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LITERATURE REVIEW

THE EFFECT OF HOOKAH (SHISA) AND VAPING ON CARDIOVASCULAR DISEASE: A LITERATURE REVIEW

Pengaruh Hookah (Shisha) dan Vaping Pada Penyakit Kardiovaskular: Tinjauan Pustaka

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ABSTRACT

Background: The popularity of shisha (hookah) and vaping as alternatives to smoking has increased significantly in recent years. Shisha smoking, prevalent in Arab nations and other regions, exposes users to various harmful substances including nicotine, fine particles, carbon monoxide, polycyclic aromatic hydrocarbons, and heavy metals. Similarly, vaping involves inhaling aerosols produced by heating e-liquids containing nicotine and other chemicals. **Purpose:** This literature review aims to provide a comprehensive summary of recent studies examining the cardiovascular health effects of shisha and vaping. **Methods:** Epidemiological patterns and adverse consequences of these practices on cardiovascular health were explored through a systematic search of relevant articles from PubMed, ScienceDirect and Google Scholars. **Results:** The findings suggest that chronic use of shisha and vaping is associated with respiratory issues and adverse cardiovascular outcomes. Moreover, shisha smoking has been linked to infectious diseases, pulmonary complications, metabolic syndrome, and adverse effects on fetal development during pregnancy. **Conclusion:** The review highlights the need for further research to better understand the mechanisms and long-term cardiovascular consequences of shisha and vaping.

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ABSTRAK

Latar Belakang: *Popularitas shisha (hookah) dan vaping sebagai alternatif pengganti rokok meningkat secara signifikan dalam beberapa tahun terakhir. Merokok shisha, yang lazim di negara-negara Arab dan wilayah lain, membuat penggunanya terpapar berbagai zat berbahaya termasuk nikotin, partikel halus, karbon monoksida, hidrokarbon aromatik polisiklik, dan logam berat. Demikian pula, vaping melibatkan menghirup aerosol yang dihasilkan dengan memanaskan cairan elektronik yang mengandung nikotin dan bahan kimia lainnya.* ***Tujuan:*** *Tinjauan literatur ini bertujuan untuk memberikan ringkasan komprehensif dari penelitian terbaru yang meneliti efek kesehatan kardiovaskular dari shisha dan vaping.* ***Metode:*** *Pola epidemiologis dan konsekuensi buruk dari praktik-praktik ini terhadap kesehatan kardiovaskular dieksplorasi melalui pencarian sistematis artikel-artikel relevan dari PubMed, science direct, dan google Scholar.* ***Hasil:*** *Temuan ini menunjukkan bahwa penggunaan shisha dan vaping secara kronis dikaitkan dengan masalah pernapasan dan dampak buruk pada kardiovaskular. Selain itu, merokok shisha telah dikaitkan dengan penyakit menular, komplikasi paru, sindrom metabolik, dan efek buruk pada perkembangan janin selama kehamilan.* ***Simpulan:*** *Tinjauan ini menyoroti perlunya penelitian lebih lanjut untuk lebih memahami mekanisme dan konsekuensi kardiovaskular jangka panjang dari shisha dan vaping.*

INTRODUCTION

Smoking with a hookah, or water pipe, has spread swiftly over the world and is becoming a significant tobacco epidemic. One reason for the popularity of hookah smoking is the belief that the traditional charcoal-heated smoke is detoxified as it passes through the water-filled base, making it a safer alternative to tobacco use. Electronic hookahs, often known as e-hookahs, were created in 2014 as a healthier substitute for hookah smoking. Data from the first wave of the Population Assessment of Tobacco and Health Study (2013–2014) show that 18.02% of adults in the 18–24 age range reported currently using hookahs. In the 2014–2015 Population Assessment of Tobacco and Health Study, Wave 2 data showed that 7.07% of teenagers reported having ever used an e-hookah. Of the people surveyed, 4.06% claimed to have ever used an e-hookah, and of those, almost a quarter (26.08%) stated they were currently using one (1). E-cigarette use was initially introduced in the US market in 2007 and has since experienced a significant surge in popularity. In 2018, approximately 8.1 million adults were using e-cigarettes. This increase can be attributed to the marketing strategies employed by tobacco companies and other lobbyists, who promote e-cigarettes as a safer alternative to traditional smoking. Additionally, the appeal of e-cigarette devices, which come in various shapes and forms, has contributed to their growing popularity. Furthermore, the lack of stringent regulations on e-cigarette usage, in contrast to traditional smoking, has also played a role in their increased use (2).

