

# Assessment of narghile (shisha, hookah) smokers' actual exposure to toxic chemicals requires further sound studies

Tobacco smoking is hazardous for health. However, not all forms of tobacco use entail the same risks and the latter should be studied and compared in a sound realistic way. Smoking machines for cigarettes (which are consumed in a few minutes) were early designed as a tool to evaluate the actual intake of toxic substances ('toxicants') by smokers. However, the yields (tar, nicotine, CO, etc.) provided by such machines poorly reflect the actual human smoking behaviour known to depend on numerous factors (anxiety, emotions, anthropological situation, etc.). In the case of narghile smoking, the problems are even more complex, particularly because of the much longer duration of a session. A recent study from the US-American University of Beirut was based on a field smoking topography and claimed consistency with a laboratory smoking machine. We offer a point by point critical analysis of such methods on which most of the 'waterpipe' antismoking literature since 2002 is based.

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Tobacco smoking is hazardous for health. However, not all forms of tobacco use entail the same risks as the case of the Swedish smokeless SNUS tobacco shows (1). The different methods of tobacco use should be studied and compared in a realistic way order to in keep the credibility of prevention and public health interventions safe. Indeed, recent reviews have highlighted the existence of unprecedented world confusion when it comes to water pipe smoking under its various forms: narghile, shisha, hookah, goza, etc., and the diverse products that go with it (2, 3).

For instance, many researchers have often taken one type of water pipe (e.g. shisha with moassel, a flavoured tobacco/molasses/glycerol mixture) for other ones: for example, plain moistened tobacco known as jurak, ajamy, tutun, or even jurak (containing minced fruits and molasses but no glycerol) (4). This type of smoking is known in Libya and has been reported in early works (5, 6).

One of the recent publications from the US-American University of Beirut (US-AUB) (7) is of interest for two reasons. The first one is that all the mainstream 'waterpipe' antismoking literature has virtually relied on the US-AUB smoking machine-based findings in terms of toxicity of narghile (shisha, hookah) use. The other reason is that the authors of the study stress several times that 'in a single use session, water pipe smokers inhale large quantities of smoke, ma'ssel-derived "tar",

CO, and nicotine'. They also add that their findings 'are perhaps the most robust evidence to date that water pipe smoking entails inhaling large quantities of toxicants'. Finally, their results would also be 'consistent with a growing body of studies on narghile water pipe toxicant content and health effects, which have unanimously pointed to the hazardous nature of first- and second-hand narghile water pipe smoking'.

Unfortunately, there is a first striking bias in the smoking topography field study supposed to demonstrate the relevance of the designed smoking machine. It did not involve, as expected, 100% narghile-only smokers but only 60% so that 40% were cigarette smokers. The smoking career of the former (possibly ex-cigarette smokers in a fair number of cases) remains also unclear. Furthermore, they were sometimes sitting two at a time (20% of so-called dyads) and expectedly sharing the suction hose. Tobacco science (tobaccology) specialists know that the behaviour of such cigarette (or ex-cigarette) smokers strongly differs from that of exclusive and/or recreational users (a phenomenon known as the [nicotine] compensation effect). This point of utmost importance, would thus explain the unusually elevated levels of nicotine (4.82 mg) obtained in that study.

The authors of the US-AUB study have dubbed their work (reflected in a smoking machine with certain puffing parameters; among others an inter-puff time of 17 s for a duration of about 1 h) the 'Beirut method' (7).

The apparent objective is to see it validated as a standard for 'regulation' of the related flavoured Moassel (tobacco-molasses and glycerol) based products. For memory, in the field of cigarette regulation, there is a standard regimen (Federal Trade Commission) based on inter-puff time of 60 s and others more 'intensive' (1 puff every 30 s) such as the Massachusetts, Texas, and British Columbia ones (8). It is also noteworthy that the latter (for a cigarette), when compared with the US-AUB protocol (for a narghile), implies a smoking episode of only a few minutes (9, 10).

Against the background of a complex human context the narghile fits in, particularly striking by its social and cultural diversity, the above lack of consideration poses several other methodological problems. Negative or unexpected results published over the past decades have been systematically dismissed (11, 12). Amazingly, even a study on carbon monoxide and nicotine, led in a natural environment (café) in the same city of Beirut, has not been discussed in the US-AUB study (7, 13, 14). Biased selection certainly makes it possible to state that there is 'a growing body of studies' highlighting the harm caused by narghile smoking. However, there is also peer-reviewed research from Asia and Africa that is not cited in the US-AUB study. As a result of this process, the WHO report on 'waterpipe' smoking (15) actually dismissed highly relevant scientific works (5, 11, 12, 16).

