Water Pipe Smoking: Effects, Attitudes and Directions

Waseem Watad,1 Javeed Sukhera,2 Sagit Shushan,1 Mazen Kazlak,1,3 Harvey A. Skinner,4 Arafat A. Alnueirat5 and Yehudah Roth1,6

1 Department of Otolaryngology—Head & Neck Surgery, Edith Wolfson Medical Center, Tel Aviv University Sackler School of Medicine, Holon, Israel
2 Department of Psychiatry, University of Rochester Medical Center, Rochester, United States of America
3 New Dawn Society, Nablus, Palestinian Authority
4 Faculty of Health, York University, Toronto, Canada
5 Department of ENT, Royal Medical Services, Amman, Jordan
6 Dalla Lana School of Public Health, University of Toronto, Canada

Water pipe (WP) smoking is prevalent in several countries and is emerging as a major international public health issue. This article reviews the literature on WP smoking practices and its health effects. Water pipe smoking in the Middle East is more common in women compared to cigarette smoking. WP smoking has harmful effects similar to cigarette smoking, and the nicotine and tar content of WP smoke is higher than that of cigarettes. Still, many users believe that WP is less harmful than cigarettes and are unaware of the damage that WP can cause to their health. There is limited literature on WP smoking, highlighting the need for research in several areas including: epidemiology of WP smoking, sociological dimensions and tobacco control. The unique social and traditional role of WP smoking renders forgiving, culture-sensitive and patient approach.

Keywords: prevention, cessation

While cigarettes account for the largest share of manufactured tobacco products (MacKay & Eriksen, 2002), smokeless tobacco and water pipe (WP) are extremely popular in several countries (World Health Organization, 1997). For example, 600 million individuals use tobacco and areca nut mixtures in India (Gupta & Ray, 2003), and WP is familiar to approximately 1 billion people across the globe (Wolfram, Chehne, Oguoghu, & Sinzinger, 2003). The water pipe is also known as nargile, hookah, shisha, hubbly bubbly (Kandela, 2000), hookah bubble (Kandela, 1997), boory, oriental pipe, goza (Radwan, Mohamed, El-Sethouhy, & Israel, 2003), argileh (Shafagoj, Mohammed, & Hadidi, 2002), mada’a (Yemen; Gunaid, Sumairi, Shidrawi, Al-Hanaki, Al-Haimi et al., 1995) and qalyoun (Iran) (‘Iran to ban water pipe in public’, 2004). It is used daily by approximately 100 million men and women in countries across Africa, Asia and the Mediterranean (Wolfram, Chehne, Oguoghu, & Sinzinger, 2003), and is gaining popularity both in the Middle East (Kandela, 2000) and across the world (Israel, El-Sethouhy, Gadalla, Ali Aouin, Mikhail et al., 2003; Kandela, 1997; Rastam, Ward, Eissenberg, & Maziak, 2004). Most WP users believe that WP smoking is less harmful and addictive than cigarette smoking (Kandela, 2000; Kinshkowy & Amitai, 2005; Shafagoj, Mohammed, & Hadidi, 2002). A standard WP consists of a large glass bottle partly filled with water and placed on the ground. There is tubing fixed to the neck of the bottle, a mouthpiece at the end of the tubing, and a small container that rests on top of the bottle containing the tobacco and heated pieces of charcoal (Israel et al., 2003; Kandela, 2000; Radwan, Mohamed, El-Sethouhy, & Israel, 2003). The heat from the coals lights the tobacco, the emitted smoke enters the water-filled bottle and is inhaled through the tube. The tobacco used in WP comes in several forms...
known as meassel (Kandela, 1997; Radwan et al., 2003; Shafagoj et al., 2002; Tamim, Musharrafieh, El Roueiheb, Yunis, & Almawi, 2001) or tumbak, jurak (Radwan et al., 2003; Rakower & Fatal, 1962; Zahran, Yousef, & Baig, 1982) or ajami (Shihadeh, 2003). Meassel is used by the majority of WP users (Maziak, Fouad, Asfar, Hammal, Bachir et al., 2004) and is manufactured by using tobacco leaves and combining them with molasses and fruit flavouring (Kandela, 1997; Radwan et al., 2003; Tamim, Musharrafieh et al., 2001), honey, glycerin or mint (Shafagoj et al., 2002). Jurak or ajami are cruder forms of meassel (Rakower & Fatal, 1962), which are preferred by older generations and combined with water to make a moldable paste (Tamim, Musharrafieh et al., 2001).

