GENERAL ARTICLE

Bidis and smokeless tobacco

Cecily S. Ray and Prakash C. Gupta*

Bidis and smokeless tobacco are the cheapest, least taxed and most commonly used tobacco products in India. They are highly addictive and high in carcinogens. They cause a broad spectrum of diseases; yet awareness about their ill-effects is low. Smokeless tobacco products containing arecanut, e.g. gutka and mawa, are especially addictive and carcinogenic. The high incidences of oral and lung cancers in India are mainly due to bidis and smokeless tobacco. Bidis bear no health warnings, and smokeless products, only warnings in English in small print. The public favours tobacco control policies and the Government tries to impose them, but the industry delays such implementation. This article highlights the widespread use of bidis and smokeless tobacco in India, reviews their harmful effects, documents public support for tobacco control policies, and provides scientific evidence for the implementation of these policies.

Keywords: Bidi, disease consequences, gutka, tobacco use, youth.

Use of bidis and smokeless tobacco in India

Whereas in most countries cigarettes are the main form of tobacco used, in India only less than one-fifth (19%) of tobacco consumed (by weight) is in the form of cigarettes[1]. The prevalence of cigarette smoking is also low: an analysis of the National Sample Survey 55th Round (1999–2000) showed that less than one-tenth of urban and less than 4% of rural households consume cigarettes (Table 1)[2].

On the other hand, over half of all tobacco consumed in India is smoked as bidis (54%) and about one-fourth of tobacco consumption is in smokeless form (nearly 27%)[1]. In the country as a whole, 7–8 times more bidis are sold than cigarettes[3]. The National Sample Survey of 1999–2000 showed[2] that:

(i) Bidis are smoked by at least one member of each household in:
- Over one-third of households in rural areas.
- One-fifth of households in urban areas.

(ii) Smokeless tobacco is used by at least one member of each household in:
- Almost one-third of households in rural areas.
- Almost one-sixth of households in urban areas.

It had been estimated in India that over a 100 million people smoke bidis, about 25 million smoke cigarettes, and the number of smokeless tobacco users is fairly close to the total number of smokers[1,4].

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In the whole of India, one-third (33.3%) of the men and 1.6% of women aged 15–49 yrs smoke, while smokeless tobacco use is found among more than one-third (38.1%) of the men and around one-tenth (9.9% of the women), according to the third round of the National Family Health Survey (NFHS-3), conducted in 2005–06 (Figure 1)[5].

In the NFHS-2 (1998–99), the states with the highest prevalence of smokeless tobacco use among women of reproductive age were Orissa (34.9%), the North East States (16.5–60.7%), Maharashtra (18.5%), Karnataka (14.9%) and Madhya Pradesh (14.8%), while the national prevalence for women[6] was 12.4%.

The question on smokeless tobacco in the NFHS-3 questionnaire also asked about the use of pan masala, an arecanut product, some brands of which contain tobacco. Pan masala is not supposed to contain tobacco, but is generally sold with the same brand names and nearly identical packaging as its counterpart containing tobacco (labelled as gutka or mawa). The advertisement of these plain pan masalas on television is surrogate advertising for gutka, since the packaging looks the same and the cost of these advertisements is much higher than that of the sales of plain pan masala (nearly four times the sales value). The sales of gutka (over Rs 160 crores for one company in 2003–04) well exceed the cost of the advertisements (over 6½ times[7]).

In a large survey in Uttar Pradesh, 10.6% of urban and 7.9% of rural males (≥10 years) reported using gutka or pan masala (80% of users <40 years), but fewer than 4% of these used pan masala without tobacco[7].

Table 1. Proportion of households consuming tobacco products in India

Tobacco product	Rural (%)	Urban (%)
Bidis	36.5	19.8
Smokeless tobacco (tobacco leaf, snuff, chewing tobacco, others)	30.7	15.0
Cigarettes	3.7	9.6
Other smoking tobacco (hookah tobacco, cheroot)	3.6	1.0
None	37.4	60.3

Extracted from John[2] (computed from the National Sample Survey (NSS-55th), 1999–2000).

