Waterpipe smoking: a new tobacco pandemic entailing severe health risks?

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The waterpipe (also named shisha, narghile, argileh, etc.) is a traditional aid for tobacco consumption in Asia and Northern Africa. In these countries, waterpipes differ considerably in shape and size. Although exact numbers are still missing to date, web blogs, “hookah bar” advertisements, and the advent of popular waterpipe stores in larger and smaller cities alike indicate that both the general interest and the number of young people smoking waterpipes have considerably grown in recent years throughout the Western world (Jackson 2008; Ward et al. 2007). This progression would follow an increase in the prevalence of waterpipe smoking being well documented for the Eastern Mediterranean region (Chaaya et al. 2004) and possibly results partly from people’s perception that the water would filter toxic compounds, thus rendering the practice less harmful than conventional smoking (Kandela 1997). Among the predominant reasons for the resurgence of waterpipe consumption in these countries and the spread throughout Europe and Northern America is the invention of heavily flavored tobacco mixtures. In addition to tobacco, huge amounts of sugar or honey are used in combination with fruit extracts and a wide range of different flavors. Further, the introduction of self-igniting charcoal also contributes to the increasing use of waterpipes especially in the Western hemisphere.

From the middle of the twentieth century until present days, epidemiological and experimental research in Western countries focused on adverse health effects related to cigarette smoking. However, using a waterpipe is so different from smoking a cigarette that extrapolations are unapt. During

consumption, waterpipe tobacco becomes heated rather than incinerated. During a regular smoking session, the temperature of waterpipe tobacco does not exceed 200 °C and thus stays considerably lower when compared with the glowing cone of cigarettes (600–900 °C) (Shihadeh 2003). As consequence, the overall composition of both the waterpipe smoke and tar exhibits toxicologically relevant differences to smoke or tar from cigarettes. Schubert et al. (2011a) previously identified the charcoal used for heating-up the tobacco as major source of ominous amounts of two extremely toxic ingredients of smoke released from waterpipes during consumption, that is, the asphyxiant gas carbon monoxide (CO) and the volatile aromatic hydrocarbon benzene, the latter being well known to induce acute nonlymphocytic (myelogenous) leukemia (ANLL) in humans (U.S. EPA 2008).

Applying flavored waterpipe tobacco enables consumers to inhale huge volumes of smoke. The smoke is very mild and even consumers who would reject cigarettes due to their smell and harsh taste can adapt easily. Not to be sneezed at, the common use of one waterpipe often serves as desirable social event for people gathering in hookah bars. Yet, information on health risks associated with waterpipe smoking is rare and usually available only for those countries in which waterpipe smoking is part of tradition and history. Since waterpipe use is now becoming popular among adolescents in Europe and North America, suitable epidemiological studies as well as significantly increasing experimental efforts are urgently required to support appropriate characterization of both hazard and risk. In fact, only few data on the composition of waterpipe smoke are published in the literature. Studies of the American University of Beirut and later by Schubert et al. (2011a) provided high measures of tar, carbon monoxide, and nicotine in the smoke of waterpipes (Shihadeh and Saleh 2005; Al Rashidi et al. 2008). Further experiments revealed proof for the presence of

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polycyclic aromatic hydrocarbons, primary aromatic amines, and furanic compounds (Schubert et al. 2011a, b, 2012; Al Rashidi et al. 2008; Sepetdjian et al. 2008).

It is important to emphasize that any appropriate risk characterization and quantitative risk assessment relies on measures of the real internal exposure and body burden accompanied with the practice of inhaling putatively toxic compounds present in waterpipe smoke. In a similar way as widely initiated for a better characterization of cigarette smoke exposure, biomonitoring studies focusing on blood levels, macromolecule adducts, excreted metabolites, and other biomarkers of carcinogenic compounds such as aromatic hydrocarbons or tobacco-specific nitrosamines are therefore crucial. With regard to waterpipe smoke-associated hazards, attention should be paid to blood nicotine levels as well. In accordance with the known addictive potency of nicotine, previous studies from Syria confirmed that the practice of waterpipe smoking may result in addiction (Asfar et al. 2005; Maziak et al. 2004).

Due to the lack of sufficient data on the toxicological effects of waterpipe smoke, the medical community and public health decision-makers are as yet not well prepared in providing meaningful advice regarding this increasingly important worldwide health issue. In consideration of our limited knowledge and the widespread use of the shisha, however, it seems urgent to issue and disseminate a warning, at least to certain groups of consumers. Since the brain and the heart may get severely affected by CO exposures with COHb levels exceeding 20 % (Prockop and Chichkova 2007), certainly pregnant women and individuals suffering from cardiac diseases should refrain from smoking waterpipes as excessive amounts of this gas might get inhaled during an average waterpipe session. Further, pregnant women should also avoid working or lingering in so-called shisha lounges since high concentrations of carbon monoxide may accumulate in secluded rooms containing active waterpipes (Fromme et al. 2009).

The study authored by Schubert et al. included in this issue of *Archives of Toxicology* further adds to the characterization of waterpipe smoke with regard to the levels of toxicologically relevant compounds. The focus of this work lies on seven important carbonylic compounds (e.g., formaldehyde) and how their contents in the smoke are being affected by the amounts of humectants added to the tobacco prior to use. It provides interesting insights that will help to improve risk characterization and risk assessment in this field of socially triggered addictive attitudes.

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