Tobacco smoking is the leading cause of death and sickness worldwide, accounting for 8,000,000 deaths annually, 80& of which occur in low- and middle-income nations. According to estimates from the World Health Organization (WHO), secondhand smoke causes 1,200,000 deaths annually, and direct tobacco usage causes over 7,000,000 deaths. Because tobacco use endangers the public health system, effective cessation programs must be put in place to lessen tobacco abuse and its negative effects on the economy and society (3).

In addition to satisfying a taste for nicotine, shisha smoke contains carcinogenic polycyclic aromatic hydrocarbons (PAH), volatile aldehydes, phenolic compounds, fine and ultrafine particles, carbon monoxide, and heavy metals, including lead and arsenic. Users of shisha inhale tobacco that has been flavor-infused with fruit, such as apple, plum, coconut, mango, mint, strawberry, and cola. Consequently, the experience is improved, and smoking shisha becomes more seductive and enjoyable (4).

Chronic use of vape and shisha has also been associated with respiratory issues such as coughing,

wheezing, and shortness of breath. Shisha smoking involves inhaling flavored tobacco smoke through a water pipe, while vaping entails inhaling aerosols produced by heating e-liquids containing nicotine and other chemicals (5). Smoking tobacco through a water pipe can directly impact several systems, with growing evidence linking it to harmful health outcomes such as lung cancer, respiratory conditions, cardiovascular complications, and periodontal disease. It is also associated with an increase in total plasma lipids, elevated blood pressure and heart rate, and reduced right ventricle function (4). However, no research has yet examined the potential correlation between shisha smoking and the severity of coronary artery disease (CAD). With regard to the impact of vaping and shisha on cardiovascular health, this literature review attempts to present a thorough overview of current research.

METHODS

The search engines PubMed and Google Scholar were utilized with the keywords "shisha," "water pipe," "narghile," "cardiovascular," and "hookah" to identify relevant studies. This approach was part of the overall protocol for selecting the literature. A comprehensive search yielded a total of 30 articles published between 2013 and 2023 that were relevant to the topics of "shisha," "cardiovascular health," and "hookah." All search results in the English language, including original papers, case reports, and reviews, were included. The articles that focused on the epidemiology and adverse consequences of shisha and vaping on cardiovascular health were selected (Table 1). The exclusion criteria were applied to filter out irrelevant items that did not align with the article's intended purpose and objectives.

RESULTS

Concept of Hookah and Vape

The traditional smoking pipe is a sort of waterpipe used for inhaling specially formulated tobacco mixtures, also referred to as a hookah. A metal body, a base filled with water, a tobacco bowl, and a flexible hose with a mouthpiece are its standard components. The smoke from the charcoal-heated tobacco cools as it goes through the water in the base before being breathed through the hose. Smoking a hookah is a popular social activity that has cultural value in different parts of the world (6). Contrarily, electronic cigarettes, commonly known as "e-cigs," "vapes," and "electronic nicotine delivery systems" (ENDS), are devices that consist of a heating element, a power source, and a refillable tank or cartridge (pods) that holds e-liquid. These battery-powered gadgets come in a variety of shapes, sizes, and colors; some resemble pipes and cigarettes. On the other hand, more contemporary versions resemble thin pens or USB flash drives. Interestingly, e-cigarette flavors and nicotine doses differ and are dissolved in propylene glycol and glycerol. These are the main components of the e-liquid, which is heated to create aerosols (6).