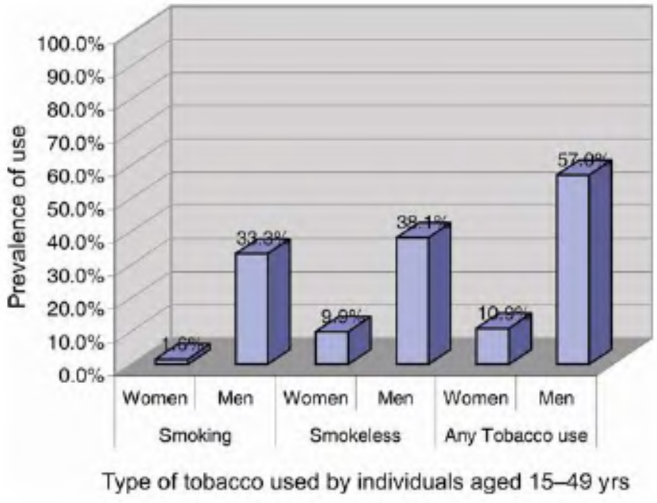

Figure 1. Prevalence of tobacco use in India, National Family Health Survey-3 (2005–06)[5].

While gutka continues to gain in popularity, unprocessed tobacco leaf is actually the most widely used form of smokeless tobacco. As many as 19.4% of rural and 7.4% of urban households consume leaf tobacco[2].

Adolescent tobacco use

Recent surveys on the prevalence of tobacco use among adolescent students in India have measured bidi smoking and smokeless tobacco use. These included a cross-sectional study of sixth and eighth grade students in Delhi and Chennai[8]. Two rounds of the nationwide Global Youth Tobacco Survey (GYTS) on students in grades 8–10 were conducted in India during 2003 and 2006 respectively[9,10].

According to the GYTS of 2006, 7.2% (95% Confidence Interval (CI): 6.0–8.6) students in grades 8–10 smoked tobacco in some form. Among these, 3.5% had smoked bidis on one or more days in the past 30 days[10]. Box 1 provides additional facts about adolescent bidi smoking.

In the GYTS of 2006, current smokeless tobacco use (8.1%) was not significantly different from overall smoking (7.2%)[10]. Additional facts about smokeless tobacco use by adolescents in India[8,10,11] are given in Box 2. The higher prevalence of smokeless tobacco use reported in the round conducted in 2000–04 was higher, 14.6% (13.1–16.1). It may be pointed out that in the earlier survey two states with low prevalence of smokeless tobacco use (Kerala and Kashmir) were excluded[6,12].

It is important to remember that tobacco use tends to start early and is higher among non-student youth, such as child labourers and street children. Since GYTS is restricted to school-going children, such children are excluded by design. These children are difficult to reach even with household-based surveys.

Increasing tobacco use among youth due to advertising

Even before the Cigarettes and Other Tobacco Products (Prohibition of advertisement, and regulation of trade and commerce, production, supply and distribution) Act, 2003 (COTPA)[13] was notified in February 2004, surveys of adolescent students in Mumbai (Maharashtra) and Anand (Gujarat) indicated that surrogate advertising on television for gutka with pan-masala brands was a major source of information for them. It was found that noticing advertising was associated with increased gutka use[14]. In Punjab, two-thirds of 100 adolescent school children studying in the grades 6–10 in five villages reported using gutka regularly, and one-third said they had been introduced to the product through advertisements (on television, in magazines and painted on buses)[15].

After 1 May 2004, when the ban on tobacco advertising in all media went into force, direct advertising on billboards was replaced by colourful point-of-sale advertisements using brand names and logos, mostly for cigarettes, but also for some smokeless tobacco products. Indirect advertising also became important, with pan masala advertising replacing gutka advertisements everywhere[16]. The packaging and branding of pan masala continued to be mostly identical to those of gutka or mawa, then as now. Colourful strips of both these products hang like banners at the points of sale. As in the case of direct gutka advertising influencing youth earlier, it is likely that the point of sale displays as well as indirect advertising in the media continue to influence them.

Children in grade 6 may be using tobacco at higher rates than those in grade 8, according to a bi-centric study in Delhi and Chennai conducted in the summer of 2004. Ever use of tobacco was 24.8% among sixth graders (compared to 9.3% among eighth graders). Ever chewing was 19.0 and 6.8% among sixth and eighth graders

Box 1. Bidi smoking among students in India[8–10]

Among students, bidi smoking typically begins in the mid to late teenage years.

1. Current bidi smoking prevalence in a survey of 11,642 students from grades 6 to 8 in 32 schools from Delhi and Chennai:
   - 2.0 and 0.9% respectively, currently smoked bidis (cigarette smoking was similar)[8].
2. Current bidi-smoking prevalence among Indian youth in grades 8–10 in the GYTS (Conducted by the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC))[9,10]:
   - 2.3% (2.1–2.6) (95% Confidence Interval (CI)) of students in 26 states (excluding Chhattisgarh, Kashmir and Kerala) in 2000–04 (N = 62,399)[9].
   - 3.5% (2.7–4.6) of students in 2006 in 30 states (N = 12,086)[10].
   - 22% (± 7.3) in Manipur boys: highest all-India prevalence for boys[9].
   - 10.6% (± 10.2) (95% CI) in Chandigarh: highest all-India prevalence for girls[9].
   - Higher in the northeastern region of India[9,10].
   - Nearly four times higher among boys (5.1%) than girls (1.3%) nationwide[10].
3. Other facts on bidi smoking[9]:
   - More than two-thirds (69.2% ± 6.3) of current bidi smokers in grades 8–10 wanted to quit smoking, nationwide.
   - More than half (57.4% ± 7.8) of the young bidi smokers were not refused purchase because of their age.
   - Factors associated with current bidi smoking included: parental tobacco use ($P < 0.001$) and lack of curricular teaching on the dangers of smoking ($P < 0.001$).