WPs can be purchased from dedicated supply shops, including Internet vendors, which also sell charcoal, tobacco and accessories. Some accessories like mouth-pieces with activated charcoal or cotton, or filters, are sold and advertised as means of reduction the harmfulness of the smoke (World Health Organization, 2005).

WP Smoking

Cigarette smokers are almost four times more likely to be WP smokers than nonsmokers. WP smoking rates, mainly reported from Middle East countries, vary between 11.5% and 40.5%, compared with cigarette smoking rates of 20.2% to 45.5%. Smoking WP is more common among men, but reports indicate rising prevalence among women. (Fadhil, 2007; Maziak, Fouad et al., 2004; Memon, Moody, Sugathan, El-Gerges, Al-Bustan et al., 2000; Tamim, Musharrafieh et al., 2001). In North America, many Arab–American youth state that their initial smoking experience was with WP and not cigarettes (Kulwicki & Rice, 2003). WP bars have opened near some US college campuses, and WP use has become familiar in college and university students (Eissenberg, Ward, Smith-Simone, & Maziak, 2008).

WP smoking is associated with social activity; it is often done within social groups and frequently perceived as bringing people together (Kandela, 2000). Traditionally in the Middle East, WP smoking has been the habit of older males who meet friends in a coffee shop. Today, younger adults, including high school students, employ WP as an important component of their social gatherings (Maziak, Eisenberg, Rastam, Hammal, Asfar et al., 2004; Maziak, Fouad, et al., 2004; Tamim, Musharrafieh et al., 2001; Varsano, Ganz, Eldor, & Gaenkin, 2003).

The WP is associated with cultural tradition and is considered a more socially acceptable activity than cigarette smoking. Although it is inappropriate for youth to smoke cigarettes in front of elders, in many Middle Eastern countries smoking WP is permissible (Kandela, 2000). Among students at the American University of Beirut, 83% smoked WP in the presence of their parents (Chaaya, El Roueiheb, Chemaitelly, Azar, Nasr et al., 2004) and the first WP smoking trial among Lebanese high school students took place with a family member (Tamim, Terro, Kassem, Ghazi, Khamis et al., 2001). A survey of Syrian university students found, however, that 57.7% of male WP smokers perceived family disapproval for their smoking behaviour (Maziak, Eisenberg et al., 2004), indicating that while WP smoking may be permissible, it is not necessarily acceptable.

There are varying reasons why people smoke WP. In a Kuwait study the most common stated reasons were to relieve boredom and to help with relaxation (Memon et al., 2000). Egyptian smokers indicated they smoked WP out of habit and to relieve cravings (Israel et al., 2003). The major reason Lebanese and Syrian university students smoked WP was because it was entertaining, tasty and relaxing. Other reasons included promotion of group communication or family gathering, following social trends, cheap cost and time for reflection. Only a few stated that they smoked WP because they felt it is less harmful than cigarettes (Chaaya et al., 2004; Maziak, Eisenberg et al., 2004).

A comparison of WP and cigarette smoking reveals that many WP users believe it is less harmful than cigarettes. A widespread perception among smokers, and even physicians, is that the water through which the smoke bubbles filters the toxic components, rendering the practice considerably less harmful than cigarette smoking (Kandela, 1997; Shihadeh & Saleh, 2005). Still, almost 50% of the Lebanese and Syrian students studied believed that WP was more harmful than cigarettes, and all believed that WP was harmful to the foetus. In contrast, a vast majority of respondents felt that cigarettes were more addictive than WP (Maziak, Fouad et al., 2004; Maziak, Hammal et al., 2004). Among older WP smokers interviewed in coffee houses, only one-third believed WP was more harmful than cigarettes (Maziak, Eisenberg et al., 2004). These data raise significant doubts about the assumption that WP smokers are not aware of its harmful effects.

There is also a relationship between WP use and quitting behaviour. Despite the perceived harm of WP smoking, many WP users still believe that WP is a safer alternative to cigarette smoking. Some physicians even advise patients to smoke WP as a substitute for cigarettes (Chaaya et al., 2004; Maziak, Hammal et al., 2004).

There is a paucity of epidemiological data on the age of WP users. Mean age of initiation was found to be 19.2 years for males and 21.7 years for females among Syrian university students (Maziak, Fouad et al., 2004), and 20 years for patrons of Egyptian WP cafes (Israel et al., 2003). Recent epidemiological data demonstrated an older mean age of initiation, 25.5 for men and 28.9 for women (Ward Eisenberg, Rastam, Asfar, Mzayek et al., 2006). Use at school age varied in different surveys between 19% to 41% (El-Roueiheb et al., 2008; Frey, 2002; Gadalla, Aboul-
Fotouh, El-Setouhy, Addel-Aziz, Mohamed et al., 2003; Varsano, Ganz, Eldor, & Gaenkin, 2003).

