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"The Impact of E-Cigarettes and Tobacco Heating Systems on Health: A Review of Current Research"

"Wpływ E-Papierosów i Systemów Podgrzewania Tytoniu na Zdrowie: Analiza Aktualnych Badań"

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Abstract

Introduction: The growing popularity of e-cigarettes (EC) and tobacco heating systems (THS) raises concerns about their impact on the health of users and passive smokers. These products are attractive to young people due to their lack of unpleasant odor and easy availability, even though they contain addictive nicotine and harmful substances.

Materialtrial and Methods of Research: China's first e-cigarette was developed in 2003. The WHO, a leading global health organization, has been actively involved in regulating the advertising and use of EC. They initially allowed the advertising of EC as a healthier cigarette alternative but later banned it due to a lack of scientific evidence. In Poland, the sale of EC to persons under 18 is prohibited, but this law needs to be better enforced. ECs heat a liquid containing nicotine, creating an aerosol with toxic substances such as acetone, glycerol, acrolein, and formaldehyde.

Studies show that EC use leads to adverse health effects such as headaches, nausea, contact allergies, increased blood pressure, irregular heart rhythm, thrombosis, and cancer risk. ECs also affect oral health and the respiratory system, increasing the risk of asthma and chronic obstructive pulmonary disease (COPD).

THS, introduced in 2019, heats tobacco to 300°C, producing an aerosol containing carcinogenic and toxic substances. These products negatively affect the cardiovascular and respiratory systems, increasing the number of pro-inflammatory cells in the lungs and potentially producing hepatotoxic effects.

Conclusion: The increasing use of EC and THS among adolescents raises serious health concerns. These products, although perceived as less harmful, contain toxic substances and addictive nicotine.

Further research is needed on their long-term effects to increase patient awareness and limit the availability of these products to minors.

Purpose of the study:

The aim of the study

This study aims to urgently review and synthesize the current literature on the effects of e-cigarettes and tobacco heaters on the body and present the impact of using these products. In this way, we aim to provide a detailed and comprehensive understanding of their potential impact on human health and the health problems associated with their use.

Materials and methodology

The literature was meticulously collected through PubMed and Google Scholar searches, supplemented by references from the initially retrieved articles. This thorough process ensures the reliability and comprehensiveness of our findings.

Keywords:

e-cigarettes, tobacco heating systems, heated tobacco products, nicotine, addictions

Introduction

We are increasingly noticing more and more people using e-cigarettes and tobacco heaters. Our interest was aroused by the possible impact of these preparations on the health of people using these preparations and on people who are passive smokers. We drew attention to the growing popularity and increasingly younger people who use e-cigarettes and tobacco heaters despite many anti-smoking campaigns about the health risks posed by their use.

In recent years, alternatives to traditional cigarettes have been introduced to the market, with the promoted assumption that these products are less harmful. They have also become more attractive due to the lack of the unpleasant smell that accompanies traditional tobacco products and their easy availability. Unfortunately, these products still contain highly addictive nicotine, which leads to the need to smoke regularly.

Alternatives to traditional cigarettes

E-cigarettes

The first e-cigarette (EC) was produced in 2003 in China by pharmacist Hon Lik (1). From that moment on, this product began to gain more and more popularity and entered the European and American markets. This product began to be advertised as free of tar produced during the combustion of traditional cigarettes. A few years later, the WHO banned advertising EC as healthier than conventional tobacco products due to insufficient scientific evidence supporting this thesis (2). Polish law prohibits the sale of e-cigarettes to persons under 18 years of age, but in practice, sales are still available to minors. These products often have a flavor aimed at young people and liquids with flavors adapted to the tastes of younger customers - such as chocolate or bubblegum aroma. The difference between traditional cigarettes and electronic ones is the method of combustion. The first ones burn tobacco, producing tar. ECs heat a liquid containing nicotine, which vaporizes and is inhaled as an aerosol. According to the producers, it does not contain tar substances. However, the aerosol inhaled when heating this product contains other toxic substances such as acetone, glycerols, acrolein, or formaldehyde, and the very addictive nicotine (3). It is worth noting that the EC content is deprived of heavy metals. However, research shows a significant discrepancy between the declared compositions of e-cigarette liquid in real life (4).

We found research that showed several adverse effects caused by smoking e-cigarettes. These are initially underestimated symptoms such as headache, nausea, and contact allergies. The impact of nicotine contained therein on the circulatory system has also been demonstrated, causing an increase in blood pressure, irregular heart rhythm, and an increased risk of thrombosis. And what is more critical and more dangerous is its proven carcinogenic effect (5). Numerous studies have also demonstrated the effect of EC on oral structures. The results of these studies emphasize the impact of irritation of mucous membranes and their dryness, which also contributes to the development of caries and other periodontal diseases (6,7). It has also been proven that the expression of suppressor genes and those responsible for immunity is reduced in people using EC. When it comes to the respiratory tract, it has been proven in many studies that the risk of asthma and chronic obstructive pulmonary disease increases, and the

immune system in the respiratory system weakens. These people are at greater risk of dry cough and allergic conditions. (7) The substances also affect the central nervous system, causing memory and cognitive disorders, and may contribute to hyperactivity. (14)

