

Alternative forms of tobacco use

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SUMMARY

BACKGROUND: A review of the available scientific literature concerning forms of tobacco use other than regular cigarettes, cigars and pipes, the nature of such products, prevalence data and trends, health effects, regulatory issues and preventive measures.

RESULTS: *Narghile* (water pipe), *bidis*, *kreteks* and other forms of oral tobacco are traditionally used in many low-income countries, and some of these are currently spreading to the Western countries. They are all linked to negative effects similar to, and often greater than, those associated with common cigarette smoking. Various potentially reduced exposure products (PREPs), including *snus*, targeted at smokers aware of the health risks of regular cigarettes, have recently been developed by the tobacco

industry. Their pathogenic potential varies widely and is not fully known; it is in any case greater than that of pure nicotine forms (such as medicinal nicotine). Their use as cigarette substitutes should not be considered even by inveterate smokers who are unable or unwilling to quit nicotine before further independent evaluation and control.

CONCLUSIONS: There is no such thing as a safe tobacco product. Like cigarettes, alternative forms of tobacco use need regulatory measures that are adapted to local situations and supplemented by preventive measures within the World Health Organization's Framework Convention for Tobacco Control.

KEY WORDS: *narghile*; *bidis*; *kretek*; smokeless tobacco; PREPs

CIGARETTES account for 96% of the global sales of manufactured tobacco in terms of value, and global cigarette production continues to increase dramatically.¹ In the industrialised world, there has nevertheless been a drop in smoking prevalence, and the tobacco industry is developing new products intended for smokers who are aware of the health risks of regular cigarettes. In the rest of the world, along with a rapid growth in sales of manufactured cigarettes, numerous traditional forms of tobacco use persist, such as *narghile*, *kreteks* and *bidis*, as well as oral tobacco in South Asia.¹

Most of the scientific literature on tobacco is devoted to industrial cigarettes. The aim of this review was to document currently available data concerning the principal alternative forms of tobacco use, their prevalence, their health effects and regulatory issues that could help to limit the tobacco epidemic, a topical question that was the subject of the 2006 World No Tobacco Day.²

WATER PIPE (NARGHILE)

Apparatus and products

The water pipe (*narghile*) is composed of four parts (Figure 1). The head contains the product to be smoked and charcoal that helps in its combustion. A variety of

products may be smoked: tobacco (*tabamel* or *maassel*, *tumbak*, *jurak*) or a mixture of tobacco and *hashish* (*tasheirah*),³ with various other additives. The smoke is directed through the body—a metallic tube submerged in the water poured into the bowl. It then bubbles through the water and is carried through the hose to the smoker.⁴

Epidemiology

The water pipe use is traditional and is still common in different parts of the world, under the name of *narghile* or *arghile* in East Mediterranean countries, including Turkey and Syria, *shisha* and *goza* in Egypt and some North African countries, and *hookah* in India. It is believed to have been used to smoke tobacco or other substances by the indigenous peoples of Africa and Asia for at least four centuries.³

The water pipe is now the object of renewed interest, as its use has recently been spreading among young people in Western countries, such as the United States, Brazil and Europe.⁴ Whereas the number of places where the water pipe could be smoked was limited to a few bars almost exclusively attended by immigrants some 10 years ago, there has been a steady increase in the number of such establishments, and consumers

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Article submitted 20 August 2007. Final version accepted 8 January 2008.

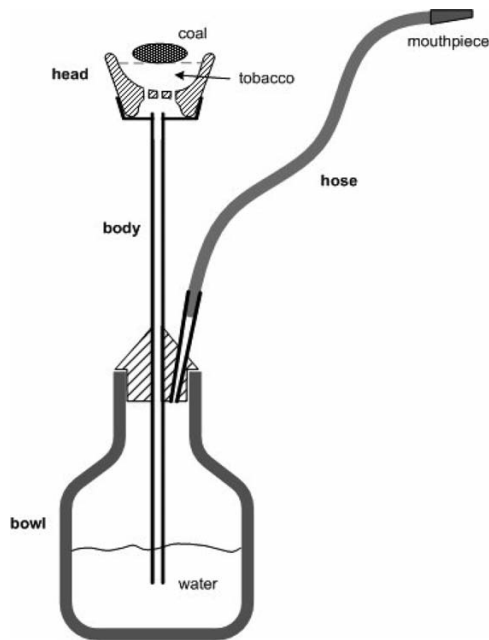


Figure 1 Diagram of a water pipe (*narghile*). Source: World Health Organization.⁴

are now mostly 15 to 20-year-olds,⁵ both male and female. The arguments presented by the consumers to justify water pipe smoking are its 'natural' quality, its fruity flavours (apple, strawberry, liquorice, etc.), the sense of belonging created by sharing the pipe, the novelty of the product, its difference from adult smoking habits and, last but not least, the unsubstantiated conviction that, with water acting as a filter, this method of smoking tobacco is less dangerous than cigarette smoking.⁶ Following the decline of cigarette sales in the Western world, the tobacco industry may be suspected of searching for compensatory profit and new

ways of getting youngsters addicted to nicotine by introducing products specific for *narghile* smoking.⁶

