



Waterpipe vs. Cigarette Smoking: Respiratory Health Risks among Youth



Shara M. Ali, Sara Imadi, Jehan Khodabocus, Savroop Kullar
Faculty of Health Sciences, Université d'Ottawa | University of Ottawa

ABSTRACT

Waterpipe, or shisha, smoking is a popular traditional method of tobacco use, particularly in the Middle Eastern region and has become a global phenomenon. The smoke passes through a reservoir of water, shisha tobacco smoking is perceived as being less harmful than other methods of tobacco use. Recent evidence suggests that shisha smoking may be as addictive and as lethal as conventional cigarette smoking. Using the Cochrane library and PubMed, a systematic-like review will be conducted to analyze the literature to determine the presence or absence of a link between waterpipe smoking and the development of respiratory diseases in comparison to smoking from a cigarette. From the literature used for systematic-like analysis, primarily from the Middle East, we have found that the risk associated with the development of respiratory diseases from a waterpipe smoking are relatively equivalent to that of smoking cigarettes.

INTRODUCTION

The rising trend in water-pipe smoking is thought to have originated in India about 400 years ago. Water-pipe smoking is a tradition found in many countries around the world, especially in the Middle East and North Africa has now spread to the four corners of the world¹⁴. Going by many names such as shisha, argile, narghile, hubble bubble, and hookah. Shisha is an instrument for vaporizing and smoking flavoured tobacco called shisha. Heated with charcoal on the head of the shisha, the smoke passes through the base to the water bowl and is smoked through the hoses¹⁵. Although shisha smoking has been around for quite some time, it is an understudied form of tobacco use with growing popularity among young adults. Canadian youth (15-24 years of age) have not been immune to the spread of this phenomenon. According to the 2011 Canadian Tobacco Use Monitoring Survey (CTUMS), 2.3 million Canadians aged 15 years and older have ever tried smoking from a waterpipe, a 4% increase from 2006 reports¹². Health effects and risk beliefs around smoking the waterpipe are evident in all finding throughout different governmental reports and literature.

METHODOLOGY

A structured literature review was conducted for four separate concepts using the University of Ottawa Library's online database, which includes PubMed research database as well as Cochrane Libraries. A total of 16 peer-reviewed journal articles were used.

- Concept 1 (C1): Carbon monoxide poisoning
- Concept 2 (C2): Lung cancer
- Concept 3 (C3): Environmental health
- Concept 4 (C4): Asthma & COPD

Inclusion criteria:
Articles in French & English including Shisha, chicha, hookah, hookah, waterpipe, lung, cancer, tobacco, smoking, second-hand environment, COPD, fungus, asthma, adolescents, cigarette, carbon monoxide poisoning, CO poisoning, youth, argile, narghile, hubble bubble, respiratory diseases.

Exclusion criteria:
Pregnant women, subjects over 25 & under 15 years of age, studies before 2005, non-peer reviewed articles & those not electronically available, articles in languages other than English and French.

Total research articles: 16

Figure 1. Methodology.

