Implications of Use of Tobacco Smoke Infused Water

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Abstract—Smokeless Tobacco Products have been collectively designated as Group 1 carcinogens i.e. carcinogenic to humans. It is estimated that the use of tobacco kills about three million people globally every year. A number of smoking and smokeless tobacco products are in use all over the world. Unlike other smokeless tobacco products, a unique water (liquid preparation) containing the extracts of tobacco smoke is used in Mizoram and is locally known as tuibur (tobacco smoke infused water). This product is made locally by passing smoke, generated by burning tobacco, through water till the preparation turns cognac in colour and has a pungent smell.

Keywords: Tobacco, Tuibur, Toxicity

INTRODUCTION

Smokeless Tobacco

Smokeless tobacco (chewing or spit tobacco) epidemic has long been recognized as a global threat and a challenge to human health affecting>300 million people worldwide (Biswas et al. 2015). South Asia is a global hub for the production and supply of Smokeless tobacco (> 33%) to the remaining part of the world and the consumers of the smokeless tobacco in Southeast Asia is about 90% of the tobacco users worldwide (Sinha et al. 2015). The main producer consisting huge number of consumer and exporter of tobacco is South Asia. Although India being the second largest consumer of tobacco (274.9 million), use of smokeless tobacco surpasses prevalence of smoking (smokeless tobacco products: 163.7 million; smoking: 68.9 million; smokeless tobacco and smoking: 42.3 million) (Global et al. 2015). The practice of smokeless tobacco is culturally accepted in India (current users: 25.9% of adults) and is prevalent both in men (1.3–38%) and women (4.6 - 27.9%) (Giovino et al. 2015). Several smokeless tobacco products are available worldwide, manufactured through different processes and their predilections vary by country, region, ethnicity and gender. In Southeast Asia, smokeless tobacco products are manufactured mostly small and cottage industries and their use are connected with lower socioeconomic status and rural residence (Kyaling et al. 2012). Smokeless tobacco product are widely consumed in India and partly across the global population which contains many toxicants (nicotine, polycyclic aromatic hydrocarbons, nitrate, nitrite, acrolein, crotonaldehyde and metals) and twenty eight known carcinogenic complexes in which tobacco specific nitrosamines are believed to be the most potent one (Bhisey et al. 2012).

Use of smokeless tobacco (snuff, tobacco powder for oral use, gutka, etc.) or cigarette smoking is known to cause various forms of cancers as various chemical constituents of tobacco are found to be carcinogenic. A carcinogen is defined as a chemical, physical or biological agent that causes cancer or induces the incidence of cancer. Even then, consumption of tobacco is the principal cause of global preventable death, it is estimated that the use of tobacco in diverse forms leading to 6 million people deaths globally every year (WHO 2012) with a majority occurring in Asia, and this figure is expected to rise further. Smokeless tobacco use is very high, among female users, in North-eastern India (Galazyn-Sidorczuk et al. 2008; Kalicanin et al. 2012). Although, the annual death figure due to tobacco consumption increases every year, cessation of tobacco consumption will not happen anytime in near future. And, if this trend increases, tobacco caused mortalities will reach 8 million worldwide annually by the year 2030 (Malakar et al. 2012).
NICOTINE AND ITS TOXICITY

For many decades in the past and again recently, much research has been done on the adverse medical consequences of smoking. The Instituto Nacional do Câncer (INCA), associated with the Brazilian Ministry of Health, estimates that the prevalence of smoking in Brazil from 2006 to 2010, among adults (18 years and older) in 26 state capitals and the Federal capital, Brasília, is 15.1% being 17.9% for men (approximately 5.5 million people) and 12.7% for women (approximately 4 million people). Additionally, the majority of these smokers became addicted at a young age and the incidence of smoking is especially high among people between 20 and 49 years of age (Cunha et al. 2013). Nicotine is a tertiary amine, and a bicyclic compound consisting of a pyridine and a pyrrolidine ring. It is also called 3-(1-methyl-2-pyrrolidinyl) pyridine according to the IUPAC nomenclature. It is hygroscopic, colorless oily liquid that is readily soluble in alcohol, ether or light petroleum. Also, it is optically active and the molecule possesses an asymmetric carbon and so exists in two enantiomeric compounds. The naturally occurring form of nicotine is levorotatory with a specific rotation of $\alpha\beta$D $= -166.4^\circ$(-)-nicotine. The dextrorotatory form, (+)-nicotine is physiologically less active than (-)-nicotine. (-)-nicotine is more toxic than (+)-nicotine.