respectively. Prevalence of ever smoking bidis was 11.9% among sixth graders and 3.4% among eighth graders. Students in grade 6 scored lower on all the 15 psycho-social predictor variables measured ($P < 0.01$), including beliefs about health effects, social effects and normative beliefs, indicating they were at increased risk. In this study, exposure to tobacco advertising was related to increased tobacco use among students in the sixth grade, but not among the eighth graders. The report offered a possible explanation, based on the lack of awareness among the sixth graders: '... it may be that the 6th graders were more receptive to the messages contained in recent tobacco advertising campaigns, and thus more susceptible to experimentation and regular use as a by-product of exposure and their "risk profile" '[17].

A higher prevalence of ever or current tobacco use in the younger group compared to the older group was an indicator of increasing prevalence in the adolescent population, since early use predicts greater likelihood of addiction and lifetime use[8].

Toxic constituents

Although nicotine is the main constituent of tobacco responsible for addiction, the user also gets exposed to all the toxic and carcinogenic chemicals contained in smokeless tobacco and tobacco smoke.

Like an opiate that targets the reward pathway in the brain, nicotine also produces feelings of pleasure and well-being. Nicotine stimulates secretion from the adrenaline glands, causing a sudden increase in blood sugar, blood pressure, heart rate and respiration. These rewarding and stimulating effects, coupled with the unpleasant withdrawal syndrome contribute to tobacco dependence[18].

Nicotine content

Indian smokeless tobacco products (khaini, zarda and unmanufactured tobacco) tend to contain more nicotine (13.8–65.0 mg/g)[19] than American smokeless tobacco (chewing tobacco, dry snuff and moist snuff, 3.4–39.7 mg/g)[20]. Various gutkas contain about 1.2–11.4 mg/g tobacco[19].

Bidi tobacco (sun-cured) has twice as much nicotine (about 37.7 mg/g) as tobacco used in western-style cigarettes (flue-cured Virginia (FCV) or Burley; about 16.5 mg/g)[21].

Nicotine delivery

Smokeless tobacco use delivers as much or more nicotine to the body as does cigarette smoking. Most smokeless tobacco products in India contain alkalinizing agents like calcium hydroxide. These can irritate the mucosa of the mouth and esophagus and more importantly, promote nicotine absorption by the oral mucosa into the bloodstream, since their pH raising action dramatically increases the proportion of unprotonated nicotine, the most easily absorbed form[20].

Bidi smoking delivers more nicotine to the user per gram of tobacco than do cigarettes, despite containing much less tobacco per stick (one-fifth to two-thirds the amount found in one conventional cigarette) – this is due

Box 2. Smokeless tobacco use among students in India[8,10,11]

Among students, smokeless tobacco use typically begins in the mid to late teens.

1. A study of 11,642 students from grades 6 to 8 in 32 schools of Delhi and Chennai:
   - 4.5 and 1.6% respectively, were currently using chewing tobacco[8].
2. Prevalence of smokeless tobacco use among Indian youth in grades 8–10 according to GYTS (2000–04; Conducted by WHO and CDC)[10,11]:
   - 14.6% (13.1–16.1) (95% CI) of students in 2000–04 in 26 states (excluding Kashmir and Kerala)[11].
   - 8.1% (6.5–10.0) of students in 2006 (conducted in 30 states)[10].
   - Ranged from 2% in Himachal Pradesh to 55.6% in Bihar[11] in 2000–04.
3. Prevalence of smokeless tobacco use regionwise in the GYTS of 2006 (N = 12,086)[10]:
   - Equally prevalent among boys and girls in two regions:
     Eastern region: 17.5% (14.3–21.2) boys; 16.4% (12.3–21.5) girls.
     Northeastern region: 20.0% (14.9–26.4) boys; 21.5% (11.0–37.8) girls.

both to the type of tobacco used and to the non-porous leaf wrapper, that does not permit much air dilution of the smoke during puffing[21].

