

Effects of Hookah/Waterpipe Smoking (WPS) on the Cardiovascular System: A Review Article

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Abstract

Background: Water pipe smoking is prevalent in every single country and the practice of tobacco smoking with hookah/waterpipe is increasing globally, mostly among young adults. In this study, we aim to review the articles related to the hookah/waterpipe smoking (WPS) that discuss its outcomes on the body, with an emphasis on the cardiovascular effects.

Methods: A comprehensive literature search was conducted to identify the studies that dealt with the prevalence of hookah/WPS and its detrimental effects on the health, particularly the cardiovascular (CV) system. The searched databases included PubMed, Google Scholar and ResearchGate. The keywords and medical subject headings related to the hookah smoking were identified prior to initiating the search. We also examined the reference sections of all selected articles to identify other relevant reports.

Results: Several studies suggested that hookah smoke contains harmful substances and causes acute adverse effects on the CV system. These effects include an immediate increase in heart rate and systolic blood pressure, a decrease in heart variability and increase in coronary blood flow. Various long-term effects such as higher blood pressure and high heart rates were also observed in people with established CV disease. WPS has a direct association with hypertension, hyperlipidemia, hyperglycemia and abdominal obesity.

Conclusion: Hookah/Waterpipe smoking significantly effects the heart rate, blood pressure, baroreflex sensitivity, tissue oxygenation, and vascular function. There is a need to study these effects and increase awareness about the associated hazards in a similar manner as of cigarette smoking.

Keywords: *Hookah Smoking; Waterpipe Smoking; Tobacco Smoking; Cardiovascular System; Adverse Effects*

Hookah smoking/WPS effects more than 100 million people worldwide [1], with a large proportion of them being young adults. It is an emerging trend in the US population also [2], especially among the youth [3], with at least 18.2% of adults between the age of 18 - 24 being current hookah users. The figure below shows an age comparison between the hookah users in 2014 in the UK specifically. This is a worrying matter because Hookah/WPS contributes a large sum of people to tobacco users, regardless of the country, which account for 9% of the deaths globally.

Hookah smoking has largely been misapprehended as less harmful than cigarette smoking. It is often viewed as a safer alternative because it is mostly flavored or sweetened [4]. New studies have begun to dismantle this belief [2,5]. One major evidence that shuts down

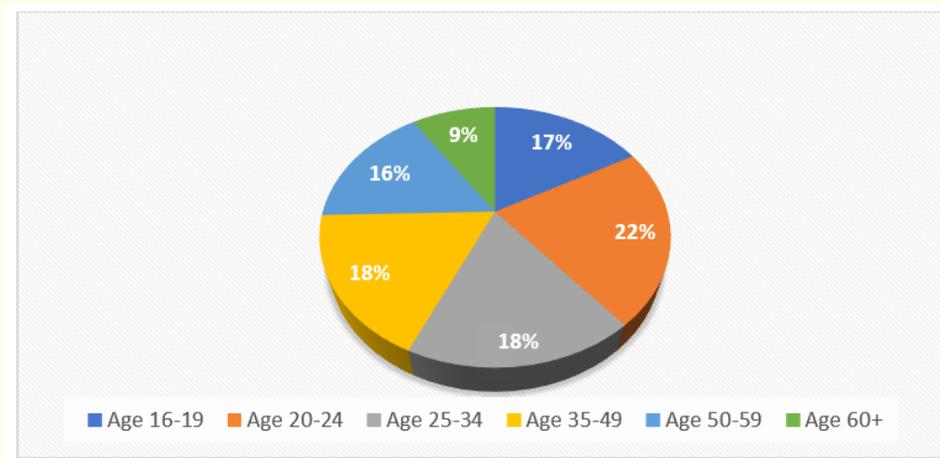


Figure 1: Hookah users in the UK (2014).