Also, the previous studies on brain demonstrated that nicotine severely increases activity in the prefrontal cortex, thalamus, and visual system, consistent with activation of corticobasal ganglia-thalamic brain circuit. Dopamine, the most important neurotransmitters in the brain is stimulated by the released of central nAChRs by nicotine in the mesolimbic area, the corpus striatum, and the frontal cortex. Theimportance is the dopaminergic neurons in the ventral tegmental area of the midbrain, and the release of dopamine in the shell of the nucleus accumbens, is its pathway appears to be critical in drug-induced reward. Nicotine also leads to the release of other neurotransmitters, including norepinephrine, acetylcholine, serotonin, $\gamma$-aminobutyric acid (GABA), glutamate, and endorphins. (Favaro et al. 2006; Ahmadiana et al. 2007; Yamamoto et al. 2007) reported a number of alterations attributed to the direct cytotoxic effects of nicotine leading to the inhibition of prostaglandin’s synthesis and decrease of testosterone level of the male mice inducing reproductive toxicity. Other previous study demonstrated that nicotine was a CNS depressor that can inhibit the neural stimulus essential for the release of pituitary gonadotrophine (Favaro et al. 2006) leading lack of pituitary gonadotrophins essential for initiating and completing spermatogenesis and steroidogenesis in the testis (Ahmadiana et al. 2007). Studies have been reported that metabolites of nicotine as cotinine produce dose response inhibition of luteinizing hormone and 3a-hydroxysteroiddehydrogenase enzyme that stimulates testosterone production (50–70%) (Favaro et al. 2006; Aydos et al. 2001; Ahmadiania et al. 2007) explained that nicotine toxicity may be due to change in the proportion of collagen fibers and contractile myofibroblastic cells, which may prevent the appropriate release of spermatozoa from the germinal epithelium into the lumen.

Nicotine caused oxidative stress which leads to the imbalance of antioxidant level in blood cells, blood plasma, and tissues resulting in a decrease in the activity of antioxidant enzymes (Reddy et al. 1998). Other researchers reported the process of spermatogenesis is interrupted in nicotine treated animals’ testes tissues which may be released of free radicals (Suleyman et al. 2002). Also cotinine, an activemetabolite of nicotine generates free radicals/ ROS in the liver and testes tissues, and induces oxidative tissue injury (El-Sweedy et al. 2007; Husain et al. 2001). Direct genotoxic effects have been shown in human gingival fibroblasts and DNA strand breaks in human spermatozoa in nicotine aneuploidy and polyplody, sister chromatid exchanges and chromosome aberrations in bone marrow cells of mice (Sen et al. 1991). High doses of nicotine increase the frequencies of premature centromere separation and premature anaphase and reduce the number of oocytes ovulated. Hansen et al. (2007) had shown that smoking affects sperm density, motility as well as sperm morphology. El-Alfy et al. (2014) in their study of the effect of mytomycin C on male albino mice, reported that the RAPD profile clearly showed variation between treated and untreated mice. Hansen et al. (2012) reported that poor semen quality is associated with higher level of alcohol consumption. As spermatogenesis is a process which involves the regulation of a number of genes the aberration of the process can be due to the differential expression of genes. Nicotine on the other hand affects various cellular processes like gene expression secretion of hormones and enzymatic activity modulation. Nicotine has been shown to cause genetic damage in human and rodents.Jones et al. (1991) but the effects are limited and contradictory. DNA strand breaks in human spermatozoa have been shown to be induced by nicotine (Lardone et al. 2007). The lower doses of nicotine in vivo increased the frequencies of sister chromatid exchange and chromosome aberrations in mouse bone marrow (Sen et al. 1991).
TOBACCO PRODUCTS AND REPRODUCTIVE TOXICITY