Bidi smoking generates similar or slightly higher nicotine levels in the blood compared to conventional cigarette smoking[22].

Carcinogens

Smokeless tobacco is known to contain over 20 known and potential carcinogens (Box 3)[20].

Bidi smoke has been found to contain many of the same chemicals found in cigarette smoke[21] which contains 69 carcinogens[23].

Tobacco-specific nitrosamines

Tobacco-specific nitrosamines (TSNAs) are the major and most abundant group of carcinogens in tobacco. Two of the most common TSNAs are NNK (4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone) and NNN (N′-nitrosonornicotine). Derived from nicotine and other alkaloids present in tobacco, TSNAs are present in small amounts in fresh green tobacco leaves. The major part of TSNAs is formed in tobacco products during processing, curing and fermentation. TSNAs may also form in the mouth of smokeless tobacco users through the enzymatic action of saliva on tobacco constituents[20]. TSNAs also arise during smoking[24].

Indian brands of smokeless tobacco (mainly khaini, zarda and unprocessed tobacco) tend to contain higher amounts of TSNAs than those marketed in Europe or North America. For example, in 11 Indian products[24], NNN concentration ranged from 1.74 to 76.9 μg/g and NNK from 0.08 to 28.4 μg/g. Testing of tuibur (hidakphu), water through which tobacco smoke has been passed and is used for gargling or sipping primarily by women[20], has yielded around 20 μg/g NNN.

Box 3. Some harmful constituents of smokeless tobacco and associated risks[19,20]

Toxic compounds	Harm caused
Nicotine	Addiction, atherogenesis, raised blood pressure
Tobacco-specific nitrosamines (e.g. NNN, NNK)	Cancer
Poly-aromatic hydrocarbons (e.g. benzo[α]pyrene)	Cancer
Volatile aldehydes	Cancer
Volatile N-nitrosamines	Cancer
N-nitrosamino acids	Cancer
Inorganic compounds (e.g. cadmium, lead, nickel, arsenic)	Cancer
Radioelements (e.g. Polonium-210)	Cancer

Mainstream bidi smoke (MS) contains higher concentrations of TSNAs than flue-cured Virginia-style cigarettes and about the same as those in the MS of conventional cigarettes made in India[25]. TSNAs are found in the particulate portion of bidi smoke, also called 'tar', the thick, sticky residue of tobacco smoke along with thousands of other chemicals[23]. Bidi smoke delivers more 'tar' than conventional cigarettes[21].

Other harmful constituents

Tobacco leaves tend to have high levels of toxic inorganic compounds, including heavy metals like arsenic,

cadmium and lead. Smokeless tobacco products made in India have been found to contain these substances. Traces of poly-aromatic hydrocarbons (PAHs) such as benzo(α)-pyrene occur in some smokeless tobacco products in appreciable amounts (≥ 0.5 μ/g)[20].

Box 3 lists the harmful constituents in smokeless tobacco and the harm they are associated with. Bidis deliver, when machine smoked at two puffs per minute, at least 1.6 times higher concentration of several toxic compounds than unfiltered American cigarettes, including carbon monoxide, ammonia, hydrogen cyanide, phenol, o-cresol, m- and p-cresol, 2,4-dimethylphenol and benzo[a]pyrene[21].

Box 4 lists some of the well-known harmful constituents in tobacco smoke.

Arecanut and its constituents

Arecanut is an ingredient of some popular smokeless tobacco products in India, including gutka and mawa. Arecanut is the chief ingredient of pan (betel quid), a roll of betel leaves, arecanut, slaked lime (aqueous CaOH) and catechu, to which tobacco is commonly added. From pan, the concept of pan masala was derived, which contains the same ingredients except for the betel leaves. Arecanut contains arecoline, the major arecanut-specific alkaloid. Arecoline mimics acetylcholine and binds to muscarinic receptors[26].

Arecanut as an ingredient in tobacco products confers taste as well as harmful constituents. Arecoline and arecanut-specific polyphenols lead to collagen damage in the oral mucosa, probably underlying the development of the painful and precancerous condition of oral submucous fibrosis (OSF), in which the chewer has difficulty opening the mouth.

Box 4. Harmful constituents of bidi smoke and associated risks[21,23]

Toxic compounds	Harm caused
Nicotine	Addiction, atherogenesis, raised blood pressure
Carbon monoxide	Inhibits oxygen exchange, stresses the heart
Ammonia	Irritation to the respiratory tract
Hydrogen cyanide	Toxic to cilia: inhibits lung clearance
Phenol	Tumour promoter
Nitrogen oxides	Inflammation of the lung
Benz[α]anthracene	Cancer
Benzo[α]pyrene	Cancer
Tobacco-specific nitrosamines	Cancer
Acrolein	Toxic to cilia: inhibits lung clearance
Acetaldehyde	DNA damage
Isoprene	DNA damage

Prevalence studies of OSF show that their incidence is increasing dramatically at ages below 35 years in males and females, and this is a harbinger of an increase in oral cancer. The increase in OSF has been linked to use of gutka, mawa and pan masala (Figure 2).