Health effects

A precise evaluation of the health effects of water pipe smoking is hindered by the paucity of published studies. Smoke from water pipes contains most of the compounds that are also present in cigarette smoke, albeit in different proportions. Importantly, the longer duration of a water pipe smoking session leads to much higher yields of tar, nicotine, carbon monoxide (CO), polycyclic aromatic hydrocarbons and heavy metals than cigarette smoking. Cigarette smokers typically take 8–12 puffs of 40–75 ml in about 5–7 min, and inhale 0.5–0.6 litres of smoke.⁴ In contrast, water pipe smoking sessions typically last 20–80 min, during which the smoker may take 50–200 puffs, with an intake ranging from about 0.15 to 1 litre each session.⁷ The water pipe smoker may therefore inhale the equivalent of 100 or more cigarettes.^{4,7}

Studies on the consequences for human health of water pipe smoking mostly come, for the time being, from Syria, Lebanon and Egypt, with occasional evaluations as part of case-control studies looking at risk factors for specific cancers that include the assessment of different forms of smoking, for example in India or China. Although numerous case reports or series have been published, only epidemiological studies are cited here (Table 1). These data indicate an increased risk of lung cancer (described in China,^{8,9} Tunisia¹⁰ and India¹²) and also possibly of other cancers, such as lip cancer (Egypt), carcinoma of the oral cavity and oropharynx (Pakistan), oesophageal and gastric cancer (Yemen) but not bladder cancer (Egypt).¹¹

Adverse modifications of cardiovascular and respiratory parameters due to water pipe smoking, and their negative impact on reproduction, have been described.

Table 1 Epidemiological studies on cancer and water pipe smoking

Authors, year of publication, reference no., country of study	Main results
Qiao et al., 1989, ⁸ People's Republic of China	Case-control study: ever use of water pipe was associated with a two-fold elevation in risk for lung cancer when compared with tobacco abstainers (OR 1.9, 95%CI 0.4–4.9), and a dose-response relationship was observed with increasing categories of water pipe-years (dose times duration)
Lubin et al., 1992, ⁹ People's Republic of China	Case-control study: compared to non-smokers, smokers of cigarettes only (OR 2.6, 95%CI 1.1–6.2), smokers of water and long stem pipes only (OR 1.8, 95%CI 0.8–4.2) and mixed smokers (OR 4.1, 95%CI 2.3–9.2) were at increased risk for lung cancer
Hsairi et al., 1993, ¹⁰ Tunisia	Case-control study: regular water pipe use was associated with an increased risk of lung cancer (OR 5.7, 95%CI 0.2–7.6)
Bedwani et al., 1997, ¹¹ Egypt	Case-control study: the ORs for urinary bladder cancer were 5.4 for <20 and 7.6 for ≥20 cigarettes per day. After adjustment for cigarette smoking, the ORs were 0.8 for water pipe and 0.4 for <i>hashish</i> smokers
Gupta et al., 2001, ¹² India	Case-control study: OR for lung cancer of 5 (95%CI 3.1–8.0) for men and 2.5 (95%CI 0.8–7.8) for women who smoke. Similar risk for cumulative consumption of <i>bidis</i> , cigarettes and <i>hookah</i>

OR = odds ratio; CI = confidence interval.

Results on respiratory parameters are contradictory. In Turkey, forced expiratory volume in 1 second (FEV₁) and FEV₁/forced vital capacity (FVC) were found to be higher in male smokers of water pipes than of cigarettes.¹³ However, a recent study did not confirm these results but found similar values among cigarettes and water pipe smokers, with an earlier occurrence of chronic pulmonary symptoms among water pipe smokers.¹⁴ A study conducted in Beirut among schoolchildren found an odds ratio (OR) for respiratory illnesses of 2.3 (95% confidence interval [CI] 1.1–5.1) due to exposure to *narghile* smoke and 3.2 (95% CI 1.9–5.4) for cigarette smoke.¹⁵ In a study of 18 healthy habitual *narghile* smokers, a modest increase in heart rate, both systolic and diastolic, and mean arterial blood pressure and maximum end-expiratory CO was found.¹⁶ A study conducted in Lebanon among pregnant women found an OR for low birth weight of 1.9 (95% CI 0.7–5.4); the risk increased to 2.7 (95% CI 0.9–7.7) among those who started smoking *narghile* in the first trimester of pregnancy.¹⁷

