

# The hookah – the Indian waterpipe

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*The hookah, a waterpipe, originated in India and became popular for smoking tobacco. It spread elsewhere and acquired other names like nargile, shisha, goza and hubble-bubble, before its popularity declined in India. A resurgence of hookah smoking is occurring in India and around the world, and is being promoted as safer than cigarette smoking. This article debunks this myth, by showing that hookah smoke contains more tar and carbon monoxide than cigarette smoke, promotes nicotine addiction and exposure to second-hand smoke, and causes gum disease, tuberculosis, chronic lung diseases, lung cancer, cardiovascular disease and low birth weight.*

**Keywords:** Disease consequences, hookah, second-hand smoke, tobacco use, youth.

## Origin, spread and decline of hookah smoking

HOOKAH smoking has been practised in India for over 400 years. The use of the hookah for tobacco smoking originated in the court of Emperor Akbar in the late 16th century, as a way of reducing potential harm from smoking, on the suggestion of royal physicians, as tobacco was then an unknown substance. In a small bowl at the top, tobacco, flavoured with molasses was kept smouldering with burning charcoal. When the smoker puffed on the hookah, the smoke passed down through a tube and then through a jar of water before being inhaled<sup>1</sup>.

As the use of tobacco spread in India, the hookah became the most prevalent form of smoking tobacco (also used by some people for smoking opium and hashish). Different forms of hookah were created to suit all social classes. Used by both men and women, the practice of hookah smoking became popular in areas where the Mughals had a strong influence and became a part of the culture<sup>1</sup>. When the British came to India with the East India Company, some of them adopted the practice for a while, for social acceptance, as it was a fashion, until other forms of smoking largely replaced it<sup>2</sup>.

From 1950 to the early 1980s in India, bidi and cigarette rose in popularity, as hookah smoking declined<sup>3</sup>. Epidemiologic support for a decline in the prevalence of hookah smoking is available from two studies in bordering districts of northern Bihar. In a survey of 10,340 individuals aged 15 years and above, conducted in 1968 in 16 villages in Darbhanga District (selected by random

sampling)<sup>4</sup>, the prevalence of hookah smoking was 14%. In a house-to-house survey conducted in Akhta village, Sitamarhi District, in the year 2000, the prevalence of hookah smoking<sup>5</sup> was <5%. The authors compared the two surveys and concluded that hookah smoking in the population had reduced considerably.

From India, the hookah may have first spread to Persia, where it was called narghile<sup>6</sup> and later, it spread to Turkey in the early 17th century, then the centre of the Ottoman Empire. Eventually, the Narghile Café came up where tea and coffee were also served. This fashion eventually saw a decline, but is being slowly revived in new forms<sup>7</sup>. The narghile also spread to North Africa and Saudi Arabia, where it was called shisha (glass bottle) or goza, and to the Far East, especially China and the Philippines<sup>8</sup>.

## Recent revival of waterpipe smoking

A revival of the narghile has occurred from the late 1990s or even earlier in parts of West Asia, northern Africa and South East Asia (especially India and Indonesia) and has spread to parts of Europe, Russia and North America. At least in some areas, its revival is linked to the people of West Asian origin and to restaurants run by them. Local enthusiasm for West Asian-style food has led to a growing interest in hookah smoking as well. The tobacco industry has picked up on the trend and introduced new flavourings to waterpipe tobacco, such as fruit, chocolate, mint etc., to appeal to the youth and women. Advertising on the internet uses the link to an old tradition and an exotic appeal.

Due to the revival of the waterpipe worldwide, concern is mounting internationally about the potential disease fallout.

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### *Target market*

The revival of the waterpipe is market-driven and the target group is young adults, including women. This does not deter some underage youth as well from experimenting with it. The setting is specialized parlours, bars, cafés or restaurants that offer the option of smoking a hookah. An alternative is smoking at home after joining web-based clubs or forums (based in various countries), where information about hookah smoking, alluring advertisements, on-line ordering facilities and space for customers to contribute their comments is provided. Hookah smoking has taken-off well with the target group, as it provides a social setting, an activity and novelty rolled into one, along with a manufactured illusion of relative harmlessness. Peer pressure and the desire for social acceptance are other factors. While some of these websites do mention the hazards, other websites and blogs refer to this practice as a lighter, less harmful or even non-addictive way of smoking or form of smoking, even where some of the risks are admitted<sup>8,9</sup>.