Arecanut products can also contain arecanut-derived nitrosamines that form in the saliva during chewing, especially in the presence of nitrates[24]. Although evidence for carcinogenicity of arecanut-derived nitrosamines is still limited, the International Agency for Research on Cancer has stated that there is now sufficient evidence for the carcinogenicity of arecanut use in humans[27].

Health-related consequences of smokeless tobacco

It has been recognized internationally that smokeless tobacco use is associated with early death, cancer and adverse reproductive outcomes[28]. Epidemiological research carried out in India has also found similar results. Higher risk of cardiovascular disease due to smokeless tobacco use is under investigation and some recent research results show an association.

Smokeless tobacco users have slightly higher risks of early death than nonusers

In the Mumbai cohort study, where 97,244 residents aged ≥ 35 years were followed up for about five years, a slightly elevated risk of premature death was found for both men (relative risk (RR) = 1.16 (95% CI: 1.06–1.26)) and women (RR = 1.25 (95% CI: 1.15–1.35)), who used smokeless tobacco. Among smokeless tobacco users, women users of mishri only (a popular product in Maharashtra) also had elevated relative risks of premature death: RR = 1.2 (95% CI: 1.10–1.34)[29].

Smokeless tobacco users have higher risks of oral and pharyngeal cancers

India has some of the world's highest incidence rates of oral and pharyngeal cancers. For example, the estimated

Figure 2. Child patients of oral submucous fibrosis caused by gutka chewing. (Source: Dr Pankaj Chaturvedi, Tata Memorial Hospital, Mumbai.)

age standardized (world) rate (ASR)[30] for 2002 for males in the entire country was 12.8 per 100,000 and for females 7.5 per 100,000. These cancers are highly related to tobacco use.

Numerous case-control studies carried out in India have shown high odds ratios for smokeless tobacco use and oral and pharyngeal cancers, and a trend of increasing risk with increasing frequency of use per day[31].

For example, chewers of pan with tobacco were six times more likely than nonusers (OR = 6.1 (95% CI: 3.3–11.4)) to have cancer of the tongue or floor of mouth, in a case-control study in Thiruvananthapuram[32].

Smokeless tobacco with arecanut can cause esophageal cancer

Several case-control studies show that the risk of esophageal cancer increased several fold in chewers of pan with tobacco[27,31].

Smokeless tobacco use in pregnancy can lead to adverse outcomes

Many women in India use smokeless tobacco even during pregnancy, and lack awareness about the adverse effects[33]. A recent cohort study of 1217 pregnant women in Mumbai found that smokeless tobacco users (17.1% prevalence during pregnancy; 80% mishri users) had a 50% higher risk of giving birth to a low-birth-weight baby if they used smokeless tobacco five times a day and over 100% higher if they used it ten times per day, a risk ratio of 2.1 (95% CI: 1.1–4.0)[34]. Users ($N = 16$) also had an elevated risk ratio for stillbirth of 2.6 (95% CI: 1.4–4.8), after adjustment for confounding variables. A dose response relationship was found for frequency of mishri use per day, the most common type of smokeless tobacco use. Stratifying by type of smokeless tobacco used, gutka users ($N = 3$) had a higher risk for stillbirth than mishri users[35].

Smokeless tobacco users may have higher risks of cardiovascular disease

Emerging evidence points to smokeless tobacco as a cause of cardiovascular diseas[36]. Even a small increase in risk could have a large public health impact in countries where smokeless tobacco use is widespread[20]. In a large cohort of never-smoking men in Sweden ($N = 118{,}465$ men) followed up from 1978 to 2003, an increased risk for fatal ischaemic stroke was associated with current snuff use, with RR = 1.7 (95% CI: 1.1–2.8)[37].

Recently in Rajasthan, prevalence of cardiovascular risk factors was found to be similar among 200 tobacco chewers and 200 smokers (except for obesity), in a population-based case-control study also comprising 200 age and gender-matched controls with no history of tobacco use. Tobacco chewers had a significantly higher ($P < 0.001$) systolic and diastolic blood pressure, resting heart rate, total cholesterol, LDL cholesterol and triglycerides compared to the controls and these values were similar to the smoker group. There was also a significantly greater ($P < 0.01$) prevalence of hypertension, positive stress test and other risk factors in the tobacco chewer group compared to the control group[38].