The common problem among couples of child bearing age is reproductive inefficiency. About half of this problem is raised due to male factor which may be genetically predisposed to be sub-fertile (Reijo et al. 1996). Certain chemicals and drugs are highly sensitive to male reproductive system causing pose adverse effects under uncontrolled conditions (Bonde et al. 1996). Tobacco and tobacco products caused heath problems are reported by many researchers. Tobacco products are an important cause of increased mortality and morbidity in the developed countries and the prevalence of its use is also increasing (Kapoor et al. 2005). In spite of advances research on smoking it is still unclear that the nicotine has the same effects on male reproductive activities causing reproductive toxicity. Nicotine is contained in almost all type of tobacco products and can be consumed through smokeless tobacco products either chewing or snuff tobacco. Nicotine represents 90%-95% of the total alkaloids present in tobacco and is a highly toxic substance which absorbed quickly through the respiratory tract, oral mucosa and skin. Despite of causing lung cancer cigarette smoking is also associated with low birth weight, preterm delivery and abortion in women who are addicted to it. It also causes menstrual irregularities, pregnancy complications, and increased chances of sterility in women. In addition, cigarette smoking inhibits spermatogenesis and causes decreased steroidogenesis in men (Tanko et al. 2004). It has also been reported to have anti-estrogenic effects in women (Jones et al. 2009). Recent study proved that the smoking is associated with low androgen levels, the metabolic syndrome and coronary heart disease and it also leads to premature ejaculation and reduced penile erection; however, these depend on individual sensitivity or susceptibility (Gaworski et al. 2004). It has been previously demonstrated under experimental condition the exposure of cigarette smoke resulted in low litter weight in rats. Oyeyipo et al. (2010) while oral administration of nicotine have been associated with testicular degeneration, disorganization of the cytoarchitecture and decreased serum testosterone levels (Tanko et al. 2009). Further, nicotine has been shown to have adverse effects on fertility potentials of female albino rats by reducing the weight and disorganizing the histology of some vital visceral and reproductive organs (Iranloye et al. 2009).

According to the study of Vine, the testosterone levels might be unchanged, elevated, or decreased in smokers (Vine et al. 1996). Yardimci et al. (1997) reported a decreased level of testosterone in rats that were exposed to cigarette smoke. It may be due to the effect of smoking that causes degeneration of Leydig cells and reduce testosterone production. However another finding reported that serum testosterone levels were significantly increased in a group of smokers due to the increase of luteinizing hormone (LH) level which causes the stimulation of the central activation of Leydig cells, thus elucidating the elevation of testosterone level (Harald et al. 2002). On the other hand many studies also revealed that rats with nicotine exposure caused disintegration of spermatocytes and spermatids resulting in disruption of spermatogenesis (Kuladiip et al. 2010). In addition, previous study also claimed that smoking reduced the number of germ cells, decreased the height of germinal epithelium, the diameter of tubules and induced apoptosis in genital cells of the testis (Rajpukar et al. 2007). Previous authors have reported that exposure of rodents to cigarette smoke would led to degeneration and reduction in number of Leydig cells. These changes occurred due to the presence of many toxic substances in cigarettes that affected all tissues including the testis (Hasan et al. 2007). The detrimental effects of nicotine exposure on seminiferoustubules might be due to the over production of reactive oxygen species (ROS) that leads to excessive lipid peroxidation. This process might eventually result in structural damage and dysfunction of the cell (Smith et al. 2005). As a result of excessive ROS, mutations in mitochondrial genomemight occur and could disturb the formation of morphologically and functionally mature spermatozoa thus leading to male infertility (Saalu et al. 2005). Mahanem et al. (2011) reported that histological sections of testis from the nicotine group revealed vacuolation of tubules and sloughing of immature germ cells into the lumen. In addition, the Sertoli and germ cells shrank within the tubules, thus greatly suppressing spermatogenesis (Born et al. 1988). Previous studies reported that disruption in Sertolicells which plays a major role in the regulation of spermatogenesis leads to the alteration of the rate of sperm production (Russell et al. 1993).

TOBACCO SMOKE INFUSED WATER

In the North-East corner of India, Mizoram is situated between 92.15’ to 93.29’ E longitude and 21.58’ to 24.35’ N latitude, virtually land locked bordering Myanmar in the east and Bangladesh in the west. The people of Mizoram are culturally and ethnically distinct from the other tribes and communities of India (Phukan et al. 2005). Consumption of tobacco and smoking habit is deeply embedded in the tradition and culture of the Mizo. They grew tobacco to meet their requirements. Till the eighties there was no public
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awareness of the disastrous consequences of tobacco use. Both sexes, young and old indulged in it any time and place except the church and educational institutions. Tobacco was used in different form such as hand-rolled cigarette, smoking pipe-a hookah type apparatus and a unique form of water extract of tobacco smoke, locally known as tuibur, is consumed orally.