Finally, water pipe smoking is associated with an infectious risk, most importantly, of tuberculosis (TB). In Australia, a cluster of TB cases was described among young marijuana water pipe smokers. Sharing a water pipe was associated with an OR for TB of 2.2 (95% CI 1.0–5.2).¹⁸

Additional smoking-related risks may be introduced by the toxic properties of the flavour-related compounds and by the combustion of wood-cinders and charcoal, which produce their own toxicants. Second-hand smoke from water pipes (a mixture of tobacco smoke and smoke from the fuel) poses a serious health risk for non-smokers.¹⁹

The dangers associated with water pipe smoking depend on the local context and may vary in magnitude from one population to the next. Although the few available studies present multiple limitations, it is obvious that water pipe smoking is not a safe habit and should not be regarded as a less harmful alternative to cigarette smoking.

Along with its direct health effect, the *narghile* may be a gateway product for introducing adolescents to tobacco and to nicotine addiction, thereby greatly increasing their risks of also smoking cigarettes. The communal nature of *narghile* smoking may also be an introduction to cannabis smoking later.⁶

BIDIS

Product

Bidi cigarettes are small, thin, slightly conical smoking sticks that contain ± 0.2 g of flaked tobacco wrapped in a *temburni* or *tendu* leaf (plants native to India); the hand-made roll is secured by a thread at one or both ends. *Bidis* can be flavoured (e.g., chocolate, cherry, mango) or unflavoured.²⁰ In the US, some are filtered with a small wad of cotton, while others are

unfiltered.²¹ *Bidis* must be puffed more rapidly than regular cigarettes to remain lit.

Epidemiology

There is a huge *bidi* production in India (800 billion a year vs. 95 billion cigarettes), mostly hand-rolled at home by millions of *bidi* workers, most of whom are women, and some children. *Bidis* are imported to the US primarily from India and other South-East Asian countries.²⁰

In a house-to-house cross-sectional study conducted in 1992–1994 in the city of Mumbai (former Bombay) among almost 100 000 individuals aged ≥ 35 years, the percentage of ever smokers among men and women was respectively 15.4% and 0.3% in comparison with a higher rate of use of various types of smokeless tobacco (respectively 47.8% and 59%). Current *bidi* smokers represented 13.3% of the total study population in men and 0.3% in women in comparison with 9.9% cigarette smokers in men and 0% in women. The number of *bidis* used per day was 1–5 in 20.8% of male current smokers, 6–10 in 18.0%, 11–20 in 25.4% and ≥ 21 in 35%, compared to respectively 46.5%, 33.9%, 15.1% and 4.5% for industrial cigarettes.²²

In the US, *bidis* are less widely available than regular cigarettes,²³ and there are no national estimates for *bidi* smoking among US adults.²⁰ Middle school students are much less likely than high school students ever to have tried *bidis* (4.4% vs. 12.8%) or to be current users (2.4% vs. 4.1%). Young men in both age groups are more likely than young women to report using *bidis*.²³ Current cigarette smokers are far more likely to report using other tobacco products, including *bidis*, than non-smokers.

Health effects

In mainstream *bidi* smoke, the concentrations of nicotine, tar and CO are higher than in conventional cigarettes sold in the USA, with no significant differences between filtered and unfiltered *bidis*.²¹

Almost all case-control studies reported in the International Agency for Research on Cancer monograph on tobacco smoking²⁴ show a significantly increased relative risk (RR) (≥ 2.0) for cancer of the oral cavity and the pharynx, with a significant dose-response relationship. The RR is similar to that of cigarette smoking for other cancers (larynx, oesophagus), here also with a dose-response relationship. In Indian studies, *bidi* smoking is shown to cause an increased risk of lung cancer,²⁵ a more than 3-fold higher risk of heart attack^{25,26} and a nearly 4-fold higher risk of chronic bronchitis.²⁵

The OR of prevalence of self-reported TB by smoking habit in the previously cited Mumbai cohort study appears in Table 2.²⁷ Using never smokers as reference group, the OR (3.8) for TB is significantly higher for all smokers together and tends to be greater for *bidi* smokers, with a dose-effect relationship. Among smok-

Table 2 Prevalence of self-reported tuberculosis by smoking in a cross-sectional phase of the Mumbai study, 1991–1997

Habits	Total <i>n</i>	TB cases <i>n</i>	OR (95%CI)*
Never smokers	47 452	274	1.0
All smokers	22 912	332	3.8 (2.9–4.9)
<i>Bidis</i>	11 295	246	5.3 (4.1–7.0)
1–10/day [†]	4 402	76	4.2 (3.0–5.8)
≥11/day [†]	6 891	170	6.1 (4.6–8.1)
Other [‡]	11 617	86	2.2 (1.7–3.1)
Total	70 364		

* Adjusted for age, education and smokeless tobacco use.