Regarding narghile second-hand smoke and biased experiments (17), critiques have been recently published elsewhere in the peer-reviewed literature (18–20). When comparing cigarettes with narghile (filled with flavoured moassel and not all 'water pipes', which is not true because different smoking products induce different smoking behaviours in terms of puff volume, etc.), it is important to stress that the latter's smoke, unlike the former's, is mainly made up of water and glycerol as in the Eclipse cigarette (19, 21). This is the reason why flavoured moassel narghile smokers can draw such large puffs. Users of other smoking products (tumbak: pure moistened tobacco shredded leaves or jurak: unflavoured glycerol-free moassel) cannot do the same and their puffs are shallow and much less frequent (22, 23). This is why the use of the 'waterpipe' neologism (implying that, when no detail is provided, all water pipes are the same in spite of their striking diversity) is absolutely inappropriate (19). This lack of basic precaution has led some public health organisations to declare that, on the basis of yields artificially produced by the AUB-smoking machines, one narghile session equals inhaling the equivalent of 200 cigarettes (24). Even some researchers from the US-AUB working on this very issue believe that tar is to be found in the tobacco plant (25). However, tar only appears when tobacco is burnt (cigarette). Finally, it is worth noting that the first measurement of a wider range of toxic substances on a real human smoker was led in Russia (26).

## Other methodological problems

### *The other Lebanese water pipe*

The use of 'water pipe' is often deceptive because in Lebanon there are actually two main types of water pipes that are completely different from each other. The one on which the US-AUB authors have been recently focusing on for several years now is one type and, on the other, there is a not less widespread pipe working with tumbak/ajamy (pure moistened tobacco shredded leaves) directly in contact with embers of natural charcoal (vs. quick-lighting charcoal systematically used by the US-AUB authors, which is usually separated from the smoking mixture by an aluminium foil thermal screen). Although both types of water pipes can be found in most cafés of Lebanon in particular and in Asia and Africa in general, their characteristics and that of their users strongly differ from each other: either on the level of the corresponding smoke chemistry or on that of the smoking behaviour (volume and frequency of puffs, etc.), as emphasised above (22, 23). It is not unlikely that tumbak smokers may have found themselves among the participants in the US-AUB field study.

### *'Faking good behaviour' and over-ritualising*

The smokers were certainly willing to participate. From there, they knew they would be observed. However, behavioural, but also tobacco, scientists (who are supposed to rely on behavioural sciences) know that awareness of observation often introduces a serious bias. Social psychologists name 'impression management' a conscious 'deliberate and systematic attempt to distort self-reported actions in the most positive manner, to "fake good behaviour" [here smoking behaviour] "and to provide normatively desirable responses in order to obtain social approval" ', this 'in front of a real or imagined audience'(27). On a social anthropological level, one directly related bias leads to 'over-ritualising' one's posture (5). The case of the four smokers who 'drew >400 puffs in a sitting' is a good example of this bias provided by the US-AUB authors themselves (7). It remains that even for a 'more realistic' total number of puffs the above biases are still present. Indeed, in everyday natural non-observed life, intervals of several minutes between puffs are much more common than in this type of field study as the puffing is only a side accessory to the main reason for the gathering; conversation, among others. In this respect, anthropologists often rely on a complex method named 'participating observation' (5).

### *Emotional states*

Such contingencies are already true among cigarette smokers whose behaviour (puff number and duration), as well as the length of the left butt, also vary according to their emotional state (28). We assume that they are

even more relevant to the study of narghile users who are known to dedicate much more time to their social 'activity' (10). Furthermore, the geographical location of the field study has its own utmost importance as Lebanon is known for having been struck by a long series of wars. Interestingly, the US-AUB smoking topography was led in September 2006, i.e. immediately in the wake of a war of an exceptional violence (July of the same year). As with other large-scale catastrophes, one may at least assume that such events have some influence on smoking behaviour as the latter is known to relate to the degree of psychological stress. In this respect, we would like to refer to a relevant work carried out in a disaster area of the United States (29). Yet, independent Lebanese researchers have drawn the attention on the relation between war and the narghile epidemic (30).