### **Dynamics in Mumbai, India**

A recent proliferation of hookah parlours has occurred in Mumbai. The current Mayor, also a physician, reported receiving many phone calls from parents from all walks of life and communities to complain about the hookah parlours. The Mayor then decided to visit a few of them. Following this, the Municipal Corporation decided to order the closure of these parlours and announced that restaurants offering the hookah would not be permitted to renew their licences. This was based on a local rule that eateries are prohibited from offering anything harmful to their guests<sup>10</sup>. Hookah smoking in restaurants is also a source of second-hand smoke and violates the law against smoking in public places (the Cigarettes and Other Tobacco Products Act, 2004), unless carried out in a separate room where no food is served. According to a news report, there may be around 59 hookah bars in Mumbai<sup>11</sup>. The restaurants have challenged these decisions in the Bombay High Court. Ahmedabad and Chandigarh are other cities in India also taking action against hookah bars.

### **Prevalence in India**

Due to the earlier decline in waterpipe smoking, few scientific reports are available on its health consequences. Also, due to the relatively recent revival, few studies are available on the prevalence of waterpipe smoking in India or anywhere in the world.

In India, John<sup>12</sup> reported the household prevalence from the National Sample Survey, 2000: 2.6% of rural and 0.4% of urban households in India consume hookah

tobacco – this primarily reflects lingering usage from the previous epidemic. In a survey of urban slums in Faridabad, Uttar Pradesh, use of the hookah has been reported among women (around 1.5%, i.e. 22% of the 7% women smokers)<sup>13</sup>.

An earlier cross-sectional study conducted in 1977 in a village near Bhiwani, Haryana, hookah smoking was investigated. Among the 278 men above 15 years of age screened (82% participation rate), 70% (197) were current smokers, among whom 50% (98) exclusively smoked the hookah, 28% (56) exclusively smoked the bidi and 22% (42) smoked both. There were smokers in all the age groups, except men over 71 years<sup>14</sup>.

### *Smoking practice*

Hookah smokers in the Bhiwani study each consumed on an average 50–100 g tobacco per day – a tobacco mixture used for hookah smoking. Half the amount of tobacco used consisted of jaggery (molasses), which was added to the tobacco for flavour. The hookah was customarily smoked in a group of 6–10 persons, who shared the same instrument. In view of this sharing, it was not possible to accurately assess each individual's tobacco consumption<sup>14</sup>.

In current times, a hookah smoking session typically lasts 45 min to 1 h, but may last up to several hours<sup>15</sup>. From all accounts, this seems similar to how hookah smoking has traditionally been practised.

### **Composition and toxic constituents**

Waterpipe tobacco is grown and manufactured in India and in some West Asian countries. The composition of waterpipe tobacco is variable and not standardized<sup>15</sup>. Most waterpipe tobacco is mixed with a sweetening agent, like molasses (jaggery), honey, dried fruits or even glycerin. Increasingly, other flavouring essences are also added. Occasionally other drugs are added, like alcohol or hashish. Available studies on waterpipe emissions are mostly from Lebanon.

### *Nicotine delivery*

A Lebanese study found that in a single standardized waterpipe smoking session, the yield was 2.94 mg nicotine, 802 mg tar, 145 mg CO and greater quantities of polycyclic aromatic hydrocarbons (PAHs) relative to the smoke of a single cigarette. In comparison to cigarette smoking this works out to at least 10–50% more than the amount of nicotine, at least 30 times the amount of tar and at least ten times the amount of CO. This could imply that to get the same nicotine satisfaction for the amount in one cigarette, one has to be exposed to much more CO and tar while smoking a waterpipe<sup>16</sup>.