Tobacco heating systems and tobacco products

Newer alternatives are heated tobacco systems (HBN) and heated tobacco products (HTP). The first products of this type appeared on the American market in 2019. This device heats the tobacco to approximately 300°C. It has been proven that aerosols contain carcinogenic and toxic substances such as aldehyde, pyrrole, furans, and quinoline. These products have also been shown to hurt the cardiovascular system, such as increased heart rate and blood pressure, which results in increased vascular stiffness (8). It is also proven to increase oxidative stress, affecting the function of the endothelium of blood vessels (8). Inhalation of aerosols containing HBN and HTP increases the number of pro-inflammatory cells in the lower parts of the respiratory system (9). In recent years, it has also been shown that these products cause bronchospasm, swelling of the mucous membranes, and increased secretion of mucous substances in the respiratory tract. (10). In vitro tests were carried out on respiratory cells, and the effect of HNB aerosol, e-cigarettes, and traditional cigarettes was compared. The most toxic aerosol turned out to come from traditional cigarettes, followed by HNB and EC (11). Recent studies have drawn attention to the possible hepatotoxic effect, which should be more thoroughly investigated, especially since smoking such preparations is often combined with alcohol consumption, which additionally burdens the liver (12). Aerosol of these products and EC have shown in scientific studies a negative effect on the oral cavity and periodontium (13).

Discussion

An increased risk of using conventional cigarettes in the future by people previously addicted to these products has also been proven, which is alarming because contact with these products begins at an increasingly younger age and begins to affect people who have not used tobacco products before. (14)

There is very little research showing the problem of passive smoking; these products are often used in closed rooms, which only increases the risk of contact with vapors for other people; this is a signal to expand research in this direction. (15)

It would be essential to prepare research showing the impact on reproductive health, especially since smoking is starting to affect an increasingly younger population. Studies on animals show that sperm motility in animals exposed to EC aerosols was significantly weakened. As for the female reproductive organs, it has been demonstrated that follicles in the ovaries of female rats exposed to the fumes from these products were reduced. There has also been evidence of a negative impact on the embryos of developing animals whose mothers were in contact with these substances (16).

The lack of control and availability of these preparations for minors is also alarming. And the fact that young people are more willing to reach for these preparations than for traditional cigarettes. Flavored liquids are particularly tempting among young people; limiting the availability of flavored products would significantly reduce the use of these products. We also believe that advertising these products should be banned since they are currently targeted mainly at young people they attack on social media. They spend much of their free time in them in particular, unaware of the consequences of using these preparations. Unfortunately, they are often mistakenly called healthier equivalents of traditional cigarettes. These products are increasingly becoming an addition to conventional smoking cigarettes because people take advantage of the greater public acceptance of using these preparations indoors.

Consequently, it does not result in quitting the addiction to smoking cigarettes and has quite the opposite effect (17). The role of doctors is also to make patients aware that switching to these alternatives does not mean quitting the addiction because these people continue to supply nicotine to the body. From our observations, we know how many people perceive the use of e-cigarettes or HNB in this way (18). It is worth mentioning that deciding to stop smoking before the age of 40 reduces the risk of death resulting from continued smoking by up to 90% (19). It is essential to inform patients about the possible adverse effects of these products because they are often unaware of this problem (20). It is worth noting that people with an addiction who decided to quit smoking using e-cigarettes, maintained abstinence longer than the group of people using only over-the-counter nicotine replacement therapy products (21). Currently, there is still a lack of research assessing the long-term effects of smoking and a thorough analysis of the harmful effects of these products on the body.

Summary

In recent years, we have observed the growing popularity of e-cigarettes and tobacco heating systems, especially among young people. Despite anti-smoking campaigns, these products are becoming more attractive due to their lack of unpleasant odor and easy availability, which raises concerns about their impact on the health of users and passive smokers.

E-cigarettes appeared on the market in 2003, gaining popularity around the world. Despite the initial belief that they were less harmful compared to traditional cigarettes, the WHO banned advertising e-cigarettes as a healthier alternative due to the lack of sufficient scientific evidence. Instead of burning tobacco, e-cigarettes heat a liquid containing nicotine, which generates an aerosol. Studies show that this aerosol contains toxic substances that hurt the circulatory, respiratory, and nervous systems. It has also been shown that using e-cigarettes may lead to an increased risk of asthma, chronic obstructive pulmonary disease, and a weakened immune system.

Tobacco heating systems (HNB) and products (HTP) are newer alternatives to traditional cigarettes that have gained popularity since 2019. They heat the tobacco to a temperature of about 300°C, which produces an aerosol containing harmful chemicals. Studies show that these products hurt the cardiovascular system, causing an increase in blood pressure and heart rate, as well as increasing the stiffness of blood vessels. Inhalation of HNB and HTP aerosol also increases the number of pro-inflammatory cells in the lower respiratory system, leading to bronchospasm, mucosal edema, and increased mucus secretion.

There is also a growing body of research showing that people addicted to e-cigarettes and HNB have a greater risk of using traditional cigarettes in the future. This phenomenon is alarming because young people are increasingly reaching for these products, even though they have never used tobacco products before. Additionally, the problem of passive smoking in closed rooms remains insufficiently researched, which is an essential signal for further research. An important area requiring further research is the impact of these products on reproductive health, particularly in the context of young people. Preliminary animal studies have shown that e-cigarette aerosol negatively affects sperm motility and ovarian health.

It is also important to make patients aware that e-cigarettes and HNB are not a safe alternative to traditional cigarettes. Although they can be used as a smoking cessation tool, further research is necessary to assess their long-term health effects more accurately. Patient education and awareness about the potential risks associated with using these products are crucial in the context of their growing popularity.

Disclosure

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