

Smoking Cessation and Prevention Principles

Efstathios Konstantinou Koutsostathis*

Consultant in the ICU of Sotiria Hospital, Greece

***Corresponding Author:** Efstathios Konstantinou Koutsostathis, Consultant in the ICU of Sotiria Hospital, Greece.

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Abstract

The multiple correlations between smoking and diseases that relate to the entire range of internal medicine have been known for decades. Various alternatives have been proposed, including nicotine patches and gum, and bupropion pills. Other alternatives used are acupuncture and sleep therapy.

References to the electronic cigarette or e-cigarette date back to 2004, when Hon Lik first developed it in China. It is atomiser that looks like a conventional cigarette, but differs in that it contains a mixture of glycerol, propylene glycol, fragrances and possibly nicotine in quantities of 1.6-1.9 mg/device. It is generally believed that it is a form of smoking that is safer than the conventional one. Even though there has been a limited number of experimental and epidemiological studies conducted and the results in some cases are contradictory, it seems that this view is not far from the truth given that, to date, the adverse events of e-cigarettes are significantly fewer than those of conventional cigarettes.

However, the potential health risks reported include airway irritation, cardiovascular burden and fatty liver infiltration. In addition, strict specifications are not always followed during the manufacturing of e-cigarettes. As a result, apart from very small quantities of nicotine, they also contain carcinogens and metals that could theoretically impact one's health.

Keywords: Smoking; Cigarettes; China

Introduction

The e-cigarette was developed in China in 2004 by Hon Lik. It is a battery-operated electronic device that resembles a conventional cigarette. It consists of a plastic tube, a heating element, a container with nicotine and propylene glycol, an atomiser, a filter for removing harmful substances and a lithium battery. The solution in the container is heated when the electronic heating element is activated, creating the smoke inhaled by the smoker. E-cigarettes contain nicotine in concentrations proven to be smaller than conventional cigarettes [1]. A new generation of e-cigarettes has been developed lately (HNBC-Heat not Burn Cigarette). This technology is based on heating thin tobacco sticks at 35°C without using smoke, or vaping propylene glycol or other substances. The

effectiveness and possible health impacts of this device have not been fully tested yet in clinical and experimental studies [2].

Figure 1: Electronic cigarette.

From “Electronic Cigarette and Young People”, Thesis by Vasiliki Zisi, School of Health Sciences, University of Thessaly, 2012.

Epidemiology

According to surveys, in general, 70% of EU citizens are aware of the use of e-cigarettes. As a matter of fact, the highest rates are found in countries such as Finland, Greece and Latvia, while in the UK, e-cigarette users amount to 3,000,000 people. In addition, according to literature, one in ten smokers of conventional cigarettes also uses e-cigarettes. The 15-24 age group has a high recognition rate for e-cigarettes, while men appear to be more likely to be aware of its use than women [1].

Health risks from smoking

Billions of people around the world smoke conventional cigarettes. Every day, some 100,000 young people around the world start smoking, without taking into account the multiple harmful side effects. It is believed that oxidative stress is the pathophysiological basis of these harmful effects of smoking at cellular level [2].

Some typical conditions and diseases that are strongly associated with smoking are listed below:

- Morning cough
- Loss of taste and smell
- Chronic bronchitis, pulmonary emphysema, bronchial asthma (chronic obstructive pulmonary disease)
- Ischemic heart disease
- Ischemic stroke
- Peripheral arteriopathy
- Immunological deficiency
- Various malignancies, such as lung, throat, pharyngeal, oesophageal, mouth and bladder cancer. It is estimated that smoking is associated with nearly 80% of lung malignancies aetiologically and is additionally considered responsible for about 140,000 deaths from cardiovascular disease per year [3].

Electronic vs conventional cigarette

On the one hand, it has been observed that using e-cigarettes reduces the desire to smoke and offers more effective abstinence,

without the appearance of withdrawal symptoms, compared to nicotine patches or bupropion. On the other hand, more vaping effort is needed during vaping than conventional smoking, and this can potentially have adverse health effects.

However, e-cigarettes send a stronger message to young people that smoking may not be dangerous. As a result, the likelihood of dependence on nicotine and tobacco use increases, as many young people in particular have returned to the traditional way of smoking after having tried e-cigarettes for a while [4].

The differences in nitrosamine content among different types of cigarettes, e-cigarettes and nicotine gum are listed below.

Product	Total level of nitrosamines (ng)	Daily exposure	Proportion (4)
Electronic cigarette	12	62 (1)	1
Nicotine gum	2	48 (2)	0.92
Winston	3365	50475 (3)	971
Marlboro	6260	93900 (3)	1806
Camel	5191	77865 (3)	1497
(1) Based on daily use of 4ml liquid (2) Based on maximum recommended consumption of 24 pieces per day (3) Based on consumption of 15 cigarettes per day (4) Difference between e-cigarette and all other products in daily exposure to nitrosamines			

Table 1: Nitrosamine levels found in cigarettes with tobacco, e-cigarettes and nicotine gum based on findings from Laugesen (2009), Cahn and Siegel (2011), and Kim και Shin (2013).

Electronic cigarette and potential risks

To date, there are few epidemiological data available related to the risks of e-cigarettes. However, it is widely assumed that

e-cigarettes are expected to have significantly less harmful effects than conventional ones. On the one hand, this is based on the fact that they do not contain tobacco, which is responsible for the many harmful side effects, and, on the other, that polycyclic aromatic hydrocarbons and carbon monoxide are not found in the aerosol of e-cigarettes. The latter is due to the fact that the evaporation of liquids takes place at temperatures much lower than the temperature of conventional cigarettes.