Unlike other smokeless tobacco products, a peculiar habit of consuming tobacco in the form of water called “tuibur” (tobacco smoke infused water) has been observed in Mizoram and Districts of Manipur (known as Hidakphuin Manipur) bordering Mizoram. The consumption of tuibur has been the part of the culture of Mizoram and Manipur for a long time. These communities also have a very high incidence of tobacco use (Sinha et al. 2004). Tobacco smoke infused water is made by passing the tobacco smoke, generated by smoldering tobacco, through water until the preparation turns cognac in color and has a pungent ammoniacal nicotine smell. Habitual consumption of tuibur is presumed to be one of the “safe” nicotine delivery medium. Most of the users take about 5 to 10 ml of tuibur few times a day by keeping it in the buccal space of mouth for about 15–20 minutes, when the flavor is gone they spit it out and take again as & when needed. Some people are addicted to the extent of consuming it constantly and also, and some people have the habit of swallowing tobacco smoke infused water occasionally by the users (Phukan et al. 2005).

DIFFERENT VARIETIES OF TOBACCO ARE USED FOR TOBACCO SMOKE INFUSED WATER PRODUCTION IN MIZORAM

1. Locally Grown Mizo Tobacco: The tobacco crop when it is ripen are harvested by the farmers, tread with barefoot and then allowed to dry under the sun for a period of time. When tobacco colour becomes redden or golden brown, the farmers separate the stalk from the leafy part. The leaf is utilised for smoking and it is the stalk, which is used for production of Tobacco smoke infuse water. The leaf is never usually used for making Tobacco smoke infused water because the taste becomes bitter. And, the stalk of the homegrown tobacco is also not very good for Tobacco smoke infuse water production as the taste is bitter and sticky.

2. Imported from Myanmar: Bamasayo as is primarily called is mainly grown in Minchhan/ Pakokku region along the riverbanks of Chindwin and Irrawady of Myanmar. The tobacco imported from Myanmar, coming all the way from the place mentioned is the stalk not the leaf. The stalk, however, is cut in a machine into smaller pieces of equal length and size. The quality of Tobacco smoke infuse water production is better using imported tobacco.

In the month of February/March the tobacco seeds are sown in a nursery for transplant. The soil is properly tilled/plough using machinery or local methods. Once the crop is about eight inches, they are transplanted into the tobacco field using bare hand. It needs approximately three months for full-grown. Sometime around the month of September, the leaves are plucked from the crop only leaving behind the stalk without leaf. And then a pitch is dug in the earth for keeping the tobacco leaves, the depth normally of 6 feet deep, size and depth depending upon the quantity of the Tobacco. The tobacco leaves are carefully piled on top of the other in a dug pitch, the top layer will be covered again by the soil, protecting the leaves from sunshine. In the month of January next year, the leaves are taken out from the pitch and the leafy parts are again cut it off from the stalk. The leaves are utilised for making cigarettes like Farstar, Winbody, etc. The stalk and the main branch of the crop are cut down, put in a machine for cutting into equal sizes and then packed for export to Mizoram. There are two varieties of Tobacco grown in the region, Bamasayo and Virginia. The former is harsh and the latter is light. The two varieties may be mixed together for the purpose of making Tobacco smoke infuse water.

3. Imported from Shillong: The tobacco coming from Shillong is the stalk and the leaf. The quality of Tobacco smoke infused water produced using this Tobacco is not very good. But the cost is much cheaper in compared with locally grown tobacco and imported from Myanmar. This type of tobacco is not normally used for making Tobacco smoke infuse water. When the supply of Tobacco from Myanmar is scare during rainy season, only then other tobacco are utilised. Even if it is used, it can be mixed with other variety of tobacco.
GRADES OF TOBACCO SMOKE INFUSED WATER

Table 1: Parameters Used to Grade Tobacco Smoke Infused Water available in the Market

<table>
<thead>
<tr>
<th>Grade</th>
<th>Amount of Tobacco Required to Burnt (kg)</th>
<th>Time Used to Process (Hours)</th>
<th>Amount of Water Used (L)</th>
<th>Amount of Tobacco Water Produced (L)</th>
<th>Price/Litre</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>21</td>
<td>18</td>
<td>20</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>Second</td>
<td>14</td>
<td>12</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Third</td>
<td>7</td>
<td>6</td>
<td>20</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

