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Comparison of the impact of e-cigarettes and new tobacco heating devices on the human body and their potential in the fight against smoking

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Abstract

Nicotine is one of the most common stimulants used by humans in the world. Its addictive potential is almost the same as that of cocaine. [1] The most popular way of delivering nicotine to the body, which is cigarette smoking, has many negative effects, including considerable carcinogenic potential. Cigarette smoke contains approx. 6,500 chemical compounds, of which around 150 are considered toxic. [2] With the advancement of technology, alternative ways of delivering nicotine to the body have been found. These include e-cigarettes and tobacco heaters. In the following study, we will compare the method and mechanism of operation of these devices and their possible effects on human health compared to smoking.

Keywords: e-cigarettes, tobacco heater, nicotine, effect on the body

Introduction and purpose.

Smoking has serious health effects. Some smoking-related diseases are associated with the action of nicotine itself, which, inter alia, narrows blood vessels and has a high pro-thrombotic potential. However, a significant proportion of diseases are not caused by nicotine itself, but by the toxins present in the smoke inhaled - these are mainly cancer diseases. [3]

Smokers are particularly at risk of:

- Diseases of the respiratory system - emphysema, chronic bronchitis, lung cancer, tongue cancer, lip cancer, oral cavity cancer, laryngeal cancer, tracheal cancer, chronic obstructive pulmonary disease, bronchial asthma, tuberculosis.
- Cardiovascular diseases - ischemic heart disease, myocardial infarction, obliterating atherosclerosis of the lower limbs, arterial hypertension, aortic aneurysm.
- Other diseases: kidney cancer, bladder cancer, esophageal cancer, gastric and duodenal ulcers, intestinal hernias, eye diseases (cataracts, amblyopia, macular degeneration), impotence, impaired fertility. [4]

The most serious health effects of smoking are due to the presence of tar and carcinogenic compounds in tobacco smoke. To minimize this risk, scientists have found alternative ways to deliver nicotine.

State of knowledge.

E-cigarettes.

E-cigarettes are made of three main elements, located in a steel housing, which include: a cartridge (cartridge), an atomizer and a battery. A cartridge is a small reservoir containing a liquid, usually oily substance that contains propylene glycol and/or vegetable glycerin, water and flavors (e.g. tobacco, mint, fruit, coffee, chocolate etc.). The e-cigarette oil may also contain nicotine in various concentrations (0-36 mg / ml) or it may be devoid of it. By using an e-cigarette, the smoker activates a battery-powered atomizer which, using a heating system, heats the liquid inside the cartridge, producing smoke-like fumes. The smoke is then drawn in by the e-cigarette smoker through the mouthpiece and inhaled into the lungs.

In 2009, the FDA's Division of Pharmaceutical Analysis analyzed two brands of e-cigarettes for the presence of carcinogenic tobacco-specific nitrosamines (TSNA) and other tobacco-specific contaminants. As a result of these studies, it was found that TSNA and tobacco-specific impurities in both tested products are present at very low levels. TSNA concentrations in the e-cigarettes were found in the order of "ng/g nicotine". For comparison - in conventional cigarettes the concentrations of these substances (TSNA) are given at the level of "µg/g nicotine". Thus, it can be concluded that the level of TSNA in conventional cigarettes is about 1000 times higher than in e-cigarettes. At the same time, toxic carbonyl compounds, such as formaldehyde, acetaldehyde and acrolein, were detected in almost all tested e-cigarettes. Most of the e-cigarettes tested contained carcinogenic TSNA, heavy metals such as cadmium, nickel and lead, and toluene - a volatile organic compound with carcinogenic potential. However, when comparing the concentrations of these toxins in e-cigarettes with their concentration in smoke produced from conventional cigarettes, researchers found that the levels of toxic compounds found in e-cigarette fumes were up to 450 times lower.