this belief is extensive experiments on how hookah users expose themselves to the same chemicals and toxins that cigarettes have, but at a much higher level. Several toxicants have been found in mainstream hookah smoke including nicotine, carbon monoxide, carcinogenic polycyclic aromatic hydrocarbons (PAHs), aromatic amines, aldehydes, furanic and phenolic compounds, tar, particulate matter, heavy metals, and ammonia [2]. Researchers corroborated that someone who smokes hookah on a daily basis will have a .783 mg/mL reading for urinary cotinine level over a 24 hour period, the same for someone that smokes 10 cigarettes a day. Measuring cotinine level is important because it is a chemical that your body makes after you are exposed to nicotine. Even if you are not a daily smoker and have a single session over 4 days, that still equivalates to 2 cigarettes a day. As a result, effects of nicotine consumption lead to an increase in heart rate and blood pressure, among other things [8]. Particulate matter is also another thing that is being inhaled. PM is generated in high levels and can also vary in size. A single session of water pipe smoking can lead to a 10-fold greater exposure to tobacco, making it detrimental to your organs because of an effect on your immune response and many negative tissue and organ responses. Long-term exposure to WP smoking has also been linked to severe coronary artery disease. Hence, a greater need to cut-down WPS among the cardiac patients [9,10].

Previous studies have shown that smoking hookah also acutely impairs large artery endothelial function, which was measured by brachial artery flow-mediated dilation. When considering the traditional method of charcoal-heated hookah smoking, the acute endothelial dysfunction is masked by carbon dioxide. In a study involving 53 subjects [6], the immediate effects of hookah smoking on central and peripheral CV indices were evaluated. It showed an acute increase in the heart rate and diastolic blood pressure. This is further supported by another study [7], where three groups were studied: non-smokers, cigarette smokers and waterpipe smokers. The results showed that WP smoking significantly increased HR compared to cigarette smokers. According to [1], carbon dioxide happens to be a vasodilator molecule that is generated by charcoal combustion. This study primarily uses 2 methods to understand the peripheral circulatory response to smoking in cutaneous and muscular beds which were tested simultaneously. Out of the 37 people that were screened, only 21 were eligible to participate. The first method measured the blood flow of skin by laser Doppler velocimetry and the second method measured the calf muscle blood flow by venous occlusion strain-gauge plethysmography. The probe was placed on the dorsal side of the right foot. The skin vascular resistance was measured by estimating the value of mean arterial pressure divided by skin flux. The skin temperature was also measured by a sperate probe placed near the first probe. The second method measured the calf muscle blood flow by venous occlu-

sion strain-gauge plethysmography. The cuff was placed on the patients left thigh right above the knee. The measurements obtained consisted of 4 separate readings that were performed at 10 - 15 second intervals. The calf muscle resistance was then estimated by the ratio of mean blood pressure to calf muscle blood flow. All the participants were asked to enter a custom smoking chamber with air circulating in from the vent in the ceiling. They were semi-reclined and heart rate and BP was continuously recorded throughout the process. During the experiment, the task of the participants was to smoke 12 grams of flavored hookah tobacco with a .05% nicotine level. Measurements were taken before and after 30 minutes of smoking hookah and then continued for 60 minutes in each participant.

The results from this experimentation show that 43% of the participants were females that smoke 3 times a week with the average session lasting 90 minutes. The results corroborate that there was an increase in heart rate, blood pressure, and calf muscle blood flow, but a decrease in skin blood flow and skin temperature. There was also an increase in plasma nicotine and exhaled carbon monoxide. Sitting in the chamber for 30 minutes without smoking had no effect on the cutaneous or skeletal muscle blood flow, vascular resistance, skin temperature, or cardiovascular hemodynamics. This shows that all the fluctuating levels of the determents listed above were only affected after smoking hookah. The main points of this research's findings inform that habitual hookah smokers that do not smoke cigarettes showed an increase in plasma nicotine and exhaled carbon monoxide levels. Hookah smoking also induced acute cutaneous vasoconstriction and even skeletal muscle vasodilation. These effects lasted well after the exposure period, further shows how smoking effects our bodies in the long run. As supported by the research and evidence, overtime the more frequently one smokes, the longer it takes the body's levels of various determents to go back to normal levels, until eventually when the damages become permanent.

Conclusion

When it comes to hookah smoking, a lot of the continuation of smoking is because of a lack of information. Even though many are aware of the great risks associated with water pipe smoking, most have a difficult time in quitting it. Despite the reasons one chooses to quit or continue to smoke, the research speaks for itself when it shows the direct correlation between the components of hookah smoke and how it leads to heart attacks and strokes. As we write, the ongoing research provides suitable evidence that WPS is associated with several adverse health indicators and outcomes. However, there is still need for more studies to document hookah smoking and its effects on health so that in-time prevention interventions and techniques can be implemented to control the widespread increase of WPS in the US.

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