[†]Total may not add up as data on frequency/day was unavailable in some cases; χ^2 for trend for frequency of *bidi* smoking = 273.3 ($P < 0.000001$).

[‡]Mainly cigarette smokers.

TB = tuberculosis; OR = odds ratio; CI = confidence interval.

ers, the adjusted RR for all-cause mortality compared with no tobacco use is higher for *bidi* users (1.9, 95%CI 1.8–2.0) than for cigarette users (1.4, 95%CI 1.3–1.5), and increases with the number of *bidis* consumed (1.7, 95%CI 1.5–1.9) for 1–5 and 2.1 (95%CI 2.0–2.1) for ≥6. The same is true for the adjusted RR for TB mortality rate (2.6, 95%CI 2.1–3.3) for *bidi* smokers, compared with never smokers. For both self-reported TB disease and for all causes and TB mortality rates, smoking *bidis* implies a major risk compared with no smoking, and is probably linked to a greater health risk than cigarette smoking.

KRETEK

Product

Produced in Indonesia, *kretek* cigarettes contain mixtures of hundreds of different additives (flavours, ammonia, cacao, etc.), apart from 30 varieties of tobacco (black or other), cloves and 'sauces'. Cloves contain eugenol, whose local anaesthetic effect induces more intense smoking and is suspected, although not classified, to be a possible carcinogen. *Kreteks* are named after the *keretek-keretek* sound of cloves burning and exploding.

Some *kreteks* are hand-rolled in a cornhusk or in paper. Machine-made *kreteks* with or without filters have been produced commercially in large numbers since the 1970s after the mechanisation of the industry²⁸ by multibillionaire brands: Gudang Garam, Djaram, Bental and Sampoerna (bought by Philip Morris). *Kretek* is exported to the USA.²⁰

Epidemiology

Among the 210 000 000 inhabitants of Indonesia, 65% of men and 4.5% of women smoke, a total proportion of 35.4% or >70 000 000 smokers, consuming 215 billion cigarettes annually. Between 2001 and 2004, the prevalence of smoking increased from 62.3% to 65.2% in men and from 1.4% to 4.5% in women. Most (80%) of the cigarettes used are in the form of *kretek*.²⁹ The high prevalence of cigarette and

Table 3 Smoking habits among pulmonary patients, Jakarta, Indonesia

	Persahabatan Hospital		Indonesian Anti-tuberculosis Association clinic TB patients* (<i>n</i> = 180) <i>n</i> (%)
	Lung disease patients (<i>n</i> = 209) <i>n</i> (%)	TB patients (<i>n</i> = 130) <i>n</i> (%)	
Total			
Current smokers	103 (49.3)	68 (52.3)	72 (40.5)
<i>Kretek</i> only	(89.9)	(88.3)	68 (93.1)
Classic cigarette only	(5.9)	(5.2)	
Both	(4.2)	(6.5)	5 (6.8)
Mean daily consumption	12.6		

* 44 AFB-positive, 129 AFB-negative.

TB = tuberculosis; AFB = acid-fast bacilli.

kretek use among patients was found in surveys conducted in several hospitals in Jakarta (Table 3).³⁰

No data are available concerning *kretek* use among US adults. An estimated 3% of high school students and 2% of middle school students are current *kretek* smokers, with more males than females.^{20,31}

Health effects

Standardised machine-smoking analyses in the USA indicate that *kreteks* deliver more nicotine, CO and tar than conventional cigarettes.³² The tar and nicotine content indicated on *kretek* packets vary widely, between 12 and 39 mg for tar and between 0.9 and 2.4 mg for nicotine, compared with 19 and 1 mg for classical Marlboro cigarettes (unpublished data).

The health impact of *kretek* smoking is indicated by an OR of 7.8 for lung cancer in men³³ and 3.1 in women;³⁴ 81.1% of lung cancer patients in Indonesia are known to be *kretek* smokers.³⁵ In the 2004 Indonesian TB prevalence survey,³⁶ the OR for TB was 3 in *kretek* smokers compared to non-smokers. Regular *kretek* smokers have 13–20 times the risk of abnormal lung function compared with non-smokers.³⁷

In the US, there has been no research concerning the long-term effects of *kretek* smoking, but a higher risk for acute lung injury was shown, particularly among susceptible individuals with asthma or respiratory infections.³⁸

SMOKELESS TOBACCO

Products

Smokeless tobacco includes tobacco leaves in plugs or twists to be chewed;³⁹ powdered tobacco (with additives) that is inhaled (dry snuff) through the nose; and moist snuff (ground tobacco for oral use) that exists either in loose form or in small semi-permeable packets to be kept in the mouth between lip or cheek and gum, or under the tongue. *Snus* is a variety of moist snuff produced in Sweden. Other forms of oral tobacco are betel quid (areca nut, powdered slaked lime and

tobacco) and *nass* (tobacco, wood, ash, oil and lime) and, in Western countries, lozenges of compressed low nitrosamine tobacco to be chewed (Ariva).⁴⁰