The liquids used include propylene glycol, glycerine, water, nicotine and fragrances. Nitrosamines, which are considered primarily carcinogenic, are found in concentrations up to 1,000 times lower in e-cigarettes than in conventional ones. The same applies for their metal content.

However, there are certain issues that raise concerns regarding their safety. An important problem seems to be that the manufacturing specifications are not always followed. This results in carcinogenic substances and metals such as nitrosamine, acetaldehyde and mercury being found in e-cigarettes, though in significantly lower amounts compared to conventional cigarettes, which can potentially have a significant impact on the health of smokers [5].

It seems that e-cigarette smoking is associated with respiratory (upper and lower), liver and possibly cardiovascular diseases through pathophysiological mechanisms that include reducing the excreted nitric oxide fraction.

Pathological effects reported in clinical studies include:

- Irritation of the mouth and oesophagus
- Irritation of the sclera of the eyes
- Dizziness, vertigo, nausea and urge to vomit, mainly associated with the nicotine content
- Dry cough intensified with repeated use
- Harmful effect in large and smaller airways (trachea, bronchi), similar to that observed in conventional cigarettes and potentially increased incidence of chronic bronchitis and emphysema
- Damage to primordial nerve cells and fibroblasts, mainly due to long-term inhalation of glycerol
- Possible disorders in the normal development of embryos in long-term use [6].

- Studies conducted on lab animals have correlated e-cigarettes to obesity and metabolic syndrome through the increase in oxidative stress

- Fatty liver by causing mitochondrial damage to the hepatocyte. At cellular and biochemical level, changes associated with the increased activity of poly(ADP-ribose)polymerase-1 (PARP1) appear to occur, leading to a decrease in NAD⁺ production. In addition, the low levels of Sirtuin 1 enzyme (SIRT1) combined with mitochondrial dysfunction result in an increase in free radical levels. These are directly linked to disorders in lipolysis and lipid metabolism in general

- Increased hepatocellular apoptosis, as evidenced [7].

However, e-cigarettes do not seem to affect the heart rate or cause electrocardiographic lesions. Experimental studies on mice seem to associate e-cigarettes with cardiomyopathy, possible abrupt mutations in genetic material and oxidative stress, as well as increased risk of atherosclerosis. They also cause increase in inflammatory reactions, but without an associated increase in inflammatory factors in the blood, and changes to the number of white and red blood cells and platelets, or to nitric oxide and nicotine levels in plasma [8].

Figure 2: Pathophysiological mechanisms of hepatocellular damage.

From Espinoza-Derout J, Hasan KM, Shao XM, Jordan MC, Sims C., *et al.* "Chronic intermittent electronic cigarette exposure induces cardiac dysfunction and atherosclerosis in apolipoprotein-E knockout mice". *Am J Physiol.*, June 2019.

Electronic cigarette and pregnancy

The potential adverse events of e-cigarettes during pregnancy are also under research. Although it is considered safer and without adverse events for the foetus, the review of existing literature confirms the potential risks in terms of primary neuron development, and pulmonary and cardiac function. This concerns both the amount of nicotine content, which approaches that of conventional cigarettes, and other potentially harmful substances contained in e-cigarettes.

Generally speaking, all relevant experimental models relate to experiments on animals, and it is a fact that the history of vaping is very recent, since 2004. As a result, it is not possible to fully and adequately identify the harmful effects on both the pregnant woman and the foetus. More and better evidence-based research is therefore needed to provide adequate answers as to the safety of this method [9].

Legal framework - WHO stance

E-cigarettes are not in any case a valid smoking cessation treatment. The WHO does not have the necessary scientific data to confirm their safety and efficacy. Clinical trials and toxicity analyses need to be carried out, while the rules and safety regulations during manufacturing must be followed.

In addition, both the European and the relevant Greek pulmonary societies have not classified e-cigarettes as a safe alternative to smoking. It is recommended to follow the guidelines and to not swap one potential carcinogen for another. On 25/07/2008, the National Organization for Medicines of Greece (EOF) issued a deterrent directive on the marketing of nicotine-containing products and e-cigarettes as medicinal products.

So evidently, e-cigarettes are marketed for smokers as entertainment products or for use in places where smoking is prohibited. Unfortunately, there is ambiguity regarding the legal status of the use of e-cigarettes, since they are not classified as tobacco products, food or medicines [10].

Conclusions

Much more needs to be done with regard to the study of the adverse events of e-cigarettes. So far, the study findings are contradictory and do not seem to draw any clear conclusions. However, the risks are real, perhaps even more so because of the fact that many of the chronic smokers of conventional cigarettes who try to stop using them switch to their electronic format and ultimately fail to shake the habit. They eventually return to conventional smoking. In addition, vaping is a relatively recent alternative (since 2004), meaning that its adverse events over time have not been adequately studied. To sum up, it is necessary to balance existing scientific data rather than focus on looking for potential harms. In any case, smoking in any form has been proven to be a harmful habit with an impact on the majority of the human body systems (cardiovascular, respiratory, urinary, gastrointestinal). The various alternative methods that have been developed, such as nicotine gum or bupropion pills, for example, but also vaping, help to kick the addiction caused by traditional smoking. However, the goal is still the permanent cessation of smoking in any form. The main ways to achieve this goal relate to both the smoker and their immediate and broader social environment. Alternative activities coupled with a supportive family and professional environment can help in this direction. In any case, e-cigarettes are not the solution or treatment to smoking, but a step towards kicking this harmful habit.

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