TOBACCO SMOKE INFUSED WATER MANUFACTURING SET UPS

For Tobacco smoke infused water production, we need items such as two tins for the upper portion also known as Tobacco smoke infused water Lu (head). One 20 litres tin container for the lower portion also known as Tobacco smoke infused water Mawng, three half inches diameter plastic pipes of length, three 1 inch diameter plastic pipe and three Bamboo internodes (Rua/ mauchâng), half feet iron pipe, ½ inch diameter covered with cement (Tobacco smoke infused water Lai/ Phunthli).

**Tobacco Smoke Infuse Water Lu:** Two Tins may be joined together, take off one end of the tin cover, there will be cover on the other end, and on it a hole of ½ inch diameter will be forged at the center. On the one end where a hole is forged, three inches thick earth will be filled up at the bottom (Fig. 1A, B).

**Tobacco Smoke Infuse Water Mawng:** One big tin container with a capacity of 20 litres is required. Two inches hole is made at the centre of the top and at the top edge; two or three half inch hole will be forged (Fig. 1C, D).

**Tobacco Smoke Infused Water Lai/Phunthli:** 15 cms length, ½ inch diameter iron pipe. Almost all the length of half feet iron pipe will be covered with conical shape cement, one end bigger than the other end. Leaving one inch iron pipe un concealed both ends (Fig. 1E, F).

**Pipes:** Two/ three pipes, a diameter of 1 inch, 6 feet length is required. One end of the pipe may be inserted into a hole made in the Bamboo nodes. One Bamboo inter-node (the area between the nodes) may be used as the Tobacco smoke infused water engine to be able to intercede massive circulation of air from the flowing water. Three to Six inches length of plastic pipes will be inserted into the hole made at the other end of the Bamboo inter-node. At the top (one side of the Bamboo surface) of the Bamboo, a small hole will be made. In this hole, ½ inch diameter plastic pipes will be inserted and therefore connect the container with the Bamboo (Fig. 1G, H).

![Fig. 1: Tobacco Smoke Infused Water Manufacturing Set Ups. (A,B) Tuibur Lu, (C,D) Tuibur Mawng, (E,F) Tuibur Lai and (G,H) Tuibur Pipes](image)

TOBACCO SMOKE INFUSED WATER MANUFACTURING PROCESS

Water in the stream or rivulet may be diverted through large pipes to water checkpoint. It must be ensured that Water checkpoint or Waterhole is located at the edge of the waterfall or slope so that we will have intense running/ flowing water in the pipe, and hence good circulation of air. Put one end of the pipes with Bamboo in water checkpoint. The pipes will draw water from Waterhole or checkpoint. We will try to ensure good flow of water in a pipe. Insert half inch pipe into the Bamboo connecting with the container (Tobacco smoke infused water Mawng). Two or three pipes may be utilised for one set of Tobacco smoke infused water manufacturing, depending on the availability of water and need of the manufacturer. Now, we will fill up the container Tobacco smoke infused water Mawng with water. Tobacco smoke infused water Lai/ Phunthli will be vertically put on top (within the hole made in the middle of the top). One end of Tobacco smoke infused water Lai/ Phunthli will be dipped into water/ diluted Tobacco smoke infused water in the container and the other end will rise out so that, Tobacco smoke infused water Lu will be put on top of it to enable the other end of Tobacco smoke infused water Lai penetrating into the hole made at the other end/ bottom of the Tobacco smoke infused water Lu.

When the three components are connected together, the water rapidly flow in the pipes will generate air circulating back and forth the small pipes up to the container. At the top of the empty tin vessel (tobacco smoke infused waterlu),
tobacco will be burnt using a fire with the help of the air flowing back and forth through the pipes up to the container. The burning tobacco smoke will pass over the water stored in the container and then smoke ventilate towards the large pipe in the stream through the small pipe. At one instant, 5–8 kgs of tobacco is normally used, which will be put inside the top vessel. Once the tobacco started burning, it usually takes 8–12 hours in normal condition, to completely burn the whole tobacco. The smoke, concentrate and ventilate through the container, helps in transforming the water stored in the container from a mere $\text{H}_2\text{O}/$ diluted Tobacco smoke infuse water to Watery Tobacco (Tobacco smoke infuse water) which can be intoxicated and addicted. One cycle of production within 12 hours will normally produce 20 ltrs. Tobacco smoke infused water of lower quality. Special quality Tobacco smoke infused water can be manufactured by doubling the quantity of tobacco and hence required longer duration (Fig. 2).