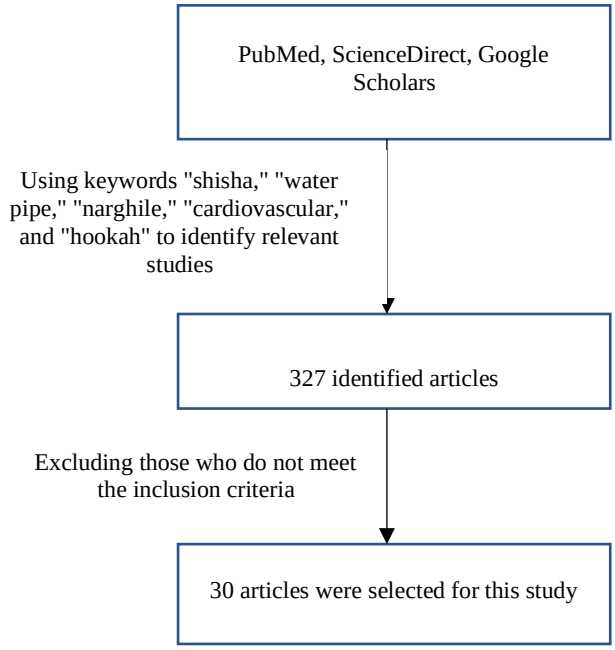

Figure 1. Flow Chart of Selected Studies

Composition of Hookah and Vape Smoke

Nicotine is the primary addictive component present in various tobacco products and alternatives. Hookah smoke contains many of the same harmful ingredients as traditional cigarette smoke, including nicotine, tar, carbon monoxide, arsenic, chromium, cobalt, nickel, cadmium, lead, and polonium 210. Additionally, hookah smoke contains polycyclic aromatic hydrocarbons like benzo (a) pyrene, which react and bind to DNA to cause various forms of cancer (7). Organic molecules included in e-liquids break down into smaller compounds when heated. Several studies show that vaping produces formaldehyde, acetaldehyde, acrolein, and diacetyl. Formaldehyde and acrylamide are known carcinogens and potent irritants. Studies show that, when heated, PG/VG is oxidized, and intermediate breakdown products, including acetyl and glycidol, are produced. Recent research suggests that the cytochrome P450 aryl

hydrocarbon pathway of e-cigarette aerosol may increase the production of benzo(a)pyrene metabolites that are known to cause cancer. This means that dual users are more likely to be hurt. To understand how vaping impacts cytochrome P450 proteins in the cardiovascular system, more research is required (8).

Table 1
Characteristics of Reviewed Studies

Researcher	Study Design	No. of participants	Main Findings
Shakhatreh et al., 2018 (11)	Case control study	59 waterpipe smokers 41 non-smokers	It was shown that waterpipe smokers had more mouth infections. Only waterpipe smokers had subgingivated Acinetobacter and Moraxella species. waterpipe smokers' subgingiva had: more Candida albicans ($p = 0.023$) less Fusobacterium nucleatum ($p = 0.036$).
Khabour et al., 2018 (13)	Experimental study	20 adult mice	Exposure to waterpipe tobacco smoke recruited airway inflammatory cells. The bronchoalveolar lavage fluid of subjected animals showed a significant increase in macrophages, lymphocytes, and neutrophils ($P < 0.01$).
Al-sawalha et al., 2018 (14)	Experimental study	20 pregnant rats	Prenatal exposure to WTS at any stage of pregnancy caused short- and long-term memory impairment in adult offspring rats ($p < .05$), compared to offspring whose mothers were exposed to fresh air.
Alzoubi et al., 2019 (15)	Experimental study	49 Wistar male rats	Waterpipe smoking negatively impacts short-term and long-term memory ($P < 0.05$). Waterpipe smoking decreased hippocampal catalase, GPx, and GSH/GSSG ratio activity ($P < 0.05$). VitE protected memory loss and oxidative stress biomarker changes.
Alqudah et al., 2018 (18)	Experimental study	52 Adult male Wister rats	WTS exposure hampered short- and long-term memory ($p < .05$). Conversely, VitC mitigated WTS-induced memory impairment ($p < .05$). VitC also reduced WTS-induced drop in hippocampal GSH/GSSG ratio ($p < .05$).
Alzahrani et al., 2018 (21)	Cross-sectional study	2014 (n=36,697) and 2016 (n=33,028)	Both daily conventional cigarette smoking and daily e-cigarette use (OR=2.72, 95% CI=2.29, 3.24, $p<0.001$) increased the risk of myocardial infarction independently.
Ammar et al., 2024 (22)	Cross-sectional study	105 healthy volunteers	Heart rates were significantly higher among chronic electronic cigarette users and traditional cigarette smokers compared to non-smokers ($p <0.001$). Both traditional smokers and e-cigarette users had significantly shorter QRS complex durations ($p<0.001$) than non-smokers.