Epidemiology

According to the WHO, some 400 million people, chiefly in Central and South India, consume smokeless tobacco, with increasing use recorded in some of these countries.³⁹ Tobacco leaves have traditionally been used in Asia, particularly in India. Dry snuff is currently used in South Africa. The prevalence of oral tobacco use, including betel quid, is greater in India than the prevalence of smoking. Use of all forms of tobacco is highly prevalent in rural areas: 33–80% among men and 15–67% among women, depending on the area.^{41–43}

Nass is used in some countries of Central Asia by up to 20% of adults.³⁹

Snuff is presently marketed in Western countries by the tobacco industry (Revel from US Smokeless Tobacco, Stonewall from Stars Scientific, Ettan and Lucky and Exalt from Swedish Match). Snuff is frequently used in the USA (14.8% of male school students in 2001,⁴⁴ 36% in major league professional baseball players)⁴⁵ and in Sweden (21% of daily *snus* users in men).⁴⁶

Health effects

Oral forms of tobacco require neither burning tobacco nor inhalation of smoke and their resulting effect on the lungs, and produce neither environmental tobacco smoke nor butt pollution. They are potentially less harmful than smoking, as the number of known carcinogens is much lower in unburned tobacco (>15) than in cigarette smoke (>60)⁴⁷ and, in the absence of inhalation, the nicotine peak in arterial blood is limited, with swallowed nicotine being metabolised rapidly in the liver (first pass metabolism). Commercial smokeless tobacco products vary greatly in nicotine and carcinogen concentrations (e.g., tobacco-specific nitrosamines)⁴⁸ due to differences between brands in the quality of tobacco, the presence of water (50–60% in moist tobacco, for easy use), salt and flavour additives and the manufacture technique (with or without fermentation, pasteurisation and preservation during storage).

In current users of Copenhagen moist snuff, which is also sold in the US, the area under the curve of nicotine is larger (1038) with this product than with other smokeless products such as Revel (189), Stonewall (292) or Ariva (192), and is even higher than with the pharmaceutical nicotine Commit (464), with therefore a greater reduction in craving for 30 min. The decrease of withdrawal score is similar with Copenhagen and with medicinal nicotine.⁴⁹ In users of American smokeless tobacco, the levels of total NNAL (a metabolite of NNK, a powerful nitrosamine carcinogen) in urine is significantly higher than in smokers.⁵⁰

The health hazards of a lot of previously produced moist tobacco are well known.⁵¹ Local reactions included hypersalivation, gum reactions, leucoplasia, cancers of the mouth and pharynx, possible general effects like other types of cancer, cardiovascular diseases, foetal toxicity and nicotine addiction. In Central and Southern Asia, oral tobacco is estimated to cause cancer in 100 000 men and in 50 000 women per year.³⁹ In the Mumbai study,²⁷ in comparison with individuals with no tobacco use, the adjusted RR for all-cause mortality rate is 1.2 for those using smokeless tobacco (95%CI 1.0–1.3), which is lower than for smokers (1.6, 95%CI 1.2–2.3).

The Swedish '*snus*', a tobacco with lower levels of nitrosamine produced using severely controlled techniques (the Godiatek Standard), is presented as being partly devoid of a number of these deleterious health effects, although it still contains tobacco-specific nitrosamines (TSNA), at lower levels.⁵²

A recent systematic review of the health effects of modified smokeless tobacco products, published by Broadstock,⁵³ included 16 primary studies and two systematic reviews, all evaluating the Swedish *snus*. In the two systematic reviews of head, neck and gastrointestinal cancers, *snus* use was associated with a much lower risk than smoking. An increased risk for these cancers was not shown when comparing *snus* with no tobacco use. A report published after the Broadstock review shows an increased risk of pancreas cancer in a cohort (1978–1992) of construction workers ever using *snus* (OR 2.0, 95%CI 1.2–3.3) compared with non tobacco users.⁵⁴ No excess risk of oral or lung cancer could be shown in the same study. There is no significant increased prevalence of cardiovascular diseases for *snus* users compared with no tobacco use in five of the six primary papers reviewed by Broadstock; the sixth large cohort study⁵⁵ was recruited in the early 1970s, before the change to the non-fermentation method. Compared with never tobacco users, an RR of 1.4 (95%CI 1.2–1.6) was observed in males who were exclusive *snus* users compared with RR 1.8 (95%CI 0.7–2.2) in male smokers of >15 cigarettes per day.

