impact on the brain development. The nicotine content of e-cigarettes raises concerns regarding its potential to cause addiction. As a result, the young users have reported signs of severe dependency including inability to concentrate in classroom, mood disorders and problems with impulse control. Moreover, pregnant mothers using e-cigarettes can have adverse effects on the development of the fetus during pregnancy.

There is also a growing body of knowledge that e-cigarettes are undoubtedly associated with increased risk of cardiovascular diseases<sup>5</sup> and pulmonary diseases. Researches have shown that use of both conventional cigarettes and e-cigarettes is associated with altered hemodynamics such as increased heart rates and blood pressure, increased risk of coronary artery disease, myocardial infarctions and strokes. The underlying mechanism is endothelial dysfunction, oxidative stress and enhanced activation of circulatory platelets with resultant atherosclerosis and thrombogenesis. In addition to that, e-cigarettes bear harmful impact on lungs cellular mechanism and immune functions with resultant increased risk of lung cancers, irreversible lung injuries and inflammations.

“Are e-cigarettes more or less dangerous than conventional tobacco cigarettes?” is a burning question to be answered yet. It is difficult to generalize on the health risks of e-cigarettes compared to the regular cigarettes or other tobacco products. It is safe to say that both the tobacco smoking and e-cigarettes pose serious risks to human health. The safest approach is not to use either.

World Health Organization (WHO) recommends that use of ENDS including e-cigarettes should be regulated through adopting the following measures:

- o Preventing initiation of ENDS use by non-smokers and children, such as by preventing or restricting advertising, promotion, and sponsorship, and restricting flavors that appeal to children
- o Minimizing as far as possible potential health and/or risks to ENDS users, such as by regulating product characteristics

- o Protecting non-users from exposure to their emissions, such as by prohibiting ENDS use in indoor spaces where smoking is not permitted

- o Preventing unproven health claims
- o Protecting public health policies from commercial and other vested interests.

In conclusion, the effectiveness of ENDS including e-cigarettes as a smoking cessation tool is yet a question mark and scientific evidence is still being debated. To date, the potential for ENDS to play a role as a population-level tobacco cessation intervention is unclear and so far ENDS are not approved by FDA. WHO also has grave concerns regarding their use and has advised to restrain from their consumption to prevent harmful health impacts.

## References:

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