### *Nicotine absorption*

Combined human absorption data from 117 adults in four studies (from Lebanon, Jordan, Kuwait and India) analysed together showed that daily use of the waterpipe produced a nicotine absorption rate equivalent to smoking ten cigarettes/day (95% Confidence Interval (CI) = 7–13 cigarettes/day), as measured by a 24 h urinary cotinine level of 0.785 µg/ml (95% CI = 0.578–0.991 µg/ml). Even among subjects who did not smoke the waterpipe daily, a single session of waterpipe use produced a urinary cotinine level equivalent to smoking two cigarettes in one day. Researchers have concluded that daily waterpipe use would be an effective means of initiating and maintaining nicotine addiction. They have suggested that more research needs to be done to find out whether waterpipe use is a gateway to cigarette smoking or vice versa<sup>17</sup>.

### *Carbon monoxide and carcinogens*

Two well-known charcoal emissions are CO and PAHs. In Lebanon, a study compared the emissions from a machine-smoked waterpipe, first using the traditional charcoal and then using an electric heating element. It was found that about 90% of the CO and 75–92% of the four- and five-membered ring PAH compounds originated in charcoal. More than 95% of the benzo(a)pyrene in the smoke was attributable to charcoal<sup>18</sup>.

Analysis of smoke condensates from a waterpipe collected on fibreglass filters revealed that a single narghile smoking session delivers approximately 50 times the carcinogenic four- and five-membered ring PAHs as a single standard cigarette<sup>19</sup>. Hence tar is qualitatively different from that produced by cigarettes, as most of it comes from the burning charcoal, and it is much higher in quantity.

Use of a plastic hose, when compared to a highly permeable leather one, more than doubled the CO yield, while the nicotine yield did not change much<sup>20</sup>.

### *Heavy metals*

In another study on waterpipe emissions, higher levels of arsenic, chromium and lead were found in comparison with smoke from a single cigarette<sup>21</sup>.

### *Summary of toxic exposures from waterpipes*

The CO and PAH emissions from waterpipes are much higher than those of cigarettes. The nicotine delivery is somewhat higher than that of one cigarette spread over a longer duration of time. Heavy metals are another hazardous component of waterpipe smoke. While nicotine, the

alkaloid people smoke tobacco for, is miscible in water<sup>22</sup>, PAHs which are carcinogenic, are largely water insoluble<sup>23</sup> – the waterpipe cannot remove any significant portion of them from the smoke.

### **Health hazards**

There are few epidemiological studies documenting the adverse health consequences of waterpipe smokers, since the practice had declined to a low level in most parts of the world, where it was popular earlier. Studies from India are reported here, with a few other studies where there are gaps in information.

### *Addiction*

The high levels of nicotine absorption from waterpipe smoking<sup>17</sup> are likely to quickly lead to addiction, which users could maintain using cigarettes or bidis when a waterpipe is not available. Studies on youth addiction to nicotine through waterpipe use are needed.

### *Gum disease*

In a cross-sectional study in Saudi Arabia among 262 participants aged 17–60 years, periodontal disease measured in terms of probing depth was found associated with both waterpipe and cigarette smoking. The prevalence of periodontal disease defined as a minimum of ten sites with a probing depth of 5 mm was 19.5% in the total population, 30% in waterpipe smokers, 24% in cigarette smokers and 8% in non-smokers. The relative risk for periodontal disease was 5.1 and 3.8-fold higher in waterpipe and cigarette smokers respectively, compared to non-smokers ( $P < 0.001$  and  $P < 0.05$  respectively)<sup>24</sup>.

### *Tuberculosis*

In Storstroem County, Denmark, the incidence of tuberculosis has been increasing since 1990, both among Danish citizens and the immigrants. The increase in patients born in Denmark has been seen mainly among younger males. When contacts of index patients were traced, sharing a waterpipe with a patient was found to be a risk factor for infection, as confirmed by Mantoux test<sup>25</sup>.

### *Chronic lung diseases*

Among 300 men (150 smokers and 150 non-smokers) in Chandigarh, between the ages of 55 and 85, in a case-control study on the long-term effects of smoking on pulmonary function, the 32 exclusive hookah smokers had airflow parameters comparable to the heavy bidi and/or cigarette smokers. In this study, only the heavy

smokers had significant worsening of the airflow parameters. Measurements included forced vital capacity (FVC), forced expiratory volume in the first second (FEV<sub>1</sub>), FEV<sub>1</sub> ratio (FEV<sub>1</sub>/FVC × 100), forced expiratory flow between 25 and 75% of the vital capacity forced expiratory flow at 80% of FVC and the time taken to expel 50% of the FVC. The values were also corrected for height and weight<sup>26</sup>.