In one study, however, it was shown that vaporization of essential oil without nicotine used in e-cigarettes, it is able to stimulate the release of pro-inflammatory cytokines in lung

epithelial cells and keratinocytes. [6] It is also important to bear in mind the impact that e-cigarettes can have on the cardiovascular system - one epidemiological study has shown that chronic e-cigarette use increases the risk of cardiovascular events by 1.27 times compared to non-smokers. [7] Interestingly, scientists have noticed that the use of e-cigarettes reduces the symptoms of tobacco abstinence. It has been reported that for tobacco smokers, replacing the use of conventional cigarettes with e-cigarettes for a period of 2 weeks resulted in some positive health effects, such as a decrease in carboxyhemoglobin levels and an increased oxygen saturation of hemoglobin [6].

One of the significant threats related to the use of e-cigarettes may be cases of acute nicotine poisoning. This is due to the greater use of e-cigarettes compared to conventional cigarettes. When smoking a cigarette, the smoker delivers a certain amount of nicotine to the body, while using a vaporizer it is really difficult to determine the amount of nicotine inhaled. There is also a risk of oil ingestion or contact with skin and eyes in the event of a leak in the heating system.

Tobacco warmers.

The principle of operation of tobacco heaters (e.g. IQOS) is that the tobacco sample is heated to a temperature sufficient to evaporate volatile compounds, e.g. nicotine inhalation spray. The temperature, however, is so low that the combustion of tobacco does not occur in this process. The user places the tobacco rod in the heating chamber, then after pressing the activation button on the device, the heater brings the tobacco rod to a temperature below 350 °C. This temperature is much lower than when burning a conventional cigarette (350-900 °C), but is sufficient to release nicotine, glycerol which is the main aerosol and tobacco volatile aroma compounds. Such a mechanism significantly reduces the level of toxins in the resulting aerosol as compared to the combustion of tobacco in a classic cigarette. Moreover, it has been shown that heating the tobacco at temperatures lower than those necessary for the combustion of conventional cigarettes reduces the mutagenicity of the generated aerosol. The content of ammonia, benzo (a) pyrene, formaldehyde, carbon monoxide, benzene, acrolein and other toxins is up to 90 percent. lower than in a traditional cigarette and also smaller than in an e-cigarette. [8]

In 2018, a study was conducted to detect the presence of carcinogenic tobacco-specific nitrosamines (TSNA) in an aerosol generated when using tobacco heaters. It was then shown that TSNA are present in an aerosol, but their values were 8 to 22 times lower than in tobacco smoke. [9]

New devices for heating tobacco have been on the market for a relatively short time, and thus the effects of their long-term use are still unknown. The too short period of observation does not allow to conclude that the use of this device does not affect the development of cancer or chronic respiratory diseases, such as chronic obstructive pulmonary disease (COPD) or asthma.

Conclusions.

It is no secret in the scientific world that smoking is one of the most harmful addictions. Apart from the strong addictive potential of nicotine and its effect on the human body, the way of taking this substance poses a great threat to health. Smoking tobacco carries a high risk of carcinogenesis due to hundreds of toxic substances released in this process. Thanks to the development of technology, new, seemingly better, alternatives to the conventional cigarette have been created. Both e-cigarettes and tobacco heaters provide the body with nicotine, but

their mechanism of action allows you to avoid inhaling such a large amount of toxins. It is obvious that these are not ideal devices - there are still harmful chemical compounds present in the aerosol that goes to the smoker's lungs, but their concentration, compared to the burning of a classic cigarette, is even 90% lower.

E-cigarette companies and tobacco heaters advertise their products as a "healthier alternative" to a conventional cigarette or as an aid to quitting smoking (IQOS - I Quit Ordinary Smoking). This is quite a bold statement, as a healthier alternative would be to quit smoking altogether, but while using these devices, nicotine is still delivered to the body, which is itself an addictive factor. Therefore, the best and healthiest alternative is to stop smoking completely, regardless of the method of its administration.

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