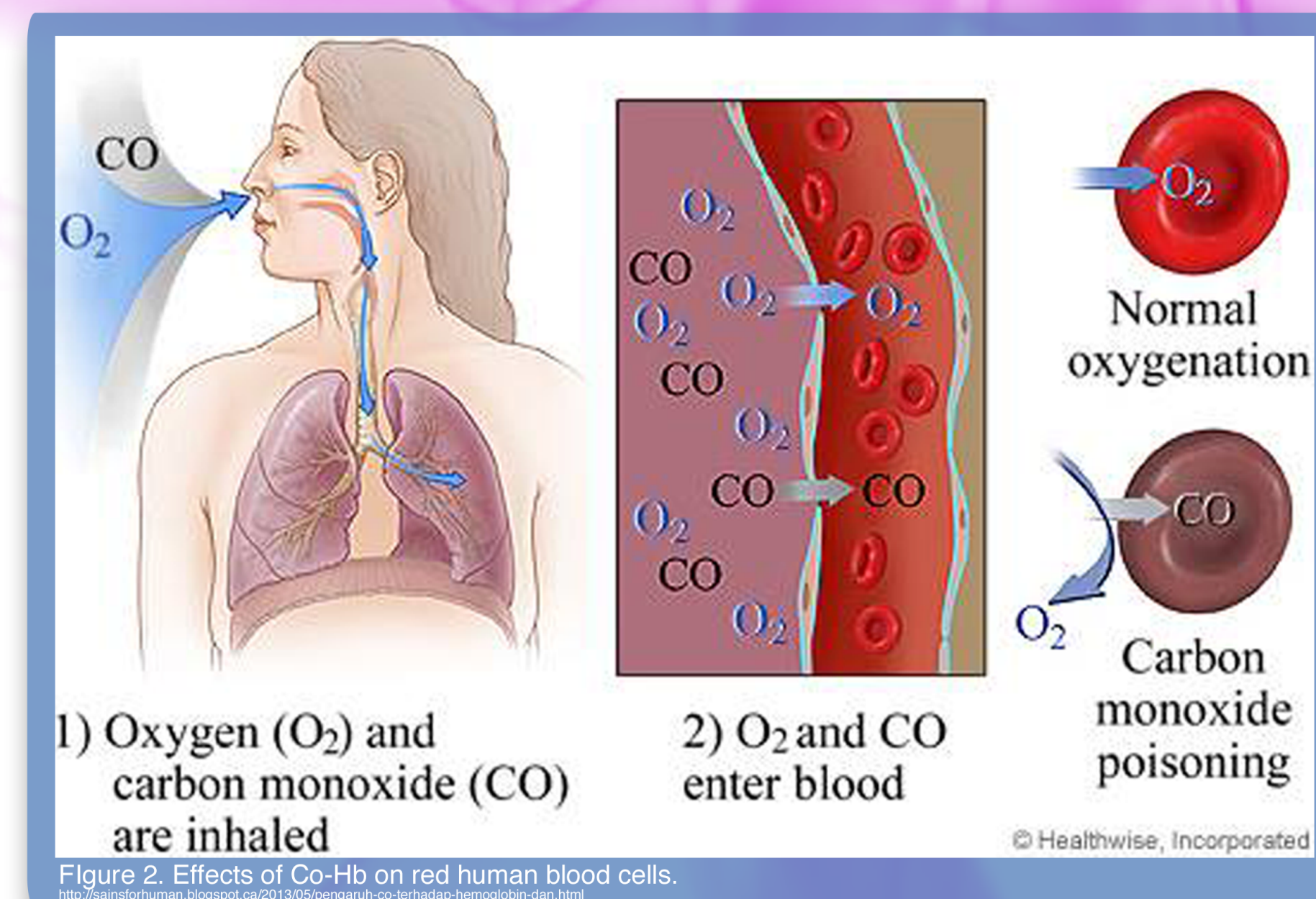


Figure 2. Effects of Co-Hb on red human blood cells.



Figure 3. Possible Respiratory Health Effects caused by smoking, pneumonia, etc.



Figure 4. Waterpipe Diagram

FINDINGS

Environmental Health Implications

With every puff of shisha toxic chemicals known as polycyclic aromatic hydrocarbons (PAHs), as well as phenols and heavy metals are inhaled and consequently exhaled out. These are not only environmental contaminants but carcinogenic to humans. A 2013 study conducted in a waterpipe venue in Toronto revealed that particulate matter, carbon monoxide and nicotine levels were at dangerous levels of 1419.4 µg/m³, much higher than the daily standard set by the Canadian Council of Ministers of the Environment as 28 µg/m³. In addition to chromium and arsenic, benzene, a known carcinogen is also present in shisha smoke and because of its large molecular weight, it becomes very persistent in the lungs. One study reported a total retention average of 75% for both moderate and deep inhalation of benzene. Despite the misconception, nicotine, a potent drug that is also a carcinogen found in cigarettes and in flavoured tobacco waterpipes are of the similar levels; though the nicotine exposure from shisha is greater due to the longer duration of exposure. A 2009 study found that relative to a cigarette, shisha smokers were exposed to 1.7 times the nicotine dose when they were smoking tobacco through shisha. Finally, despite a 4.7% fall in second-hand smoke exposure among Canadian youth between 2004 and 2008, second-hand exposure to shisha is an emerging threat in Canada that can increase lung cancer risk by 30%. In spite of lacking research in this area, the abundance of enclosed public venues in Canada suggests that high possibility of second-hand and even third-hand exposure to shisha smoke.

