



The Effect of Shisha on Respiratory Health

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Abstract

In the Middle East, smoking shisha is considered a more socially acceptable activity. The prevalence of shisha smoking among Middle Eastern adolescents varies. Smoking shisha requires burning tobacco with a distinct aroma, commonly referred to as molasses, over coals. Some people believe that shisha is a safer alternative to cigarettes, but evidence suggests that shisha use is associated with harmful and detrimental respiratory health effects.

Keywords: Respiratory health, Shisha, smoking

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INTRODUCTION

Smoking is a serious health problem and the most important avoidable cause of death globally.¹ An estimated 1.3 billion people worldwide smoke, and 80% live in developing countries. Cigarettes occupy the second position as the leading cause of death globally and are estimated to be the cause of death of 1 in 10 adults in the world.² The number of smoking-related deaths is expected to reach 8.3 million by 2030.^{1,3} Smoking, regardless of the method, can cause health hazards. There are various smoking methods available in different parts of the world, including cigarettes, e-cigarettes, or the form of shisha/hookah.⁴ Geographic areas, such as the Middle East, where tobacco use has become part of the culture, have a very high prevalence of shisha use, especially among young people⁵

The prevalence of shisha smokers varies between 6–34% among adolescents in the Middle East.⁶ The number of shisha smokers has also increased in recent years in the United Arab Emirates and has caused particular concern in the society.⁷ The number of adolescents who use

tobacco in the form of shisha, Dokha, and cigarettes are very high in the United Arab Emirates/Saudi Arabia. Although the legal age for smoking is 18 years, recent statistics show that in the 13–15 year age group, 19% of men and 10% of women used shisha.⁵ Study in the UAE pointed out that Shisha users in Emirati were 26.8%, lower than Arab Non-Emirati for as much as 42.6% with the most age group 18–29 years old of 41.6% compared to ages 30–39 years of as much as 37.6%.⁷ Moreover, in one study, it was found that nearly 15% of students at the University of Sharjah, Saudi Arabia reported that they had smoked either regular cigarettes or shisha. Furthermore, 18% of students in Dammam, Saudi Arabia, also smoked.⁴

Shisha goes by various names, including hookah, narghile, water-pipe, argils, etc.^{1,2,6,8} A smoking session of shisha usually lasts 20–80 minutes. Thus, smokers are exposed to so much smoke for a long time. Shisha smokers inhale 50–200 puffs in one session, inhaling 0.15–1 L of smoke in one session, the equivalent of smoking 100

cigarettes. Shisha was also associated with a higher effect on passive smokers than regular smokers.⁶

Smoking shisha is considered a more socially acceptable activity because it is often considered harmless.^{3,5,9,10} A study in Saudi Arabia found that 50% of students considered shisha to be less harmful than cigarettes, and 61% of them thought that the harmful substances in shisha were purified.¹¹ Broadly, shisha is presumed a safer alternative to cigarettes because, with shisha devices, the smoke is passed through the water first in an attempt to “filter/purify” the smoke and filter out all harmful chemicals such as tar, CO, and nicotine.^{1,4,7-10} Some people believe that there is a little or no nicotine in shisha.¹⁰ In addition, people also think that shisha smoke is more environmentally friendly.³

Despite these misconceptions, various studies have indicated that smoking shisha actively might be the same or even more dangerous than smoking and was associated with various diseases and adverse health effects such as cardiovascular and respiratory complications, cancer, infections, infertility, and others.^{1,4,7-9,11} Shisha smoke also contains the same toxins as regular cigarette smoke, even though it has been passed through the water before.⁴ Compared to cigarettes, shisha has high levels of nicotine, arsenic, chromium, and lead. In addition, CO exhaled by shisha smokers is twice as high as that of regular cigarettes.⁷ Another thing that attracts people to use shisha is the trend of smoking shisha among young people and the availability of various shisha aromas such as chocolate, mint, grape, cherry, apple, and others.^{6,11} Shisha smoke leaves a pleasant smell, unlike cigarette smoke in general.^{1,10,11}

Lately, shisha is also assumed normal or even ordinary and has been assimilated into popular culture, marked by the many pop-up “hookah bars” or “shisha cafés” that are found in many big cities around the world.^{6,10} The existing misunderstanding is also further strengthened by the fact that people regard smoking shisha is a social and popular/famous activity at family gatherings or other social events.^{4,7,10,11} Many shisha smokers believe

that smoking shisha provides pleasure, strengthens intimacy in social gatherings, and relaxes the mind. However, they do not realize that smoking shisha indirectly causes addiction both physically and mentally and can be harmful to health.^{4,10}