Since WP is primarily smoked in an intermittent pattern, it is difficult to measure dependence based on frequency of use. Nonetheless, Maziak, Ward and Eissenberg (2004) found that WP dependence shares many features with nicotine dependence found in cigarette smokers. A survey of 268 WP users found that while the irregular and occasional use pattern of WP may reduce the likelihood of nicotine dependence, the behavioural and social components of dependence are especially enhanced by unique features of WP smoking. The researchers suggest that dependence begins when WP use follows a transition from social and occasional to individual and regular use (Maziak, Ward & Eissenberg, 2004).

Noncigarette tobacco use is especially common among women across the globe. While the prevalence of female cigarette smoking is the lowest in the world in South Asia (5%) and the Middle East/North Africa (6%) (Asma, Mensah, Warren, & Henson, 2003), research indicates that female WP smoking rates in these areas are much higher. Among Syrian university students 29.8% of women reported ever smoking WP (Maziak, Fouad et al., 2004), while a survey of pregnant women in Lebanon found that 18% reported ever smoking WP and 6% reported smoking WP during pregnancy (Chaaya, Awaad, Campbell, Sibai, & Kaddour, 2003). WP use is more socially acceptable for women than cigarette smoking (Maziak, Fouad et al., 2004; Maziak, Rastam et al., 2004). Some of this trend may be attributable to the introduction of the more attractive sweetened and flavoured WP tobacco during the 1990s (Chaouachi, 2006; Frey, 2002; Hadidi & Mohammed, 2004).

Health Effects

In an average WP smoking session, substantial amounts of nicotine and smoke are consumed. WP smoke burns at a temperature several hundred degrees lower than cigarette smoke (Maziak, Fouad et al., 2004). WP smokers also tend to inhale more deeply with a shorter duration between puffs in order to keep the WP lit (Djordjevic & Zang; 2000; Salem & Abdel-Latif, 1974; Shihadeh et al., 2004). Puff magnitude is one order greater than required for cigarettes (Hadidi & Mohammed, 2004; Shafagoj et al., 2002; Shihadeh, 2003).

WP smoke contains several carcinogens and toxic elements, similar to cigarettes. Lead, arsenic, nickel, chromium, cobalt and tar content of WP smoke were reported as significantly higher than that of cigarettes (Behera, Uppal & Majumdar, 2003; Chaouachi, 2006; Hadidi & Mohammed, 2004; Kiter, Ucan, Ceylan, & Kilinc, 2000; Rakower & Fatal, 1962; Shafagoj & Mohammed, 2002; Shihadeh, 2003; Zahran, Yousef & Baig, 1982). For example, tar is one to two orders of magnitude greater in WP smoke, with one 100-puff WP-smoking session producing as much tar as 20 low-tar cigarettes (Shihadeh, 2003).

Water filtration traps some of the hazardous elements, such as tar (Tamim et al., 2001), or acts similarly to a cigarette filter (Macaron, Macaron, Maalouf et al., 1997; Radwan et al., 2003; Shafagoj & Mohammed, 2002; Zahran et al., 1982), yet there is ample evidence to several adverse effects of WP smoking on health.

Nicotine and cotinine absorption are commonly used as methods of assessing the extent to which tobacco is inhaled and taken into the body (Jarvis, Tunstall-Pedoe, Feyerabend, Vesey, & Salloojee, 1984). A Jordanian study showed that plasma and saliva nicotine values after one run of WP smoking rose to higher levels than after one cigarette. Rate, depth and duration of inhalation varied significantly among participants and influenced the absorbed levels (Shafagoj et al., 2002). Smoking-machine studies indicated that the nicotine yield from a single session of WP smoking exceeds the nicotine yield from smoking a typical cigarette (2.94 mg compared to 0.88 mg, respectively). The nicotine content in WP smoke is estimated at 2–4%, while nicotine in cigarettes is 1–2% (Kiter et al., 2000). Nicotine yield from smoke condensate is not highly correlated though with the amount of nicotine absorbed into the circulation.