(*Continued*)

Table 1
Continued

Researcher	Study Design	No. of participants	Main Findings
Mahmoud* et al., 2023(23)	Analytical cross-sectional	1045 individuals	Shisha users had 1.65 times higher odds of reporting a cardiovascular disease diagnosis than non-smokers (95% CI: 0.71–1.91). Additionally, dual shisha and cigarette users reported 1.47 times higher odds of reporting diagnoses for cardiovascular disease (95% CI: 0.88–2.45) than did non-smokers.
Alomari et al., 2018 (24)	Cross-sectional study	195 waterpipe and 288 nonsmokers	According to the results of the current investigation, Wp smoking is linked to decreased circulatory BDNF.
Benowitz et al., 2020 (25)	Crossover study	36 healthy dual CS and EC users	CS and EC had comparable 24-hour hemodynamic effects to no tobacco product, including higher average heart rate and inflammatory biomarkers. Switching to EC may not damage smokers, but it may increase cardiovascular disease risk, especially for smokers.
Roxlau et al., 2023 (28)	Experimental study	36 Wild-type C57BL/6J mice	When nicotine-containing or nicotine-free e-cigarette vapor extract (ECVE) or PASMCs (pulmonary artery smooth muscle cells) were exposed in vitro, their gene expression changed (NF ECVE).
Herr et al., 2020 (29)	Experimental study	Human Cell culture	Gene transcriptomes related to inflammation and host defense are distinct in TCIG-treated and ECIG-exposed cells. Compared to TCIG, ECIG-vapor has less of an impact on epithelial cells and has no effect on host defense.

The liquid used in electronic cigarettes commonly contains nicotine, propylene glycol, and glycerin. These three components are the main sources of hazardous chemicals that can be extracted from the vapor produced by electronic cigarettes. Carbonyl compounds, such as toxic aldehydes and ketones, are formed as byproducts when the e-cigarette liquid is heated During waterpipe sessions, a variety of carcinogenic chemicals, such as PAHs and VOCs, are released into the smoke. These compounds have been connected to the emergence of several types of cancer (9). Formaldehyde and acrolein, in particular, exert their detrimental effects by forming adducts with proteins and DNA.

Health Risks of Hookah

The health consequences of using a hookah are still up for debate, despite the fact that users and others nearby are frequently exposed to numerous potentially harmful toxicants. This is partly explained by the inconsistent and non-standardized tobacco smoke composition and puffing behaviors found in hookahs. Despite conflicting data, using e-cigarettes has been cross-sectionally linked to an increased risk of myocardial infarction. There is a small amount of data regarding the subclinical cardiovascular (CV) effects of electronic cigarettes in people (10).

In theory, sharing the mouthpiece when smoking a hookah with others may be a likely way for infections like bacteria, fungus, and viruses to spread. For instance, a study discovered that sharing a mouthpiece among users who have bleeding gums may raise the possibility of contagious illnesses like hepatitis C. Additionally, using a hookah has been connected to changes in the oral microbial flora that are about as severe as those brought on by cigarette smoking (11).

The usage of hookahs is associated with detrimental effects on the pulmonary system, much like smoking cigarettes. As a result, symptoms including wheezing, coughing up sputum, and shortness of breath are common among hookah users. Furthermore, hookah smoking significantly reduces lung function measures such as FEV1, FEV1/FVC ratio, and FEF and FeNO levels. Reactive oxygen and nitrogen species, as well as the

quick conversion of nitric oxide to peroxynitrite by nitric oxide synthase downregulation, can lower FeNO levels, which are a crucial marker of eosinophilic airway inflammation. Additionally, there was found to be a decrease in lung diffusing capacity and an increase in apoptotic endothelial cell microparticles in hookah smokers (12).