In the cross-sectional study in a village in Haryana, where 278 males (≥ 15 yrs) were screened for chronic respiratory disease of non-specific origin, symptoms of chronic respiratory disease, including cough, phlegm, shortness of breath, wheezing and frequent chest illness, as well as ventilatory abnormalities, were common in the subjects, the majority of whom were smokers; and mostly hookah smokers. Diagnosis of chronic bronchitis was more in smokers compared to non-smokers. The major causative agent in this community was smoking, particularly hookah smoking<sup>14</sup>.

In a house-to-house survey for chronic bronchitis in three villages in Jhansi, Uttar Pradesh, where 1424 men and women aged 20 years and above were clinically examined, 92 cases of chronic bronchitis were detected. Prevalence of chronic bronchitis was highest among chillum or hookah smokers (85 per 1000), which was almost twice as high as that among the bidi or cigarette smokers (46 or 43 per 1000 respectively)<sup>27</sup>.

Studies from Saudi Arabia and Turkey have shown similar results<sup>15</sup>. It may be safely concluded that hookah smoking is an even more powerful cause of lung damage and chronic bronchitis than cigarette and bidi smoking.

### *Lung cancer*

Twenty-five cases of cyto-histologically confirmed bronchogenic carcinoma diagnosed in a hospital in Srinagar between 1970 and 1972 were reviewed. All were males between the ages of 40 and 80 years. Only three patients denied a history of smoking. Among the 22 (88%) smokers, 17 smoked the hookah, three smoked both the hookah and cigarettes and two smoked only cigarettes<sup>28</sup>. In Pakistan, an earlier study had observed a close association between hookah smoking and carcinoma of the lung<sup>29</sup>. On the basis of these two studies and knowledge of the carcinogenic nature of tobacco smoke, it is clear that hookah smoking causes lung cancer.

### *Cardiovascular disease*

The high concentration of CO in the smoke of the waterpipe, is likely to cause cardiovascular disease and heart attacks. A case control study from Lebanon has reported that ever smokers of the narghile had double the risk of coronary heart disease compared to never smokers<sup>15</sup>.

### *Reproductive outcomes*

Recent cohort studies of pregnant women in Lebanon showed a twofold odds ratio for low birth weight among women who smoked narghile<sup>30-32</sup>.

### **Second-hand smoke**

Waterpipe smoking poses a significant hazard of suspended particulates to non-smokers by way of second-hand smoke, of a similar nature as that of cigarettes<sup>33</sup>.

### *Relevant policies*

As a policy, the Indian government promotes tobacco growing and export, for revenue and foreign exchange. Hookah tobacco is an important tobacco product export from India. A total of 10,656 t of hookah paste were exported in 2007-08, representing one-third (34.7%) of the quantity of tobacco products exported and 8.4% of the value<sup>34</sup>.

The attraction of the youth to waterpipe smoking, including underage youth, is the most important reason for concern in the health community and the government, since addiction to tobacco in youth can lead to lifelong addiction and adverse health consequences. Hookah smoking could also become a gateway to cigarette smoking. The revival of hookah smoking in India calls for effective policies to curb it.

In India, the Cigarettes and Other Tobacco Products Act, 2003, bans smoking in most public places, and restricts smoking to a separate room in restaurants. This works as a loophole for the hookah parlours. Other aspects of the Act which apply to hookah parlours are the prohibition on the sale of tobacco within 100 yards of educational institutions and sale to minors; prohibition on advertising, except at the point of sale, and health warnings. A suitable plan for providing health warnings for hookah tobacco and hookah smoking needs to be worked out, as users are unlikely to see the packaging.