In a population-based prospective cohort study,⁵⁶ the adjusted OR for pre-term delivery was 1.98 (95%CI 1.5–2.7) for children born to mothers who used *snus* compared to non-tobacco users. The mean birth weight was lower by 39 g (95%CI 6–72), which is considerably less than that of children born to smoking mothers (190 g, 95%CI 178–202). Furthermore, smokeless tobacco is addictive.

The other health risks of Swedish *snus* need further evaluation. The studies reviewed do not have sufficient power to rule out small to moderate excess health risks associated with *snus* use, they rely on retrospective, unvalidated self reports of tobacco exposure at study entry, they do not consider potentially confounding effects and six of the 18 papers received some financial support from the tobacco industry. Furthermore, these

conclusions cannot be extrapolated to *snus* manufactured or sold outside Sweden, as the Swedish Match's product Exalt appears to have TSNA levels that are higher in products marketed in the US than in the products available to Swedish consumers.⁴⁴

Some authors report that use of *snus* can be the first step to smoking, that it could deter smokers from quitting all types of tobacco use, that it can be used concurrently with smoking and that it is currently marketed by the tobacco industry for circumstances where smoking is banned. Others consider that it is less harmful than smoking and can help avoid initiation of smoking, that it is a useful step towards complete cessation of all tobacco use⁴⁶ and that it is a potentially valuable substitute for smoking for inveterate smokers who are unable or unwilling to quit tobacco. This controversy thus remains unresolved.

POTENTIALLY REDUCED EXPOSURE PRODUCTS (PREPS) FOR INHALATION

Products

New tobacco products are regularly launched by the tobacco industry to retain those smokers who are concerned about the health risks of the regular cigarette.

Light, extralight and ultralight cigarettes

The so-called light, extralight and ultralight cigarettes are actually a catch, as their reduced tar and nicotine yields are generally obtained by smoke dilution through the filter holes during measurements with the smoking machine, while the weight of the tobacco components in the unburned cigarette remains virtually unchanged.

Tobacco heating devices

Heating devices are designed to avoid tobacco combustion, with a reduced production of various toxins and carcinogens, and a theoretical harm reduction as well for both active and passive smokers (see health effects and discussion below). The inhaled nicotine content nevertheless provides the smoker with some satisfaction and there is a consequent potential for dependence.

Some tobacco heating devices are currently available, at least in the US. Accord, an engineering smoking device developed by Philip Morris, is intended to heat and not burn tobacco. It is battery powered and activated by a microchip that senses when the smoker is puffing, resulting in a controlled timed heating.

Manufactured by R J Reynolds, Eclipse is a cigarette that also heats rather than burns tobacco (Figure 2). The peripheral carbon tip, wrapped in a heat-insulated tube has to be lit; when puffed, the incoming air heats a mixture of glycerine and tobacco present in the vaporisation chamber, and the vapour produced passes through the cooling chamber that contains the tobacco and through the filter. The smoker inhales a smoke-like vapour.

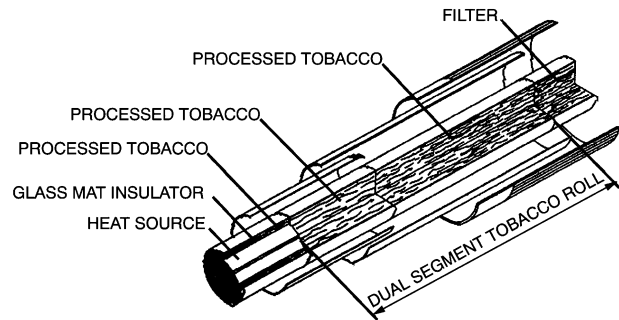


Figure 2 R J Reynolds' Eclipse nicotine delivery system. Reproduced from Fagerström et al.⁵⁷ with the kind permission of the BMJ publishing group.

Modified tobacco cigarettes

'Advance light' is manufactured by Brown and Williamson using an improved tobacco curing process that reduces the TSNA yield, but maintains a large nicotine increase after puffing.⁵⁸ The plasma nicotine concentration increases more with Advance than with the smoker's usual brand of cigarettes.⁵⁹

Manufactured by Vector, Quest cigarettes contain genetically modified tobacco which, according to the manufacturer, gives a greater control over nicotine delivery, with three levels of yields: Level 1 has 17% less nicotine than an average light cigarette, Level 2 has 58% less and Level 3 is virtually nicotine free.⁵⁸ Smokers are advised to use the three types of Quest cigarettes successively.

Epidemiology

Light and ultralight cigarettes constitute a significant proportion of the global cigarette market particularly for young smokers and women.