In broncho-alveolar lavage fluid, there are more neutrophils, lymphocytes, and macrophages than usual as well as noticeably higher amounts of many cytokines after hookah use. It reduces the anti-inflammatory cytokine IL-10 while increasing the levels of TNF, IL-1, IL-6, IL-12, and IL-13 in the lungs of exposed mice (13,14). As further evidence of the pulmonary harm caused by hookah smoking, hookah use alters the levels and mRNA expression of the three main matrix metalloproteinases (MMP-1, MMP-9, and MMP-12), increasing catalase activity in the lungs (13). Long-term hookah smoking exposure in mice for four months was found to affect the development of chronic obstructive lung disease, and it also significantly increased mean linear intercept and alveolar destructive index (15).

Smoking hookah or cigarettes, as well as using other inhaled narcotics and alcohol addiction, can impact oral health by creating changes in the lips, tongue, and oral cavity. Epidemiological studies indicate that smokers have a chance of acquiring oral carcinoma up to nine times higher than non-smokers. Zamzuri and colleagues showed that hookah smokers had substandard oral hygiene and moderate gingival irritation. Periodontitis was more common in hookah smokers, possibly due to a weakened immunological and inflammatory response similar to that seen in cigarette smokers (16).

As previously indicated, hookah use is regrettably rising among at-risk demographics like youths and pregnant women. Animal model data show that ENDS products can be hazardous to the developing fetus as well as the mother. There have been reports of reduced placental and cord blood flow, fetal development limitation, and postnatal growth delay associated with maternal ENDS use (17). According to animal research conducted by Khabour et al. (2018), pregnant women who are exposed to hookah smoke may experience low birth weight, higher neonatal mortality, and slower child growth. In addition, (14) discovered that adult mice offspring from an asthma mouse model suffer from airway inflammation and poor lung function as a result of prenatal exposure to hookah smoke. In a study by (14), memory problems and reduced levels of brain-derived neurotrophic factor (BDNF) in the hippocampus of the adult male progeny were observed in pregnant rats exposed to hookah tobacco smoke.

Teenage hookah smoking may impede brain development by reducing levels of brain-derived neurotrophic factor (BDNF), which is crucial for cognition and behavior. Smoking hookah lowers BDNF levels, which may affect the body's immune system and result in atypical behaviors including poor focus and aggression, according to a study conducted on children in grades 7 through 10. In mice exposed to hookah tobacco smoke, lower levels of important oxidative stress markers and oxidative capacity enzymes were associated with reduced short- and long-term memory (15,18).

Epidemiological Evidence of Shisha and Vape Smoke Effect on Cardiovascular Diseases

It is commonly known that tobacco use has harmful (acute and long-term) consequences on the cardiovascular system. As a result, smoking increases the risk of cardiovascular events and substantially raises the mortality and morbidity associated with cardiovascular disease, accounting for up to 30% of heart disease-related deaths in the United States of America annually. Significantly, the chemical and toxicant profiles of hookah and regular cigarettes are similar. While long-term use of hookahs increases the risk of coronary heart disease (CAD), short-term usage has been linked to sympathomimetic effects, such as an increase in heart rate and blood pressure. Additionally, data suggest that hookah smokers have a higher risk of developing CAD than smokers of traditional cigarettes. Therefore, it is necessary to dispel the myth that smoking a hookah is safer than smoking cigarettes by providing evidence of greater risk in comparison to traditional cigarette smoking (19).

A cross-sectional analysis of National Health Interview Survey data revealed that consuming electronic cigarettes raised the risk of circulatory diseases, myocardial infarction (MI), and stroke (20). The National Health Interview Survey data from 2014 and 2016 showed a link between daily e-cigarette usage and MI, even after adjusting for risk factors including cigarette smoking. Chronic e-cigarette users may experience sympathetic activation, similar to that of traditional cigarettes. This can lead to atrial and ventricular arrhythmias, sudden cardiac death, and alterations in heart rate variability after short-term use. Consequently, regular e-cigarette use is associated with the same cardiovascular risk factors as traditional cigarette smoking (21).