Health-related consequences of bidi smoking

Cigarette smoking has been widely studied in many countries and is known to cause higher early mortality, ischaemic heart disease, stroke, chronic obstructive pulmonary disease, lung cancer and numerous other cancers[39]. A cigarette is generally defined as a smoking device in which tobacco is wrapped in a non-tobacco material. The bidi is a burning device containing tobacco, but with a non-tobacco wrapper. Hence, by definition, bidi smoking is a type of cigarette. Epidemiological studies in India have confirmed that bidi smoking carries similar types of health risks as cigarette smoking. Major results of such studies are described below.

Bidi smoking is associated with early death

Several studies carried out in different parts of India have demonstrated a risk of early deaths, at least 50% higher in bidi smokers than in never-smokers[40].

For example, a recent nationwide population-based case-control study in 1.1 million homes, has estimated that each year about 930,000 adult deaths in the country are due to smoking. Also, in the age group 30–69 years, one in five male deaths and one in 20 female deaths in ages are due to smoking. Most male smokers in the study smoked only bidis and a dose response relationship was found for death with the number of bidis smoked per day. Even among men who smoked the fewest bidis – from one to seven (mean 4) per day – the smoking associated excess deaths accounted for a quarter of all deaths[41].

Another example is the Mumbai cohort study. The relative risk of death in the case of men who smoked bidis was found to be at least 60% higher than for non-smokers (RR = 1.6; 95% CI: 1.5–1.8), with increasing risk for higher number of bidis smoked per day (RR for 1–5 bidis = 1.42; 95% CI: 1.20–1.68, going up to RR for ≥ 16 bidis = 1.78; 95% CI: 1.57–2.02)[29].

Bidi smoking is associated with cardiovascular disease, at least tripling the risks

A causal relationship has been established between smoking and coronary heart disease, cerebro-vascular disease

(stroke) and abdominal aortic aneurysm[38]. Tobacco smoke adversely affects the heart and the circulatory system in several ways through nicotine, carbon monoxide and free radicals: by increasing heart rate and blood pressure, reducing oxygen supply (hypoxia) to the heart and clogging of the arteries due to altered blood lipids and enhanced platelet aggregation (blood clotting)[42]. Arterial stiffening also occurs due to tissue oxidation by free radicals[43]. Epidemiological studies have confirmed the association of bidi smoking with cardiovascular disease (CVD).

For example, in a case-control study in Bangalore, with 300 cases with first heart attack and 300 age-matched controls, smoking ten or more bidis or cigarettes imparted a four-fold higher risk of acute MI compared to not smoking. The odds ratio of acute MI for smoking ≥ 10 bidis per day was 4.36 ($P < 0.0001$) and somewhat higher than that for smoking the same number of cigarettes (OR = 3.58; ($P < 0.0001$)). Bidi smoking was thus found to be an independent risk factor for heart attack, at least as important as cigarette smoking[44].

Thromboangitis obliterans is another disease found among smokers. It mainly affects the legs, leading to poor mobility and sometimes gangrene and the need for amputation. It is a disease that typically develops in bidi smokers who start smoking in childhood[42].

In the Mumbai cohort study, the RR for deaths from CVD (ICD10 codes – I61-64,66,67) among smokers was 1.54 (95% CI: 1.09–2.19)[29].

Bidi smoking is associated with tuberculosis

Prevalence of tuberculosis (TB) is about three times greater among ever-smokers compared to never-smokers, and mortality from TB is about four times greater. This has been reported from epidemiological studies in rural and urban Tamil Nadu and urban Maharashtra (Mumbai cohort study). Furthermore, bidi smoking was found to confer higher RR than cigarette smoking in causing deaths due to TB[45].

In the Mumbai cohort study, men who smoked had more than twice the risk of death due to TB[29]. Among bidi smokers, the adjusted relative risk was 2.6 (95% CI: 2.0–3.3). The risk of self-reported TB among bidi smokers was five times higher than never-smokers. It was estimated from the results of this study that in India nearly one-third of TB deaths (32%) could be attributed to bidi smoking[46].

Bidi smoking increases the risk of chronic obstructive pulmonary disease

In a large study of 35,295 adults aged 35 years and above in India[47], bidi smokers had a nearly threefold higher risk of chronic obstructive pulmonary disease (COPD) (OR = 2.7 (95% CI: 2.3–3.1)) compared to non-smokers. This was found in a multicentric cross-sectional study in both urban and rural areas of Bangalore, Chandigarh, Delhi and Kanpur. Cigarette smokers had a twofold higher risk of COPD (OR = 2.0 (95% CI: 1.6–2.4)). Prevalence[48] among bidi smokers was 8.2% and among cigarette smokers 5.9%.