Several PREPs, such as Premier®, an engineered smoking device from R J Reynolds, Next®, a Philip Morris cigarette, Omni®, a Vector cigarette and Advance®, a Brown and Williamson cigarette, have been removed from the market, presumably because of low sales due to dissatisfied smokers.⁶⁰ Others remain on the market, generally in areas for marketing trials.

Health effects

No significant health benefit is currently observed when using 'light', 'extralight' or 'ultralight' cigarettes rather than regular cigarettes. The addicted smoker in need of a nicotine dose compensates by taking more and deeper puffs, obstructing the filter holes with the lips or fingers or smoking the cigarette down to the filter rod. The toxin intake is thus not significantly reduced, and the health risks remain similar.⁶¹⁻⁶⁴

Limited data are available concerning tobacco heating devices. Unlike other cigarettes, there is no increase in CO concentration and a slower pulse when four Accord cigarettes are smoked in succession.⁶⁵ There is, unfortunately, no decrease in withdrawal symptoms,

which usually provokes more intense smoking.⁶⁶ With Eclipse, no ash and no tobacco smoke are produced. The majority of smokers (57%) believe that 60–100% of the health risks are eliminated with Eclipse, but Eclipse produces 30% more CO than a light or ultralight brand. As the nicotine level is 13.3 ng/ml instead of 18.9 ng/ml with the light or ultralight brand, they are more toxic and give less satisfaction.⁶⁶ In smokers who are not interested in quitting, Eclipse causes an increased concentration of CO without influencing the nicotine level when used concomitantly with the smoker's usual brand of cigarettes, while with the pharmaceutical nicotine inhaler, both CO and nicotine concentrations decrease.^{57,67}

With modified tobacco cigarettes such as Advance light, there is a large increase in plasma nicotine after puffing⁵⁸ that is even greater than with the smoker's usual brand of cigarettes. So far, no independent studies have been conducted for the Quest cigarette.

DISCUSSION

Issues about alternative forms of tobacco use are different for the industrialised and developing worlds. In Western countries, use remains relatively limited (*narghile*, *bidis* and *kreteks* are used by >15% of US adolescent smokers),⁴⁴ but it could increase in the future under pressure from the tobacco industry.

Unlike cigarettes, scientific knowledge about alternative tobacco forms remains limited, and in most cases there is a lack of regulation. Research needs include prevalence and trends in use in various types of population group, and quantification of the various toxins and carcinogens produced. Given that the level of reduced intake corresponding to reduced harm is still unknown, studies to determine dependence potential and quantification of the toxin intake by specific biomarkers⁶⁸ are also needed.

Long-term studies of cohorts with constant and exclusive use of one or other type of tobacco products compared with cigarette smoking or non-smoking could produce results only after several years. The changing nature of the diverse forms of tobacco use with time and between countries, and the variations in type of consumption, are other barriers to valuable long-term epidemiological evaluations of health risks.

Short-term proxies for specific tobacco-related diseases (cancers, pulmonary diseases, cardiovascular diseases) could provide a more rapid evaluation of the relative risks of alternative forms of tobacco use.⁶⁸ Birth weight, foetal lung and heart function, neurotoxicity in infants born to mothers who smoke PREPs during pregnancy can also provide a more rapid answer to the effective harm reduction that may be attributable to PREPs.⁶⁸

The scientific basis of tobacco product regulation⁶⁹ remains limited, especially for alternative forms of tobacco: content disclosure should in all cases be manda-

tory for new products, and unfounded claims of harm reduction should be banned. There is a great need for regulation for most types of currently permitted smokeless tobacco.

Smus is currently banned in the European Union (except in Sweden) and in Australia.⁷⁰ Before considering the liberalisation of *smus* sales in the EU, strict control measures in its manufacture and contents should be implemented to avoid any change in the content and the production process, and advertising should be banned to limit recruitment of new users. The more harmful other types of smoke-free tobacco should also be regulated.

Before considering the use of *smus* as a substitute to smoking in inveterate smokers, less harmful nicotine delivery systems containing lower levels of the carcinogenic TSNA (such as medicinal nicotine)^{49,50,68,71,72} and the currently unregulated nicotine water (Nicowater) nicotine suckers and nicotine straws⁷³ should perhaps be proposed. Their cost is unfortunately higher and their palatability lower than those of *smus*, and long-term studies of continuous nicotine use are still lacking. Furthermore, nicotine gum addiction can develop in a small number of never smokers.⁷⁴ Henceforth, preventive measures similar to those applied for regular cigarettes, such as advertising bans, sales limitations, higher taxes and health advertisements, and for those producing smoke, such as bans in public places, should be taken to avoid further spread of the use of all alternative forms of tobacco.¹⁹

In developing countries, the extent of the problem is still greater due to traditional use, lack of awareness in the population, traditional production and low purchase prices (e.g., 0.3 US cents per *bidi* in India vs. 2–3 US cents per cigarette; and between US\$0.63 and 0.94 per packet of 20 *kreteks* in Indonesia, cheaper than any commonly available large sized sandwich). The large economic and political influence of the tobacco workers unions and of the tobacco industry is also a major barrier to regulation. Education of the population about the effective dangers of currently common tobacco uses is essential, and higher taxation should deter initiation among youth.