The study included 105 healthy volunteers without cardiovascular disease or cardioactive medication usage. Three study groups of 35 participants each were chronic e-cigarette users, conventional cigarette smokers, and non-smokers. Chronic electronic cigarette users and traditional cigarette smokers had considerably greater heart rates than non-smokers ($p < 0.001$). Compared to non-smokers, e-cigarette users and traditional smokers had considerably shorter QRS complex duration ($p < 0.001$). QT and QTc intervals were longer in e-cigarette users and conventional smokers compared to non-smokers ($p < 0.001$). Chronic e-cigarette users and traditional smokers had significantly longer ventricular repolarization indices (T wave—peak to T-end (Tpe) interval, TPe/QT ratio, and TPe/QTc ratio) compared to non-smokers ($p < 0.001$). Mean systolic, diastolic, P wave amplitude, length, and PR interval were not significantly different across groups ($p > 0.05$) (22).

Compared to non-smokers, shisha smokers had 1.65 times greater chances of reporting diagnoses for cardiovascular disease (95% CI: 0.71–1.91). In addition, compared to non-smokers, dual shisha and cigarette users had 1.47 times greater chances of reporting cardiovascular disease diagnoses (95% CI: 0.88–2.45) (23). Contrary to earlier findings in adults, a recent cross-sectional study concentrating on adolescent hookah smokers revealed reduced blood pressure and heart rates compared to non-smokers. According to the study, this gap may be caused by the subjects' twelve-hour abstinence from hookah smoking before the test, which decreased their nicotine levels and therefore regulated their levels of neurohormones, including cortisol and sympathetic activity. To pinpoint the precise mechanism underlying this conclusion, more research is necessary (24).

A 2015 population-based study in Syria by Ward et al. indicated that daily waterpipe users had an average weight 2.26 kg/m2 higher than never smokers, even after controlling for cigarette smoking, chronic illnesses, age, sex, income, and marital status. Smokers were approximately three times more likely to be overweight than nonsmokers. A Punjab, Pakistan, study linked long-term waterpipe use to belly obesity, hypertension, hyperlipidemia, and hyperglycemia. It was unrelated to blood HDL. In a 7.6-year cohort study in Bangladesh by Wu et al., hookah use was linked to 1.45 relative risk for ischemic heart disease, 0.91 for cerebrovascular disease, and 1.20 for coronary artery disease.

DISCUSSION

Effect of e-cigarette Vapor Versus Traditional Cigarette Exposure

Numerous researches have been conducted to investigate the risks associated with using electronic cigarettes, both in living organisms (known as "in vivo") and in cell cultures (known as "in vitro"), respectively. A crossover study involving 36 healthy dual-CS and EC users was conducted in a controlled research setting. Circadian heart rate, blood pressure, plasma nicotine levels, 24-hour urine catecholamines, 8-isoprostane and 11-dehydro-thromboxane B2, and plasma interleukin-6 and interleukin-8 were all assessed in CS, EC, and no nicotine situations. Compared to circumstances in which no tobacco product was used, heart rate and blood pressure were higher in CS and EC during the day and over the course of a 24-hour period ($P<0.01$). The average heart rate with CS was higher than with EC. There was no significant difference in urinary catecholamines, 8-isoprostane, or 11-dehydrothromboxane B2. However, both CS and EC raised plasma levels of IL-6 and IL-8 as compared to no tobacco product ($P<0.01$) (25).

The immune system implications of vaping are unknown. Nonsmokers' usage of conventional and e-cigarettes may rapidly activate and aggregate platelets. This effect was found stronger with traditional cigarettes than e-cigarettes. Platelets and neutrophils exposed to e-cigarette aerosol had higher neutrophil activation markers. These effects may cause endothelial dysfunction, platelet and leukocyte activation, and cardiovascular disease. Although daily e-cigarette use and heart attack risk are under investigation, moving from tobacco to chronic e-cigarettes may improve blood pressure, endothelial function, and vascular stiffness. More research is required to fully understand how e-cigarette use affects heart health (26).

The US Centers for Disease Control and Prevention (CDC) recently noted an increase in the number of youngsters who use vaping devices or e-cigarettes and suffer lung injury, also known as EVALI. Aerosolized oils from e-cigarettes produced localized inflammation, which hampered the exchange of gases in the lungs, according to computed tomography (CT) scans. However, rather than other components of e-cigarettes, tetrahydrocannabinol (THC) and vitamin E supplements were connected to the use of e-cigarettes for consumption in the majority of documented cases of lung damage (18).