In the Mumbai cohort study, the RR for respiratory diseases (ICD 10 codes J00–J99) among smokers was 2.12 (95% CI: 1.57–2.87)[29].

Lung cancer is another major risk faced by bidi smokers

Few studies have reported results on lung cancer risk for bidi smokers[49]. In one case-control study of 235 male lung cancer patients in Chandigarh, bidi smoking carried a nearly sixfold higher risk of lung cancer (RR = 5.8; 95% CI: 3.4–9.7)[50].

In a cohort of 65,829 men aged 30–84 years followed up for eight years with 212 newly diagnosed lung cancers in Karunagapally, Kerala, current bidi smokers had more than a fourfold relative risk for lung cancer compared to never-smokers (RR = 4.6 (95% CI: 2.5–8.5; $P < 0.001$))[51].

Oral and pharyngeal cancers are strongly associated with bidi smoking

Bidi smoking is causally related to oral cancer in India[52]. A review of six case-control studies on oral cancer showed that bidi smokers had at least a twofold higher risk of oral cancer than non-smokers[49].

Smokers had nearly 20 times higher risk of death due to oral and pharyngeal cancers than non-smokers in the Mumbai cohort study (RR = 19.7 (2.7–146.1)). About equal numbers smoked bidis as cigarettes[29].

Several other cancers are also associated with bidi smoking

Cancers of the hypopharynx, larynx, esophagus and stomach are also found to be associated with bidi smoking in case control studies in India[49].

Tobacco-related policies and their implementation

There is a clear need for urgent tobacco control measures in India. Several tobacco-related policies are currently in place, but some are geared to promote tobacco, while others meant to control tobacco are getting delayed in implementation.

Export policy

The Indian Government views tobacco as a foreign exchange earner and a generator of tax revenue. During most years, the Indian Government sets targets for tobacco exports. Total tobacco exports represent 4% of total agro exports. Exported unmanufactured tobacco is mainly of the varieties used in cigarette manufacture[53].

Manufactured tobacco products contribute 15% of the quantity and 27% of the value of total tobacco exports. Of the total value of tobacco products (Rs 544.27 crores) exported in 2007–08, chewing tobacco represented 46.5% (Rs 253 crores), bidis 8.1% and snuff 0.3%, while the rest consisted of cigarettes 26.6%, cut tobacco 10.1% (mostly used for making cigarettes), and lastly[54], hookah paste 8.4%.

As far as the quantity of exported tobacco products is concerned, out of a total of 30,657 t, chewing tobacco represents over one-fourth (27% or 8338 t), bidis only 3% and snuff less than 1%, while hookah paste constitutes over one-third (34.7% or 10,656 t), cigarettes almost one-fifth (19%) and cut tobacco almost one-sixth (15%)[54].

The quantity of exported chewing tobacco – which includes gutka – has increased over 19 times since 1995–96, while bidi exports have increased by only about one-third[1,54]. These increases have some obvious implications for international public health.

Taxation and control policies

Tobacco products provide about 10% of the total excise revenue in India. Of total tobacco revenue, smokeless tobacco contributes less than 15% and bidis only 5%, while cigarettes generate around 80% (Figure 3)[1].

An economic analysis has found that raising the excise duty on bidis to a point where their price equals that of the lowest priced cigarettes would not reduce excise revenue, but would help curb tobacco use[55].

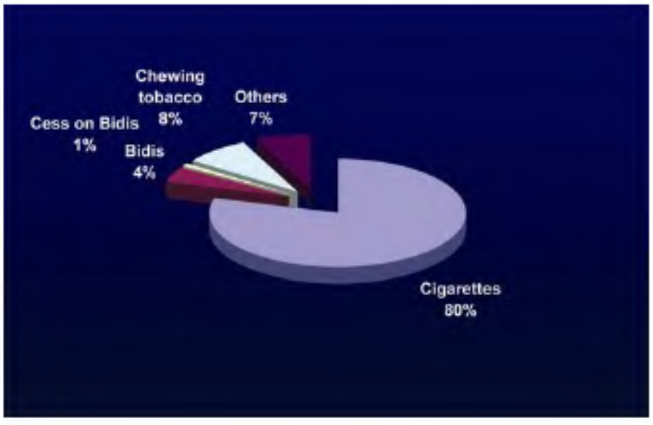

Figure 3. Break-up of total excise revenue (Rs 81,823.50) from tobacco products in India, 2000–01. (Source: Panchamukhi *et al.*[1].)