CONCLUSIONS

- 1 There is no such thing as a safe tobacco product.
- 2 *Narghile*, *bidis*, *kreteks* are all linked to a health risk that is at least equal to, if not higher than that of cigarettes.
- 3 The health risk potential of smokeless tobacco is significant in most available forms. It is lower in the case of the *smus* manufactured using the Godiatek Standard.
- 4 The health risks of the other PREPs need further evaluation.
- 5 For inveterate smokers who are unable or unwilling to quit nicotine, long-term use of pure nicotine

formulations may be a better method of coping with nicotine dependence than *snus* or PREPs.

- 6 As the use of the various alternative tobacco products is unequally and widely dispersed over the world in very different regional contexts, locally adapted regulation measures are needed within the WHO Framework Convention for Tobacco Control.

Acknowledgements

J Prignot was responsible for the structure of the article and the sections on smokeless tobacco and other PREPs. A J Sasco and E Poulet were responsible for the sections on *narghile* and for editing the paper with contributions from P C Gupta on *bidis* and from T Y Aditama for *kretek*. The authors thank the anonymous reviewers for their constructive criticisms and suggestions on the original manuscript.

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RÉSUMÉ

CONTEXTE : Une revue de la littérature scientifique disponible concernant les formes d'utilisation du tabac autres que les cigarettes classiques, les cigares et la pipe :

nature des produits, données et tendances de prévalence, effets-santé, problèmes de réglementation et mesures préventives.

RÉSULTATS : *Le narghile* (water pipe), les *bidis*, les *kreteks*, et les formes orales de tabac sont utilisées traditionnellement dans beaucoup de pays du Sud et certaines de ces formes s'étendent actuellement vers les pays occidentaux. Ils comportent tous des effets défavorables similaires et parfois plus importants que ceux de la consommation de cigarettes classiques. L'industrie du tabac a élaboré récemment divers produits à exposition potentiellement réduite (PREPs), notamment le *snus* destiné aux fumeurs conscients des risques-santé des cigarettes normales. Leur potentiel pathogène varie largement, n'est connu qu'incomplètement et de toutes façons est plus important que celui des formes de nicotine pure (comme la nicotine mé-

dicamenteuse) et leur utilisation comme substitut à la consommation de cigarettes ne devrait pas être recommandée même chez les fumeurs invétérés incapables ou non-désireux d'arrêter la nicotine avant que n'existent une évaluation et un contrôle indépendants.

CONCLUSIONS : Il n'existe aucun produit de tabac dépourvu de risque. Les formes alternatives d'utilisation du tabac nécessitent, autant que les cigarettes, des mesures de réglementation adaptées aux situations locales et complétées par des mesures préventives, le tout au sein de la Convention Cadre de Lutte contre le Tabagisme de l'Organisation Mondiale de la Santé.

RESUMEN

MARCO DE REFERENCIA : Reseña bibliográfica de los artículos científicos relativos al consumo de tabaco diferente de los cigarrillos, los puros y las pipas corrientes : tipo de productos, datos de prevalencia, efectos sobre la salud, aspectos normativos y medidas preventivas.

RESULTADOS : El *narguile* (pipa de agua), los cigarrillos de tipo *bidi* y *kretek* y las formas orales de tabaco para mascar se utilizan tradicionalmente en muchos países del sur y algunos de ellos se están difundiendo hacia los países occidentales. Todas estas formas comparten con el cigarrillo convencional los efectos negativos en una proporción con frecuencia mayor o equivalente. Recientemente, la industria tabacalera concibió varios productos con una posible reducción del grado de exposición, entre ellos los *snus*, dirigidos a los fumadores conocedores de los ries-

gos sanitarios de los cigarrillos convencionales. Su potencial patogénico varía ampliamente, se conoce mal y es de todas maneras superior a las formas puras de nicotina (nicotina como especialidad farmacéutica) ; no se debe considerar su uso como sustituto al cigarrillo, ni aun en fumadores inveterados incapaces o sin intenciones de abandonar la nicotina, mientras no se realicen nuevas evaluaciones y controles independientes.

CONCLUSIÓN : No existe ningún producto del tabaco que se pueda denominar producto seguro. Las formas no convencionales de consumo precisan, como los cigarrillos, medidas normativas adaptadas a las situaciones locales y complementadas con medidas preventivas dentro del Convenio para el Control del Tabaco de la Organización Mundial de la Salud.