



Electronic cigarette (e-cigarette)

Erdinc Nayir^{a, *}, Burak Karacabey^b, Onder Kirca^c, Mustafa Ozdogan^c

^a Department of Medical Oncology, Kahramanmaraş Necip Fazıl City Hospital, Kahramanmaraş, Turkey

^b Akdeniz University Faculty of Medicine, Antalya, Turkey

^c Department of Medical Oncology, Antalya Memorial Hospital, Antalya, Turkey

ARTICLE INFO

Article history:

Received 26 February 2016

Received in revised form

21 March 2016

Accepted 20 April 2016

Available online 2 July 2016

Keywords:

Electronic cigarette

Health

Tobacco

Nicotine

ABSTRACT

Electronic cigarette (e-cigarette) is a device developed with an intent to enable smokers to quit smoking and avoid the unhealthful effects of cigarettes. The popularity of e-cigarette has increased rapidly in recent years. The increase in its use during the adolescence period is attention-grabbing. Despite the fact that e-cigarette has become popular in a dramatic way, there are certain differences of opinion regarding its long-term effects on health, in particular. While some people assert that it is less harmful than conventional cigarettes, some others assert the contrary. Although e-cigarette contains less toxic substances compared to conventional cigarette, it contains certain carcinogens existing in conventional cigarette such as formaldehyde and acetaldehyde. It also contains heavy metals (nickel, chrome) that conventional cigarette does not contain; and therefore, raises concerns about health. E-cigarette leads to upper and lower respiratory tract irritation as well as an increased airway resistance and an increased bacterial colonization in the respiratory tract. It may also cause tachycardia and increase diastolic blood pressure. Although e-cigarette has been found to have certain benefits in terms of smoking cessation, most of the studies have shown unfavorable results. In this collected work, the effects of e-cigarette on health and its role in smoking cessation are discussed in detail.

Copyright © 2016 Turkish Society of Medical Oncology. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Electronic cigarette (e-cigarette) used today has not a long history. It was first developed in 2003 by Hon Lik, a Chinese pharmacist, with intent to enable his father, who was a lung cancer patient and a heavy smoker, to quit smoking. E-cigarettes are products that typically vaporize a liquid substance containing nicotine, flavoring agents, propylene glycol and/or glycerol.¹ The popularity of e-cigarette has increased rapidly in recent years. Its prevalence among smokers in the United States was 2% in 2010, and reached 30% in 2012.² Its prevalence in the adolescent period was ranging from 1 to 3% between 2010 and 2011. And this rate reached 10–20% between 2013 and 2014.³ Increases at similar levels were found in European and Asian countries, as well.^{4,5}

E-cigarette use among middle and high school students in America tripled in the last 2 years, according to the report from the Centers for Disease Control and Prevention. In 2014, more than 2

million middle and high school students used e-cigarettes. The greatest increase in e-cigarette use among American students was recorded between 2013 and 2014. The rate of use rose from 4.5% to 13.4%, with an increase in the number of high school students using e-cigarettes, which was 660,000 in 2013 and reached 2 million in 2014.⁶ In a study carried out by Wills et al on 2338 students, the rate of initiation of e-cigarette use in the adolescence period was found to be high.⁷

E-cigarette patented by Hon Lik in 2003 officially entered the American market in 2007. In those years, its sales began in many countries.^{8,9} In consequence of some evidence, the US Preventive Services Task Force recommended adults to use e-cigarette for smoking cessation in 2015, but there are conflicting results in this regard.¹⁰ Despite the fact that e-cigarette has become popular in a dramatic way, there are certain differences of opinion regarding its long-term effects on health, in particular. Some people assert that it is less harmful than conventional cigarettes, but some others assert the contrary.

In this collected work, we aimed at revealing whether e-cigarette is really one of the methods for smoking cessation, and whether it can be used with intent to be less affected by the harmful effects of smoking.

* Corresponding author. Kahramanmaraş Necip Fazıl City Hospital, 46050 Kahramanmaraş, Turkey. Tel.: +90 3442282800; fax: +90 3442515105.

E-mail address: drerdincnyr@gmail.com (E. Nayir).

Peer review under responsibility of Turkish Society of Medical Oncology.

1.1. General information about E-cigarette device

In general, there are two types of e-cigarettes. The most widely known and used model includes battery-powered and often cigarette-shaped devices evaporating a liquid that contains propylene glycol and/or glycerol in a rechargeable cartridge. Propylene glycol contained in the fluid in the cartridge provides the formation of an odor similar to cigarette smoke. The battery-powered microprocessor also turns on the red-orange light (LED; Light Emitting Diode) on the tip of the rode; and in this way, provides the appearance of a burning fire on the tip of a cigarette.¹

The process of tobacco combustion does not occur in this type of e-cigarettes. According to e-cigarette manufacturers, the vapor inhaled by users does not contain CO (carbon monoxide), tar (cigarette tar) or other toxic materials contained in cigarettes. The comparison of toxic substances in e-cigarettes with toxic substances in normal cigarettes is given in Table 1. Their cartridges contain various amounts of nicotine (from 0 to 26 mg). In e-cigarette, the amount of nicotine intake is determined by the user, and some users can prefer completely nicotine-free cigarettes. The products produced by different manufacturers generally differ from each other in terms of their sweeteners (tobacco, menthol, chocolate, fruit, and coffee), appearances, and whether the color of their tips changes during inhalation. But the uniform features that all products have include a cartridge that contains a solution, a tube used by the user when inhaling the vapor, and a battery-powered part called the atomizer that absorbs and heat the solution. In some products, the cartridge and atomizer are combined to create a single part called the cartomizer. In an e-cigarette device, the solution is evaporated by heating or vibrating it.^{11,12}

In other type of e-cigarettes, tobacco is used but is combusted at a lower temperature. The combustion temperature of tobacco in a conventional cigarette is approximately 750 °C, while it is 350 °C in this type of e-cigarettes called “heat-not-burn Tobacco Products”. According to animal experiments conducted by the cigarettes industry, combustion of tobacco at a low a temperature leads to up to 90% less release of harmful chemicals and carcinogens.¹³

1.2. E-cigarette's effect on health

Physiological effects developed as a result of e-cigarette use are given in Table 2.