### *Social interference and related matters (charcoal, water, size of the base)*

The waiter apparently did not interfere in the narghile smoker's activity while field anthropological observations have shown that in most cafés of the region, the pipe is prepared and maintained by a dedicated employee (sometimes named the Narghiljy). This individual spontaneously and periodically removes the ashes of the previous (smoking) material, then arranges a set of new pieces of burning charcoal on another (unconsumed, this is important) point of the bowl. He usually indulges in chatting with the patron, etc. These interruptive actions obviously have an impact on the average inter-puff time. Amazingly, in that field study, neither the preparation of the pipe (potential biases are numerous: packing of the moassel, size of holes, etc.), its size, nor the process of changing the water are given the least description. These are very important parameters. For instance, early research showed that the bigger the pipe the lesser the quantity of CO (31); a fact that was confirmed by the non-cited study led by Lebanese researchers in a Beirut café (13, 14). In these conditions, an 'average' narghile patron is expected not to smoke like the modelled robot: i.e. relentlessly drawing one puff each 17 s for one full hour.

### *Charcoal and inexperienced users*

In most cafés of the region, the charcoal that is served to narghile smokers is not the one (quick-lighting type) used in all US-AUB studies. Excepting perhaps establishments of the upper classes (in which case, this would be another bias), natural charcoal prepared in a firebox is served to narghile smokers. This means that the waiter (or the above mentioned dedicated employee) will interfere in the smoker's behaviour. All experienced users systematically move the charcoal around over the bowl. Furthermore, leaving inexperienced users to light themselves, the quick-lighting charcoal entails serious biases: to start with, the

non-observance of the lighting phase (a few minutes) that has direct consequences on the inhalation of highly toxic substances. During this period, this type of charcoal actually emits a black thick smoke of unknown composition (20).

### *Systematic contradictions with other settings (nicotine levels, inter-puff time, tar)*

#### *Nicotine*

Three decades back, researchers in Egypt found that the smokers of a local water pipe named 'goza' inhaled less nicotine than cigarette smokers (32). Recently in the United States it was found that mean blood nicotine level in hookah smokers sitting for a 45 min session was lower than that found in cigarette users after having smoked a single cigarette (for about 5 min) or equalling that of 1.7 cigarette after applying a pharmacokinetics model (33). These figures are absolutely not in agreement with those obtained in the smoking topography.

#### *Inter-puff time*

In the same experiment, the mean inter-puff time was 41 s, i.e. almost three times that of the US-AUB smoking machine or the 'human' smoker it is supposed to represent. This shows that the smokers in the Beirut observation were urged to smoke because of environmental cues (the unusual mouthpiece, tubes, wires, computer), being cognitively aware that they were observed and that they had to 'measure up'. An extra explanation is that this would be an effect of the lack of 'relaxation' (in spite of the sea panorama described by the authors). In the US experiment, the longer mean inter-puff time might be in relation with the fact that the participants had been watching videos while smoking (33). Indeed, social psychologists know that playing background music is efficient in reducing the need to 'fake good [smoking] behaviour' (and over-ritualise one's posture) by increasing 'cognitive busyness' and subsequently decreasing the tendency to engage in 'impression management' (27). Interestingly, in the neighbouring country, Syria, it was found that among narghile daily smokers in a laboratory, the mean duration for smoking sessions was 33.1 min (34). Not only is this figure colliding with the US-AUB study (in which the mean duration was 64 min) but, for such a much shorter duration, the volunteers took a mean of 169 puffs (vs. 220 in the US-AUB study) (7). Once again, one explanation may relate to the unusual emotional state of volunteers inside a laboratory, surrounded by technicians, researchers, electronic devices, and wires.

#### *Tar*

In this respect, there is a first striking contradiction with a previous similar field report (abstract) by the same team in which a mean level of 350 mg tar was found for a mean

smoking session duration of 48 min in the same natural environment (35). It is also noteworthy that the more realistic first 2003 narghile smoking machine of the AUB studies released only 242 mg tar. The inter-puff time, while being only half the one used for cigarette machine smoking (FTC: 60 s, for only a few minutes), was 30 s in that case. The explanation is that the shorter the inter-puff time the greater the tar yield (8). In these conditions, it is likely that an inter-puff time of 1 or 2 min would induce much lower levels of tar.

### In summary

For the sake of credibility, antismoking studies should also include the conditions, in which the yields of toxicants were obtained. Concerning tar, they should also clearly mention the high proportion of glycerol going included in the 'tar yield'. Additionally, a note should state that narghile smoke (from flavoured moassel) is mainly made up of water and glycerol.

### Declaration of interest statement

The author declares that he has no competing interest.

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