SHISA COMPONENT

There are three types of commonly used shisha/hookah, namely Mouassal or “Muessel,” Jurak, and Tumbak. The three types of shisha have different contents. In short, Mouassal in Arabic means “honey” contains 30% tobacco and about 70% honey/sugar cane as well as glycerol and flavorings. Moussal is the most common type of shisha used in the Kuwaiti population. Meanwhile, Jurak contains tobacco, sugar cane, and about 20% of other spices and dried fruits. Jurak is commonly used in the Middle East and the Gulf region. Lastly, tumbak, which is mainly used in Asia, is a pure form of unflavored tobacco leaf that is burnt over charcoal.^{12,13}

Basically, smoking shisha involves burning tobacco with a certain aroma, generally referred to as molasses, and burning it using coal.^{10,11} When a person inhales smoke from a smoking pipe, the air is drawn through the tobacco and heated with coal to produce cigarette smoke. As a result, smoke contains components of tobacco and coal.¹¹

Tobacco is the main source of smoke in both hookah/shisha and cigarettes. Hookah users are exposed to the same toxic compounds or toxic byproducts as cigarette users but at much higher levels and with a worse impact on shisha users.¹² This tobacco contains high levels of PAH (polycyclic aromatic hydrocarbon) and carcinogenic compounds. These high levels compounds are also largely due to the burning of coal. Significant PAH exposure can establish various types of cancer in shisha smokers, including lung cancer.^{11,12}

Other toxic compounds obtained in shisha smoke include nicotine, carbon monoxide, aromatic amines, aldehydes, furanic and phenolic compounds, TAR, heavy metals, and ammonia.^{2,6,11-14} The amount of these toxins may be higher or lower in

shisha compared to cigarette smoke (per stick/and per pack/day) depending on the heating process as well as different charcoal burning process.¹²

Nicotine, the main source of this tobacco addiction, has several ingredients in shisha that vary greatly depending on the type of tobacco used. Similar to smokers, plasma nicotine levels were also elevated in shisha users. However, the amount of plasma nicotine in shisha smokers is much higher than that of regular smokers. This phenomenon can be explained by longer sessions of using shisha with a higher number/volume of puffs. After using shisha for 5 minutes, nicotine levels increased significantly from 2–6 ng/ml. Increased nicotine levels have been shown to significantly trigger an increase in heart rate. Serum HDL levels, apolipoprotein A-1, total antioxidant capacity and vitamin C were significantly lower in Shisha users compared to non-smokers thereby increasing the risk of cardiovascular disease.^{11,12}

Carbon monoxide (CO) levels also significantly increased after smoking shisha. The plasma carboxyhemoglobin concentration in shisha users is higher than in regular smokers, indicating that carbon monoxide is also inhaled during shisha use. CO displaces oxygen (O₂) bound to hemoglobin to form carboxyhemoglobin (the affinity of CO for hemoglobin is 200 times that of O₂) and shifts the oxygen dissociation curve to the left, causing hypoxia and impaired cellular respiration. Carbon monoxide is also known to induce various cardiovascular diseases.¹²

The concentration of carboxyhemoglobin in shisha smokers was more than 10%, while the carboxyhemoglobin concentration in regular cigarette users was 6.5%, and in non-smokers was 1.6%. One study also stated that acutely elevated levels of CO can contribute to CO poisoning. In such cases, the carboxyhemoglobin level could reach between 20-30%, and the patient might lose consciousness as well as experience headaches and shortness of breath.^{11,12}

Furthermore, after using shisha, another carcinogenic compound, nitrosamine 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol (NNAL),

was also found to increase levels in the urine. This indicates the presence of TSNA (tobacco-specific nitrosamines) in shisha smoke. NNAL itself is a metabolite that is formed after 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK) enters the body.¹²

In addition, TAR (nicotine-free dry particulate matter) in 1 session of shisha for 45 minutes can reach 802 mg, which is 36.5 times higher than smoking 1 cigarette. This TAR level varies depending on the length of the session; the level can be up to 100 times higher if the use of shisha lasts longer.¹²

The volatile aldehydes in shisha include acrolein, formaldehyde, acetaldehyde, propionaldehyde, and methacrolein. These components are associated with respiratory diseases, airway irritation, COPD, and lung cancer. Acrolein can also generate cardiopulmonary toxicity, potentially induce leukemia, and be prothrombotic. Formaldehyde is also a strong carcinogen that can trigger leukemia. The average level of volatile aldehydes in shisha was significantly higher than in cigarettes. Therefore, shisha smoke might cause a higher incidence of aldehyde-related diseases.^{11,12}