The effects of shisha and lung cancer

Similarly to other tobacco related products, the use of water pipes has been associated to different kinds of diseases such as various types of cancer mostly lung cancer, respiratory and cardiovascular diseases. In a study done by the Asian Pacific Journal for cancer prevention, Koul et al. tried to determine if there was a correlation between hookah smoking and lung cancer. The study was done in the Kashmir valley of the Indian subcontinent where most of the inhabitants believe that hookah smoking was relatively safe in comparison to cigarette smoking since the smoke passes through water before its inhalation. Approximately, 30% of smokers having lung cancer smoked shisha, 31.7% smoked filtered cigarettes and 8.1% smoked shisha, bidi (hand-rolled cigarettes) and cigarettes interchangeably. In conclusion, the authors found that hookah smoking was associated with a higher risk of lung cancer in Kashmiri population with an increase of about 6 fold in comparison to non-smokers. Similar results were found in other studies by the international journal of epidemiology, where water pipe smoking was associated with lung cancer [odds ratio (OR) = 2.12; 95% confidence interval (CI) 1.32-3.42].

Table 5. Quality of life and smoking dose relationships.

Smoking type	Number	All sample	P-value	ANOVA	COPD and chronic bronchitis subgroup	P-value	ANOVA	Correlation coefficient
Previous cigarette smoking								
Never smokers	308	0.43 (0.88)	267	1.33 (1.44)				
1-10 pack-years	94	0.99 (1.29)	74	1.62 (1.63)				
11-15 pack-years	139	1.42 (1.58)	135	2.06 (1.57)		<0.001*	0.32*	
16-20 pack-years	120	2.71 (1.59)	144	2.84 (1.48)				
Previous waterpipe smoking								
Never smokers	358	0.43 (0.88)	270	1.32 (1.43)				
0.1-20 waterpipe years	42	1.29 (1.54)	26	2.44 (2.36)		<0.001*	0.12*	
20+ waterpipe years	67	2.36 (1.69)	59	3.02 (2.28)				
Current cigarette smoking								
Never smokers	467	0.51 (0.93)	343	1.39 (1.49)				
1-10 pack-years	139	0.81 (0.92)	82	1.62 (1.69)		<0.001*	0.30*	
11-15 pack-years	163	1.28 (1.49)	159	1.88 (1.48)				
16-20 pack-years	274	2.18 (1.69)	215	2.42 (1.59)				
Current waterpipe smoking								
Never smokers	374	0.43 (0.88)	281	1.30 (1.42)				
0.1-20 waterpipe years	66	0.92 (0.76)	19	0.96 (1.61)		0.001*	0.20*	
20+ waterpipe years	86	1.35 (1.63)	58	2.08 (1.69)				
Current cigarette dependence								
Dependence 0-3 Low dependence	1259	0.89 (1.33)	833	1.74 (1.26)		<0.001*	0.25*	
Dependence 4-5 Moderate dependence	139	1.91 (1.48)	128	1.93 (1.28)				
Dependence 6-10 High dependence	108	2.43 (1.54)	149	2.43 (1.54)				
Current waterpipe dependence								
LDWS 11-0 Low dependence	74	0.36 (0.64)	33	0.86 (0.87)		<0.001*	0.43**	
LDWS 11-10 Moderate dependence	40	0.83 (1.04)	21	1.64 (1.39)				
LDWS 11-17 High dependence	39	1.52 (1.76)	35	2.46 (1.73)				

Figure 5. QOL and smoking doses relationships. (Joseph, S., Pascalis, S., Georges, K., & Mirza, W., 2012).

CONCLUSION

Contrary to popular belief, waterpipe tobacco and products produce high levels of toxicants that are carcinogenic, or harm the human body as a whole. A number of these health-related effects are respiratory illnesses such as lung cancer, COPD, carbon monoxide poisoning, and environmental pollution, leading to the aforementioned diseases. Compared to cigarette smoking, shisha has been found to equally produce many diseases triggered or caused by tobacco toxicants, if not more.

Future projections would include looking at more North American data on the waterpipe smoking patterns in youth and adults. Due to the recent increase in water-pipe smoking, longitudinal cohort studies are important to initiate to determine the long- and short-term respiratory health effects of waterpipe smoking.

Cigarettes, Shisha & CO Poisoning

CO can cause harmful health effects by decreasing the oxygen-carrying capacity of the blood to tissues and organs. Multiple experiments have found that water-pipe use is associated with more carbon monoxide (CO), smoke exposure, nicotine exposure, carcinogens, nitric oxide (NO), volatile aldehydes (VA), volatile organic compounds (VOC), and polycyclic aromatic hydrocarbons (PAH), and communicable diseases. The World Health Organization has reported that a typical hookah session lasts 20-80 minutes, and can inhale more deeply as the moisturized smoke does not cause much irritation^{16, 20}.