Although the long-term effect of e-cigarette in terms of cancer is unknown, the carcinogens that e-cigarette users are exposed to known. The U.S. Food and Drug Administration (FDA) have

analyzed two popular brands in this regard. As a result, various levels of nicotine and carcinogens were found. Formaldehyde and acetaldehyde can be given as examples of carcinogens found in electronic cigarettes. Based on these findings, the FDA has issued a warning about the potential hazards of e-cigarettes.¹⁶ In the study carried out by Kim et al, nitrosornicotine (NNN), 4-(nitroso methyl-amino)-1-(3-pyridyl)-butanone (NNK) and nitrosoanatabins (NAT) among the nitrosamines specific to tobacco, known to be carcinogenic, were found in the content of e-cigarette.¹⁷ In the comparison of 12 brands of e-cigarettes with cigarette smoke, e-cigarette aerosols were found to have lower levels of toxic substances. Carcinogen levels of e-cigarettes were found to be 9–450 times lower than that of tobacco products.¹⁴ However, in a study carried out on a new product defined as a high-voltage battery powered “tank-style” system, e-cigarette users were ascertained to be exposed to more formaldehyde.¹⁸ In preclinical studies, e-cigarette vapor was found to be associated with also an increased inflammation, oxidative stress and endothelial barrier dysfunction, besides the development of oral cancer and lung cancer.¹⁹ In another study, increased necrosis and apoptosis rates, especially decreased vitality of cells, as well as development of DNA breaks were found in cells exposed to e-cigarettes.²⁰

Since e-cigarette does not burn and emit smoke like a normal cigarette, it can be thought not to cause passive smoking effect, but the studies suggest the contrary. Schober et al carried out a study to investigate indoor pollution associated with e-cigarette use; and consequently, they found 7 polyaromatic hydrocarbons, a high level of nicotine, propane-1-2-diol, glycerin, and aluminum classified as carcinogenic agents by the International Agency for Research on Cancer. Similarly, another study showed that formaldehyde, acetaldehyde, isoprene, acetic acid, 2-butanedione, acetone, propanol, propylene glycol, diacetyl (emitted from aromatizing additives), aromatic oils, and nicotine diffused around from the vapor given to the environment during the use of e-cigarettes.^{21,22}

In the literature, there are a limited number of case reports about e-cigarette's effect on the lung. Propylene glycol in the content of e-cigarette may cause upper and lower respiratory tract irritation.¹⁵ In the literature, there are case reports about eosinophilic pneumonia and subacute bronchiolitis development associated with e-cigarette use.^{23,24} In a study carried out by Gennimata et al, acute effects of e-cigarettes were tried to determined. The study enrolled 32 volunteers. 8 were never smokers and 24 were regular smokers. 11 the volunteers had normal pulmonary functions, whereas 13 had asthma or chronic obstructive pulmonary disease (COPD). Changes were observed in the results of spirometry tests performed before and after inhalation of e-cigarette vapor for a period of 10 min. The 10-min inhalation of e-cigarette vapor was found to cause an instant increase in the airway resistance in both never smokers and regular smokers. In COPD and asthmatic patients, no significant increase was observed in the airway resistance, as a result of 10-min e-cigarette use. In conclusion, researchers stated that they found a significant increase in the airway resistances of the participants of the study, associated with e-cigarette use.²⁵ And in a study carried out by Sussan et al, e-cigarette use was shown to weaken the defense mechanism of mice that the lung creates against bacteria.²⁶ In another study, it was observed to cause inflammation in the airway and consequently trigger hyperactivation of the airway caused by allergens.²⁷ As a result of some studies, it was ascertained that e-cigarette could increase the rate of viral and bacterial infection development as well as virulence of the pathogens such as methicillin-resistant *Staphylococcus aureus*, due to its effects on the respiratory tract.^{26,28,29} In their study, Hwang et al found that exposure to e-cigarette vapor increased the up-regulation of the virulence gene in the respiratory tract, led the bacteria to adhere to more epithelial

Table 1
Toxic substances in e-cigarettes, and their comparison with substances in conventional cigarettes¹⁴

Toxic substance	Average value for 15 inhalations from 12 different brands of e-cigarettes	Average value for mainstream smoke from a conventional cigarette
Formaldehyde, µg	0.2–5.61	1.6–52
Acetaldehyde, µg	0.11–1.36	52–140
Acrolein, µg	0.07–4.19	2.4–62
o-Methyl-benzaldehyde, µg	0.13–0.71	–
Toluene, µg	0.0–0.63	8.3–70
Nitrosornicotine, µg	0.0–0.00043	0.005–0.19
4-(nitroso methyl-amino)-1-(3-pyridyl)-butanone, µg	0.0–0.0283	0.012–0.11
Cadmium, ng	0.0–0.022	–
Nickel, ng	0.011–0.029	–
Lead, ng	0.003–0.057	–

Download English Version:

<https://daneshyari.com/en/article/7520936>

Download Persian Version:

<https://daneshyari.com/article/7520936>

[Daneshyari.com](https://daneshyari.com)