EFFECTS OF SHISHA ON RESPIRATORY HEALTH

Taufik FF et al. in their study observed that respiratory symptoms and other symptoms that were most often experienced after using shisha were cough (29.2%), shortness of breath (12.5%), dizziness (8.3%). Two people complained shortness of breath and dizziness (4.2%), and two people complained cough and dizziness (4.2%) Martinasek et al. in their study found that shisha smokers reported experiencing respiratory symptoms and other symptoms such as dizziness (66%), fatigue (57.4%), headache (46.8%), palpitations (21.3%), nausea (17%), dry throat (17%), and shortness of breath (7%).¹⁵

Raad et al. in their systematic review and meta-analysis conducted a separate literature search comparing shisha users with non-smokers

and shisha users with smokers, then performed a spirometry examination to obtain FEV₁ (forced expiratory volume in 1 second), FVC (forced vital capacity), and the FEV₁/FVC ratio. In 6 studies with a total of 1,156 patients, shisha users were found to have significant reduction in FEV₁ and FEV₁/FVC compared with non-smokers but not significantly different compared to smokers.⁶ In a population-based study comparing spirometry data of 245 non-smokers with 245 shisha users, Bathouee et al. pointed out that 10.2% of shisha users had an obstructive pattern on spirometry compared to 0% of the non-smokers control group.¹⁶ Saad et al. also found that in an analysis of 110 shisha users, 36% were proven to have static hyperinflation on lung function tests.¹⁰ From these three data, it could be concluded that, like smokers, shisha smokers also experienced negative effects on lung function and were at risk for COPD.^{3,6,10,16}

The content contained in shisha, such as tar, PAH, and carbonic content such as formaldehyde and acetaldehyde, elevated the risk of developing lung cancer. Carbonic content also increased a person's risk of promoting laryngeal cancer.^{10,17} In a meta-analysis by Mamtani et al. regarding risk estimates from Middle Eastern countries, researchers compared daily hookah/shisha users with a control group. Data were compiled and adjusted for other forms of tobacco use. The study noted that for lung cancer, six studies had an OR of 3.18 (95% CI, 1.87–5.42).¹⁰

In addition, the use of shisha was associated with an increased risk of lung infection as various devices used, especially the mouthpiece, could act as a reservoir of pathogens.^{3,7,14,17} Alaidarous et al. obtained cultures from water reservoirs and mouth pipes from 10 different shisha cafes and found a high frequency of bacterial contamination with resistant bacteria. A recent study showed an increased risk of inhaling spore-producing mold, which was isolated from the inside of shisha. *Aspergillus* was isolated from shisha water in a leukemia patient with invasive pulmonary aspergillosis. *Mycobacterium tuberculosis* was also found to grow and survive inside shisha pipe.¹¹ The

potential for transmission has been demonstrated in a cluster of pulmonary tuberculosis cases associated with shisha sharing in Queensland.¹⁷ In the Middle East on 2010, an outbreak of tuberculosis cases associated with shisha sharing was reported.¹¹

In addition, there are many case reports of acute eosinophilic pneumonia in shisha smokers. Dial et al. reported that a 26-year-old woman who had recently started smoking shisha was admitted with complaints of cough, dyspnea, and pleuritic chest pain. Initial chest CT showed a small nodular opacification in the right lower lobe. However, the patient's condition worsened, so she had to be admitted to the ICU. Repeated chest X-rays revealed extensive bilateral lung opacities. Bronchoalveolar rinses indicated 61% eosinophils. She was diagnosed with acute eosinophilic pneumonia and improved with prednisone.¹⁷ Several other cases following a similar clinical course have been reported, affecting young adult patients.¹⁷ It progressed rapidly to diffuse pulmonary infiltration in all reported cases and was diagnosed by bronchoalveolar lavage with >50% eosinophils. There was a progressive respiratory failure in two cases leading to intubation and in one requiring extracorporeal membrane oxygenation (ECMO). None of these patients had a lung biopsy and histological assessment of the lung lesions. In addition, two case reports informed cases of necrotizing granulomatous lung disease associated with the habit of using shisha.¹⁵