	Waterpipe Smoking	Cigarette Smoking
Carbon Monoxide (CO)	30.8 ppm bar, lounge, café ¹⁵	8.9 ppm Patio ¹⁵
CO Boost	86 ppm ¹⁶	5.2 ppm ¹⁶
Volatile organic compounds (VOC)	Was considerably higher while smoking water pipe compared to cigarettes ¹⁶	Present at low concentrations ¹⁶
Polycyclic aromatic hydrocarbons (PAH)	Intake of phenanthrene and pyrene was higher ¹⁶	Intake of naphthalene and fluorene was higher ¹⁸
carboxyhemoglobin (CO-Hb)	10.1% ¹⁶	6.5% ¹⁸

Figure 6. Comparison of Waterpipe vs cigarette content

Tobacco smoking (through carbon monoxide inhalation) raises the blood levels of COHb several times from its normal concentrations. Can cause hypoxia; it induces structural changes to the haemoglobin molecule, favouring a more stable binding to oxygen further reducing the release of oxygen to the tissues, this results in increased CO levels. Effect on myoglobin: Binding of CO to myoglobin reduces O₂ supply. This delay effects of CO toxicity. COHb values were higher in patients with severe COPD exacerbations. It should be noted that heavy cigarette smokers may have (CO-Hb) reach levels as high as 15-17%. Typical peak CO-Hb concentrations in shisha smokers are greater than in cigarette smokers. Co-Hb is a stable form of CO and hemoglobin that forms in red blood cells upon contact with CO.

COPD, Asthma & Smoking

The waterpipe is a new epidemic in the North American countries, increasing at a quick rate in the last decade; however, it is commonly used in countries overseas. That being said, research is much lacking in all parts of the world in this specific area, specifically in the particular relation between the prevalence of COPD & asthma in waterpipe smokers. In a large study conducted in the UAE, it was found that the prevalence of COPD is relatively equal in males and females (3.8% and 3.4%, respectively), with half the participants reporting having asthma. However, the ratio of the total participants with COPD or asthma as a result of WP smoking compared to the healthy participants is approximately 1 to 25, only 1 out of 25 being current waterpipe smokers. In another large, year-long cross-sectional study conducted in all areas of Lebanon looking at the quality of life in terms of respiratory health indicated that nearly 11% of the total number of participants (n=2201) were diagnosed with COPD, 2.3% included reversible COPD. However, overall, the correlation coefficients are higher for any category (previously smokers and current) of cigarette smokers compared to waterpipe smokers (table 5).

DISCUSSION

Environmental health: On the environmental health front, the 2013 study in Toronto and the high persistence of benzene and heavy metals in shisha venues suggest the importance of improved surveillance and air quality measuring strategies as well as the changing ideologies that surround shisha among youth and political bodies. The reduction of second-hand smoking rates among youth in Canada already prove encouraging and similar reduction strategies must be adapted in order to reduce exposure to waterpipes among Canadian youth.

CO poisoning: CO poison is a cancer when it comes to shisha smoking as it decreases the oxygen-carrying capacity of blood to various body parts. All experiments looked at have found that water-pipe use is associated with more CO smoke exposure, carcinogens, NO, VOC, and PAH exposure most likely due to smoking duration. Overall, it was found that CO level in those who smoke shisha are more than double of those who smoke cigarettes.

Lung cancer: In a study done in Kashmir valley of the Indian subcontinent, researchers have found that waterpipe smoking enhances the likelihood of developing lung cancer and the risk is as high as 6 times in comparison to non-smokers. Other similar studies were also done pertaining to the matter, but the correlations were relatively weak.

COPD & Asthma: Based on the little research done on these specific respiratory illnesses in relation to the use of waterpipe as a source of smoking in the Middle East and the Gulf (Emirates), there is little to suggest that there is a significant correlation between the use of waterpipe and the prevalence of COPD and asthma as a result⁴. It is also evident from this research that cigarette smoking has a slightly stronger effect on the presence of COPD in later life¹¹. This data is contrary to the findings in this study, possibly due to the minimal research done in the short period of increase in waterpipe smoking.

RESEARCH QUESTION

Is there a significant difference between the respiratory health effects of water-pipe smoking in youth compared to cigarette smoking?

REFERENCES

- Currently not enough evidence on the health effects of smoking "herbal" Shisha
- Uncertainty in the data outcomes - different factors come into play
- Certain respiratory diseases manifest over time (in late adulthood) as opposed to youth
- Lack of youth enrollment in studies
- Lack of Canadian or North American studies (focused studies in Asia)
- Small study samples, limiting information resulting in information bias, and
- Limited COPD and asthma research to youth (studies focused on 40 year-olds and above)