### **Conclusion**

While there are only a few scientific studies on waterpipe smoking (on contents, delivery, absorption and epidemiology), they are sufficient, along with data on cigarette and bidi smoking, to demonstrate that this practice is hazardous in nature. The 400-yr-old hopeful idea that the waterpipe could make tobacco smoking safe, has thus been debunked. No doubt should remain that hookah smoking is quite risky in terms of causing addiction to nicotine as well as several illnesses: chronic bronchitis, lung cancer, and adverse reproductive outcomes. Hookah smoking may lead to cigarette smoking and a lifelong addiction to smoking tobacco, which leads to smoking-

related diseases. Men and women, especially teens and youth, would do well to keep away from smoking the waterpipe. State and local governments need to be vigilant and prohibit the practice in public establishments in order to protect the youth, who are the main targets.

Parents also have an important role to play in teaching their children about the hazards of hookah smoking and tobacco use in general. They also have an important role to play in helping their children find constructive outlets for their energy and safe spaces in which to enjoy leisure time. Keeping the home open to discussion as well as for supervised informal social gatherings is another aspect of prevention of bad habits in adolescents.

1. Historical records and anecdotes: from the middle ages to the modern times. In *Report on Tobacco Control in India* (eds Reddy, K. S. and Gupta, P. C.), Ministry of Health and Family Welfare, Government of India, 2004, pp. 7–18; <http://www.whoindia.org/SCN/Tobacco/Report/TCI-Report.htm>
2. Hookah. Wikipedia. <http://en.wikipedia.org/wiki/Hookah> (accessed on 19 December 2008).
3. Sanghvi, L. D., Challenges in tobacco control in India: a historical perspective. In *Control of Tobacco-Related Cancers and Other Diseases* (eds Gupta, P. C., Hamner III, J. E. and Murti, P. R.), Oxford University Press, Bombay, 1992, pp. 47–56.
4. Mehta, F. S. *et al.*, Report on investigations of oral cancer and precancerous conditions in Indian rural populations. 1966–69, Munksgard, Copenhagen, 1971, p. 120.
5. Sinha, D. N., Gupta, P. C. and Pednekar, M. S., Tobacco use in rural area of Bihar, India. *Indian J. Commun. Med.*, 2003, **28**, 167–170.
6. Fumari (homepage on the Internet). Hookah tobacco, pipes and more; <http://www.fumari.com/hookah-history> (accessed on 19 December 2008).
7. Narghile (homepage on the Internet). [http://www.business-with-turkey.com/tourist-guide/narguile\\_nargile\\_narghile.shtml](http://www.business-with-turkey.com/tourist-guide/narguile_nargile_narghile.shtml) (accessed on 19 December 2008).
8. The Hookah Lounge (homepage on the internet). <http://www.thehookahlounge.org/2006/06/30/narghile/> (accessed on 19 December 2008).
9. The Hookah Domain (homepage on the internet). <http://www.hookahdomain.com/> (accessed on 19 December 2008).
10. Silvano, S., Mayor of Mumbai wins war against hookah parlours. *Tobacco Kills*, 2008, **3**, 14–17.
11. Desai, S. and Shah, J., Minister asks why hookah parlours still open, BMC vows to enforce ban. *Indian Express*, 10 March 2009; <http://www.expressindia.com/latest-news/minister-asks-why-hookah-parlours-still-open-bmc-vows-to-enforce-ban/432887/>
12. John, R. M., Household's tobacco consumption decisions: evidence from India. *J. South Asian Develop.*, 2006, **1**, 119–147.
13. Anand, K., Shah, B., Yadav, K., Singh, R., Mathur, P., Paul, E. and Kapoor, S. K., Are the urban poor vulnerable to non-communicable diseases? A survey of risk factors for non-communicable diseases in urban slums of Faridabad. *Natl. Med. J. India*, 2007, **20**, 115–120.