A lobbying argument of the bidi industry for keeping the excise tax low, is that it will affect the jobs of the workers in the bidi industry and tobacco-related trades, and that all these constitute a powerful vote-bank. It is also to be noted that some high-level politicians are directly involved in the bidi industry[56]. Keeping taxes low on smokeless tobacco would have similar considerations, except that the workforce is much smaller.

A loophole exists to prevent a number of companies from paying excise and providing the special cess for welfare of the bidi workers. It is the exemption for companies manufacturing ≤ 20 lakh beedis (2 million) per year[57]. This leads to evasion in payment of excise tax and cess[58], as well as evasion of legal responsibility to provide social and welfare services to bidi workers[59]. While the average size of bidi factories is 200–300 workers, the number of workers needed to make 20 lakh bidis a year is only 6–10. Hence declaring the manufacture of less than 20 lakh bidis a year is in most cases only an attempt to exploit the loophole for tax evasion[58].

According to the Indian Budget of 2007–08, excise duty (excluding cess) on bidis, which was last fixed in 2001, was raised from Rs 7 to 11 per thousand for non-machine-made bidis and from Rs 17 to 24 per thousand for machine-made bidis[60]. Yet these modest increases are nowhere near the levels suggested for curbing bidi smoking (Rs 100–168 per 1000 sticks)[55,57].

Bidis have been exempted from the special levy on tobacco products created to generate revenue for the National Rural Health Mission[1]. Yet bidis are most probably causing most of the disease and deaths due to tobacco in India. Thus, there is a need to question the favoured status of the bidi.

As taxation to raise the price is considered the most effective type of control policy for tobacco use[61], it certainly would make sense to raise taxes much higher on both bidis and smokeless tobacco.

Other policies

India, a party to the FCTC, had incorporated several effective tobacco control policies in the COTPA. This law includes five important policies: ban on smoking in public places, ban on tobacco advertising and sponsorship, ban on sale to minors and within 100 yards of educational institutions, the requirement of health-warning labels, and regulation of contents. Rules for the first four of these have so far been notified.

Even before the COTPA was passed in the parliament, a survey determined that the first three of these policies, as well as increased taxation, all enjoy strong public support (Box 5)[9,62,63].

Despite public support for tobacco control policies, lobbying from the tobacco industry has delayed implementation of the COTPA. The bidi industry has often

Box 5. Public support for tobacco control policies

Sentinel Survey[62]

A survey of nearly 30,000 persons 10 years and above in both Karnataka and Uttar Pradesh revealed that there was high acceptance of four control measures about which opinion was sought:

1. Increase in the prices of tobacco products;
2. Discontinuation of tobacco advertising and sponsorship;
3. Banning smoking in public places, and
4. Banning sale of tobacco to minors.

Even a high proportion of tobacco users supported implementation of these measures.

The maximum opposition was by tobacco users for an increase in prices of tobacco products (3.2% in Karnataka and 11.2% in Uttar Pradesh). While male tobacco users were somewhat more supportive of tobacco control measures than females, there was not much variation in the socio-demographic variables of residence, economic strata or religion. Among very young users, 10–14 years, the maximum opposition was found in Uttar Pradesh against raising the price (16.1%) and against banning sale to minors (11.3%). A high overall percentage for approval of these measures suggests a scenario conducive for social acceptance.

Surveys of school personnel[63]

Global school personnel surveys conducted in Bihar, Orissa and four North East States showed that the great majority of school personnel, including tobacco users, supported the following policies:

1. Higher taxation to increase the price of tobacco products,
2. School policies prohibiting tobacco use in school premises and
3. Other tobacco control policies.

Survey of adolescent students[9]

Three-fourths of students in the GYTS India (2000–04) favoured a ban on smoking in public places.

cited the purported difficulty in enforcing policy regulation in a cottage industry[64] and fear of job loss[65].

Creation of alternate forms of employment

Creation of alternative livelyhoods for workers connected with the bidi industry is another necessary policy[62] for the sake of justice and human rights, and is required by he FCTC (Art. 4).

It can be also argued that economic dependence on tobacco represents a poor model of development, because it gives rise addiction that leads to death and disease.

Summary and conclusion

Bidi smoking and smokeless tobacco use continue to be practised by a large percentage of the population in India. Smokeless tobacco use is twice as high as bidi smoking among adolescents. Initiation into use of these products among youth leads to lifelong adult use. Bidis are responsible for most of the one million or more yearly smoking-related deaths in the country. Political will has been lacking for the implementation of the tobacco control policies already adopted in the law. Lack of political will is also responsible for low taxes on bidis and smokeless tobacco products. To protect health and promote healthy economic development in the country, the lobbying power of the industry needs to be countered. To accomplish this, public support is a must.

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