LIMITATIONS

None

CONCLUSION

Hookah smoking has become a worldwide phenomenon, including in Saudi Arabia, with an alarming increase in its use in the adolescent population to young adults. There is a growing misconception in society about shisha, which is considered safer, and less harmful than ordinary

cigarettes, a culture in society that considers shisha a social activity. However, there were more and more evidences that consistently showed the harmful and detrimental health effects associated with the use of shisha. It is clear that, like smoking, hookah use also poses significant public health risks, including the risk of developing pulmonary complications such as decreased lung function, COPD, lung infections such as pneumonia, tuberculosis, lung cancer, as well as laryngeal cancer. Armed with knowledge about hookah use and its dangers, health care providers can more effectively educate and correct public misperceptions about the dangers of shisha

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CONFLICT OF INTEREST

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REFERENCES

1. Chwyed SH. A comparison between the effect of shisha and cigarette smoking on serum lipid profile of males in Nasiriyah city. *Med J Babylon*.2018;15(1):39.
2. Taufik FF, Giovana L, Susanto AD. Levels of urinary cotinine and exhaled carbon monoxide after shisha smoking. *J Phys Conf Ser*.2018; 1073(2): 022019.
3. Al-Rawi NH, Alnuaimi AS, Uthman AT. Shisha smoking habit among dental school students in the united arab emirates: enabling factors and barriers. *Int J Dent*. 2018;2018:2805103.
4. Saravanan C, Attlee A, Sulaiman N. A cross sectional study on knowledge, beliefs and psychosocial predictors of shisha smoking among university students in sharjah, united arab emirates. *Asian Pac J Cancer Prev*. 2019;20(3):903-9.
5. Asfour LW, Stanley ZD, Weitzman M, Sherman SE. Uncovering risky behaviors of expatriate teenagers in the united arab emirates: a survey of tobacco use, nutrition and physical activity habits. *BMC Public Health*. 2015; 15, 944.
6. Meo SA, AlShehri KA, AlHarbi BB, Barayyan OR, Bawazir AS, Alanazi OA, et al. Effect of shisha (waterpipe) smoking on lung functions and fractional exhaled nitric oxide (FeNO) among saudi young adult shisha smokers. *Int J Environ Res Public Health*. 2014;11(9):9638-48.
7. Baroud S, Eladi M, Aboelkheir A. Knowledge, practices, and reasons of hookah smoking in the united arab emirates: a cross-sectional study. *Hamdan Med J*. 2021;1(14):17-22.
8. Salloum RG, Abu-Rmeileh N, Hamadeh R, Thomas J, Mostafa A, Yusufali A, et al. Policy-relevant context of waterpipe tobacco smoking among university students in six countries across the eastern mediterranean region: a qualitative study. *Asian Pac J Cancer Prev*. 2017;18(9):2533-40.
9. Arıçgil M, Arbağ H. Hookah smoking impairs nasal mucociliary clearance. *Tob Induc Dis*. 2018;16:06.
10. Patel MP, Khangoora VS, Marik PE. A review of the pulmonary and health impacts of hookah Use. *Ann Am Thorac Soc*. 2019;16(10):1215-9.
11. Kadhum M, Sweidan A, Jaffery AE, Al-Saadi A, Madden B. A review of the health effects of smoking shisha. *Clin Med (Lond)*. 2015;15(3):263-6.
12. Qasim, H., Alarabi, A.B., Alzoubi, K.H. et al. The effects of hookah/waterpipe smoking on general health and the cardiovascular system. *Environ Health Prev Med*. 2019;24:58.
13. Husain H, Al-Fadhli F, Al-Olaimi F, et al. Is smoking shisha safer than cigarettes: comparison of health effects of shisha and cigarette smoking among young adults in kuwait. *Med Princ Pract*. 2016;25(2):117-22.

14. Wong LP, Alias H, Aghamohammadi N, Aghazadeh S, Hoe VC. Shisha smoking practices, use reasons, attitudes, health effects and intentions to quit among shisha smokers in malaysia. *Int J Environ Res Public Health*. 2016;13(7):726.
15. Martinasek MP, Haddad LG, Wheldon CW, Barnett TE. Beliefs and attitudes associated with hookah smoking among a united states college population. *Resp Care*. 2017; 62(3):370-9.
16. Bahtouee M, Maleki N, Nekouee F. The prevalence of chronic obstructive pulmonary disease in hookah smokers. *Chron Respir Dis*. 2018;15(2):165-72.
17. Choe EH, Sutherland L, Hills C, Sood JD. Shisha smoking as a possible cause of bilateral granulomatous lung lesions. *Respirol Case Rep*. 2018;6(9):e00374.