14. Malik, S. K. and Singh, K., Smoking habits, chronic bronchitis and ventilatory function in rural males. *Indian J. Chest Dis. Allied Sci.*, 1978, **20**, 73–79.
15. Knishkowsky, B. and Amitai, Y., Water-pipe (narghile) smoking: an emerging health risk behavior. *Pediatrics*, 2005, **116**, e113–e119; <http://pediatrics.aappublications.org/cgi/reprint/116/1/e113>
16. Shihadeh, A. and Saleh, R., Polycyclic aromatic hydrocarbons, carbon monoxide, 'tar', and nicotine in the mainstream smoke aerosol of the narghile water pipe. *Food Chem. Toxicol.*, 2005, **43**, 655–661.
17. Neergaard, J., Singh, P., Job, J. and Montgomery, S., Waterpipe smoking and nicotine exposure: a review of the current evidence. *Nicotine Tob. Res.*, 2007, **9**, 987–994.
18. Monzer, B., Sepetdjian, E., Saliba, N. and Shihadeh, A., Charcoal emissions as a source of CO and carcinogenic PAH in mainstream narghile waterpipe smoke. *Food Chem. Toxicol.*, 2008, **46**, 2991–2995.
19. Sepetdjian, E., Shihadeh, A. and Saliba, N. A., Measurement of 16 polycyclic aromatic hydrocarbons in narghile waterpipe tobacco smoke. *Food Chem. Toxicol.*, 2008, **46**, 1582–1590.
20. Saleh, R. and Shihadeh, A., Elevated toxicant yields with narghile waterpipes smoked using a plastic hose. *Food Chem. Toxicol.*, 2008, **46**, 1461–1466.
21. Shihadeh, A., Investigation of mainstream smoke aerosol of the argileh water pipe. *Food Chem. Toxicol.*, 2003, **41**, 143–152.
22. <http://en.wikipedia.org/wiki/Nicotine>
23. Rubin, H., Synergistic mechanisms in carcinogenesis by polycyclic aromatic hydrocarbons and by tobacco smoke: a bio-historical perspective with updates. *Carcinogenesis*, 2001, **22**, 1903–1930; <http://carcin.oxford-journals.org/cgi/content/full/22/12/1903>
24. Natto, S., Baljoon, M. and Bergstrom, J., Tobacco smoking and periodontal health in a Saudi Arabian population. *J. Periodontol.*, 2005, **76**, 1919–1926.
25. Steentoft, J., Wittendorf, J. and Andersen, J. R., Tuberculosis and water pipes as source of infection. *Ugeskr. Laeg.*, 2006, **168**, 904–907.
26. Dhand, R., Malik, S. K. and Sharda, P. K., Long term effects of tobacco smoking: results of a spirometric study in 300 old men. *Indian J. Chest Dis. Allied Sci.*, 1985, **27**, 44–49.
27. Nigam, P., Verma, B. L. and Srivastava, R. N., Chronic bronchitis in an Indian rural community. *JAPI*, 1982, **37**, 277–280.
28. Nafae, A., Misra, S. P., Dhar, S. N. and Ahmad Shah, S. N., Bronchogenic carcinoma in Kashmir valley. *Indian J. Chest Dis.*, 1973, **15**, 285–295.
29. Ibrahim, M., Bronchogenic carcinoma in East Pakistan. *Dis. Chest.*, 1954, **26**, 286–294.
30. Tamim, H., Yunis, K. A., Chemaitelly, H., Alameh, M. and Nassar, A. H., National Collaborative Perinatal Neonatal Network Beirut, Lebanon. Effect of narghile and cigarette smoking on newborn birthweight. *BJOG*, 2008, **115**, 91–97.
31. Bachir, R. and Chaaya, M., Maternal smoking: determinants and associated morbidity in two areas in Lebanon. *Matern. Child Health J.*, 2008, **12**, 298–307.
32. Nuwayhid, I. A., Yamout, B., Azar, G. and Kambris, M. A., Narghile (hubble-bubble) smoking, low birth weight, and other pregnancy outcomes. *Am. J. Epidemiol.*, 1998, **148**, 375–383.
33. Maziak, W., Rastam, S., Ibrahim, I., Ward, K. D. and Eissenberg, T., Waterpipe-associated particulate matter emissions. *Nicotine Tob. Res.*, 2008, **10**, 519–523.
34. Tobacco Board, Review on exports of Indian tobacco and tobacco products. 2007–08, Guntur, 2008; [http://www.indiantobacco.com/review\\_exports\\_2007\\_08.pdf](http://www.indiantobacco.com/review_exports_2007_08.pdf) (accessed on 15 December 2008).

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