Studies done on mice and rats, however, produced a range of results. Despite having greater levels of interleukin-6 (IL-6), mice exposed to lab air, e-cigarette aerosol, or cigarette smoke (CS) did not show any indications of apoptotic activity or increased levels of specific inflammatory markers in their lung tissue. Rats exposed to CS, on the other hand, had increased amounts of inflammatory markers in their lungs. Neurotoxicity and airway illness were seen in a rat model imitating early-life exposure to e-cigarette aerosols with or without nicotine. Overall, the results from both in vivo and in vitro studies generally support each other (27).

When e-cigarette vapor extract (ECVE) with or without nicotine or PASMCs (pulmonary artery smooth muscle cells) were exposed in the lab, their gene expression changed (NF ECVE). On the other hand, ECVE specifically led to functional changes, such as a 29.3±5.3% and 44.3±8.4% decrease in the proliferation of human and mouse PASMCs, respectively. Moreover, acute inhalation of nicotine-containing e-cigarette vapor (ECV) but not nicotine-free e-cigarette vapor (NF ECV) increased pulmonary endothelial permeability in isolated lungs (28).

Researchers have discovered that both regular cigarette smoke extracts and e-cigarette aerosols make more of a chemical called IL-8/CXCL8. This chemical attracts neutrophils and has been found to be released by human airway epithelial cells. The transfer of dextran from the apical to the basolateral side of the cell layer served as evidence that only conventional cigarette smoke extracts adversely affected the integrity of the epithelial barrier. Additionally, exposure to e-cigarette aerosol increased neutrophil elastase activity, matrix metallopeptidase 9 (MMP-9), and IL-8/CXCL8 release. These impacts might encourage neutrophils to go toward inflammatory areas (29).

Compared to those exposed to e-vapor condensates, human gingival fibroblasts exposed to traditional cigarette smoke condensate demonstrated more dramatic morphological alterations, proliferative inhibition, and apoptosis induction. Adenocarcinomic human alveolar basal epithelial cells (A549) exposed to both traditional cigarette smoke extracts and e-cigarette aerosols died, according to a different study on cytotoxicity and battery output voltage. But compared to e-cigarette aerosols, the negative effects were more pronounced with extracts of traditional cigarette smoke. This is because the former caused negative effects at lower concentrations than the latter (20).

Hookah Regulations and Policies

Inhaling toxicants from hookah smoke may be comparable to smoking cigarettes. The FDA's 2016 rule expanded its power over all tobacco products, including hookah. All hookah tobacco and devices (excluding lighters and tongs) are now regulated by the FDA. However, some US cigarette restrictions do not apply to hookahs. For example, the "Prevent All Cigarette Trafficking Act" does not interfere with the delivery of hookahs, but it does prohibit the US Postal Service from mailing cigarettes (30). Hookah is allowed in bars in 90% of the largest US cities due to exemptions (cigarettes are not). To regulate hookah access, large credit card companies should ban online payments like they did cigarettes. Health policy experts would find it useful and significant to have research on the health impacts of hookah to aid in updating and improving existing policies. It is evident that policies and their modifications are critical (12).

Research Limitations

In some case studies, confounding factor adjustment was weak, gender and age were not adequately evaluated, and there were no precautions against the use of additional tobacco products. After reviewing the evidence, hookah use is linked to health risks. Studies on humans and animals are required to evaluate the effects of hookah on the cardiovascular system because of the sensitivity of this system and the non-linear dose-response/toxicity connection of smoke.

CONCLUSION

Concerns over the effects of vaping and shisha on cardiovascular health have been raised as these trends gain popularity as alternatives to cigarette smoking. While vaping exposes consumers to nicotine and other toxins, shisha smoke contains toxic ingredients like heavy metals and nicotine. Respiratory problems have been connected to the regular use of these products. Public health initiatives like information campaigns, more stringent laws, and focused interventions are required to lessen these negative health effects. More research is required to fully comprehend the long-term consequences of these behaviors.

CONFLICT OF INTEREST

The authors affirm that there are no conflicts of interest associated with the research conducted and the findings presented in this manuscript.

AUTHOR CONTRIBUTION

AH: Conceptualization, Methodology, Writing, Original draft preparation. MAA: Visualization, Investigation, Reviewing. CUW: Supervision

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