An intake of 5 mg of nicotine per day represents an ‘addiction threshold’, which reflects smoking of 5 cigarettes or more per day. Daily WP smoking produced a 24-hr urinary cotinine level equivalent to smoking 10 cigarettes/day, whereas occasional WP smoking produced a 24-hr urinary cotinine level equivalent to smoking 2 cigarettes/day (Neergaard, Singh, Job, & Montgomery, 2007). Daily WP use clearly may be classified as an addictive behaviour.

Aside from nicotine and cotinine, there are further indicators of the extent to which WP smoking affects the health of smokers. Cadmium levels in hair of WP smokers were significantly higher than in cigarette smokers (Sukumar & Subramanian, 1991). WP smoking was associated with increased plasma epinephrine, glucose, lactate/pyruvate ratio, growth hormone, fatty acids, urinary catecholamines, cortisol, blood erythrocytes and leukocytes. Plasma proteins, urea, pyruvate, creatinine and vitamin B12 were significantly reduced and blood gases showed significantly lower oxygen pressure (Abou-Shamaa, Authman, & Kamel, 1990). Plasma carboxyhaemoglobin was significantly higher for WP smokers than after one cigarette. Rate, depth and duration of inhalation varied significantly among participants and influenced the absorbed levels (Shafagoj et al., 2002). Smoking-machine studies indicated that the nicotine yield from a single session of WP smoking exceeds the nicotine yield from smoking a typical cigarette (2.94 mg compared to 0.88 mg, respectively). The nicotine content in WP smoke is estimated at 2–4%, while nicotine in cigarettes is 1–2% (Kiter et al., 2000). Nicotine yield from smoke condensate is not highly correlated though with the amount of nicotine absorbed into the circulation.
tous degeneration in the palate and its minor salivary glands, and caused increased tongue hyperkeratosis (Abbas, Abou-Azma, & Bulus, 1987), which may lead to malignant changes. Further studies found that the heart rate, blood pressure and maximum end-expiratory carbon monoxide were significantly increased following both cigarette and WP smoking (Shafagoj & Mohammed, 2002).

WP smoking produces harmful effects that are similar to cigarette smoking on lung ventilatory capacity and increase the risk of developing obstructive airway disease. Female WP smokers had worse pulmonary function test results compared to males (Kiter et al., 2000; Al-Fayez, Salleh, Ardawi, & Zahran, 1987). Other studies revealed that, in comparison with cigarette smokers, WP users may be at higher risk for chronic obstructive pulmonary disease (Abdel Hakim & Gemei, 1985), aggressive pulmonary obstruction, pulmonary hypertension, right ventricular hypertrophy (Mazen & Aurabia, 2000), atherosclerosis and cardiovascular disease (Wolfram et al., 2003a).

WP smoking has been associated with increased rates of other disease conditions: pulmonary tuberculosis (Salem, Abdel Hakim, & Henson, 1973), chronic hypertrophic laryngitis (Abdel-Wahab, 1994), oral mucosa hyperkeratosis (Abbas et al., 1987), oral and lip squamous cell carcinoma and keratocanthoma (El-Hakim & Uthman, 1999), post-extraction dry socket (Al-Belassy, 2004) and skin hyperkeratosis (Onder, Oztas, & Arnavut, 2004). Compared to nonsmokers, WP users have a significantly increased risk of lung (Qiao et al., 1989; Gupta, Boffetta, Gaborieau, & Jindal, 2001), bladder (Roohullah, Hamdani, Burdy, & Khurshid, 2001; Bedwani et al., 1997), gastric and oesophageal cancer (Gunaid et al., 1995).

Since the WP is largely shared among users, WP use also puts individuals at some risk for infectious diseases (Chaouachi, 2006; Munchkof, Konstantinos, Wamsley et al., 2003; Radwan, 1999). WP smoking also requires the generation of significant negative pharyngeal pressures, which can be transmitted to the middle ear causing retraction of the tympanic membrane. Indeed increased prevalence of attic retraction in WP regular smokers was found, compared to cigarette smokers (Effat, 2004).

Complication rates during pregnancy were statistically and significantly higher in WP smokers compared to nonsmokers. Mean birthweight compared to nonsmokers was 0.07 kg less for WP smokers and 0.17 kg less for cigarette smokers, with lower mean birth weight reported with increased WP smoking. The effects of WP smoking were concentrated in the first trimester, and the children of WP smokers had lower Apgar scores, and greater pulmonary problems, malformations or perinatal complications (Yadav & Thakur, 2000; Nuwayhid, Yamout, Azar, & Kambris, 1998). Children of WP-smoking parents have an increased risk of chronic cough and bronchial asthma (Sherif, 1990; Tamim, Musharrafieh, El Roueiheb, Yunis, & Almawi, 2003).

Research, Practice and Policy Gaps
The current scientific literature on WP is limited. One reason for this is that WP use is most prevalent in developing countries where there is less research. This paucity of studies contrasts with the increasing popularity of WP smoking. The increasing popularity and cross-cultural appeal of WP has been linked to a desire for youth to find new ways to socialise beyond alcohol consumption and coffee houses. WP is an inexpensive way to hang out with friends and generally cheaper than cigarettes (Chaaya, El Roueiheb, Chemaitelly, Azar, Nasr, & Al-Sahab, 2004). The popularity of WP use among students younger than 20 years may be related to the fact that they cannot access bars where alcohol is served (Eissenberg, Ward, Smith-Simone, & Mazik, 2008).

WP plays a unique role for women. In conservative societies where social acceptability of females smoking cigarettes is low, many women smoke WP as an alternative. Tobacco control measures do not effectively respond to this female dimension (Morrow & Barraclough, 2003a).

WP smoking is of particular interest in Islamic countries, where the Muslim world represents a significant challenge for tobacco control. Smoking has more than doubled in Islamic nations in the past 25 years (Taha, 1980). Some suggest that the popularity of WP in Islamic nations is due to the fact that drinking alcohol is not permitted by Islamic law (Radwan, 1999). Nonetheless, certain Islamic clerics have decreed that smoking is against Islam because of harm it causes to the health and finances of smokers (Jabbour & Fouad, 2004). Islam and Al-Khateeb recommend that smoking cessation programs incorporate a network of mosques that can help disseminate mass education programs under religious leadership. They also suggest that Muslim doctors play a significant role in antismoking education and that educational programs be integrated into primary and secondary education systems (Islam & Al Khateeb, 1995). Within the public health community, by contrast, there is no consensus about using religion in interventions even for those that receive unanimous support such as tobacco control (Jabbour & Fouad, 2004).

A review on WP smoking reveals that the social dimensions of smoking and prevention are of vital importance. Yach, Shov Jensen, Norris and Evans (1998) argue that successful health policies must take the social norms, culture and communication styles of target populations into account, and anti-WP policies are no exception. A survey of Arab American adolescents found that the family plays a more important role in smoking prevention in comparison to other ethnic groups (Kulwicki & Rice, 2003). Other authors suggest that social research is necessary to explore how and why
certain factors are related to tobacco use, and how to develop multilevel, multidisciplinary, culturally sensitive approaches to tobacco use, prevention and cessation that include public health, educational and clinical models (Morrow & Barralough, 2003b).

Physicians can play a special role in WP cessation. Research shows that in industrialised countries, brief (i.e., 3 minutes) advice on quitting from a physician is associated with a small but significant increase in the odds of quitting compared to no intervention (US Department of Health and Human Services, 2000). Physicians are uniquely positioned to be able to ask patients about WP use and incorporate WP use into their surveys of patient health. As a caveat, another study in Lebanon showed that interventions by healthcare providers did not produce a measurable decrease in smoking because providers discuss smoking in abstract terms and do not provide enough background to enforce the intended message of smoking prevention (Chaaya, Awaad, Campbell, Sibai, & Kaddour, 2003). This finding is important because many physicians lack knowledge about the hazards of WP use due to the scarce scientific literature and lack of a formal education on the topic. Before physicians and healthcare providers can be more engaged in WP prevention and cessation, they need to be educated about the specific dangers of WP use and strategies for clinical prevention. While many studies have been made regarding cigarette smoking cessation, WP smoking cessation is a rare topic. It appears that most of WP smokers are not interested in quitting (Ward, et al., 2005).

In conclusion, as WP use escalates tobacco control researchers must address the specific issue of WP smoking and rise to the challenge of integrating WP prevention and cessation into current antitobacco initiatives. The unique social and traditional role of WP smoking requires forgiving, culture-sensitive and patient approach.

Acknowledgments

This study was supported by a grant from the Canadian Institutes of Health Research, Global Health Research Initiative, and by Canada-International Scientific Exchange Program (CISEPO). The generous assistance of Professor Abdeen (Al Quds University), Professor El Nasser (Jordan University of Science and Technology) and Professor Noyek (University of Toronto) is gratefully acknowledged.

Conflict of Interest

None of the authors have any conflicts of interest.

Funding

Funding sources had no involvement in any stage of the study design; in the collection, analysis, and interpretation of data; in the writing of the report; and in the decision to submit the paper for publication.

References