Fig. 2: Tobacco Smoke Infused Water Preparation. (A,B) Manufacture Process, (C) Collection of Tobacco Ash, (D) Filtration through Ash, (E,F) Tobacco Smoke Infused Water

MISCONCEPTS OF TOBACCO SMOKE INFUSED WATER USED

The misconceptions about benefits of the use of tobacco smoke infused water are widespread due to the lack of awareness of its potential harms. Nevertheless, misconceptions about the benefits of using Tobacco smoke infuse water (antiseptic, cleaning of teeth, anti-snake venom and anti-insect bite property) are widespread. Tobacco smoke infuse water consumption is common in both the sexes in Mizoram (73–80%) but also among children, teenagers, women of reproductive age, and school and college students. Tobacco smoke infuse water is sipped (5–10 mL) and retained in the buccal space of mouth for 5–10 minutes and then spit out and take it again as and when needed. One, who uses Tobacco smoke infuse water initially, soon starts sipping several times (5–30 times) in a day and get addicted. In due course, the addicted person may consume the Tobacco smoke infuse water via gulping. Tobacco smoke infuse water was used >5 times a day by 36.7% of users in Aizawl district and 92.1% of users in Churhandpur district of Manipur (Sinha et al. 2004). Further, Tobacco smoke infused water consumption increases the risk of oral, pharyngeal, stomach, breast and uterine cancer (Phukan et al. 2005).

HEAVY METALS RISK IN TOBACCO SMOKE INFUSED WATER

Galazyn-Sidorezuk et al. (2008); Kalicanin and Velimirovic (2012) reported that tobacco plant (Nicotiana tabacum L.) has the capability to accumulate toxic heavy metals from soil and concentrated them in leaves. Thus heavy metal contamination may vary from which tobacco plant it is harvested and processed. Thus tobacco and tobacco products can generally accumulate metals such as Pb, Cd, Zn, Ni and Cu preferentially and numerous studies showed presence of high levels of toxic elements in tobacco products (Galaźyn-Sidorczuk et al. 2008).

Heavy metals are the major environmental contaminants of food chain not only negatively influences soil, air and water but also become a considerable human, animal and wild life health concern due to its wide spread use, persistence in nature and potential toxic human and animal health effects. Heavy metals easily get incorporated into users’ bodies during consumption of Smokeless tobacco products. Earlier studies give evidence that heavy metals exist in higher concentration in tissues of smokeless tobacco users than in non-users. Hence, heavy metals are stable and persistent environmental contaminants and become a serious worldwide environmental problem. Therefore, the concentration of heavy metals in Tobacco smoke infuse water is of importance because of its toxic and genotoxic effects on human health.

ADVERSE EFFECTS OF TOBACCO PRODUCTS AND TOBACCO SMOKE INFUSED WATER

As a result of the excessive use tobacco smoke infuse water occurrence of stomach cancer is high in Mizoram (Phukan et al. 2004). Stomach cancer is the second leading cause
of cancer death in the world (9.7%). Highest incidence of stomach cancer was observed in Mizoram (age-adjusted rate–male: 42.9 and female: 20.5 per 105 populations), one of the north-eastern state of India, than the other regions of India. Several research findings have shown that consumption of tobacco and tobacco products are key risk factors of stomach (Mahanta et al. 1998) and particularly intake of tobacco in various traditional forms increases the risk of stomach cancer in Mizoram (Rani et al. 2003). A smokeless tobacco product, tobacco smoke infuse water (locally known as tobacco smoke infuse water) has been in general practice and integrated with the social and cultural rituals of communities in Mizoram. The quality of tobacco smoke infuse water is graded based on the quantity of tobacco used and the time taken for infusion through water, i.e., higher the concentration, better the quality (Gupta et al. 2005).

When tobacco is being chewed as “spit” tobacco or sniffed as “dry” snuff, nicotine is absorbed through mucous epithelial tissues in the buccal space or nasal space, respectively, which is relatively a slow mode of absorption of nicotine that eventually reaches brain (Benowitz et al. 1998). After reaching brain, as a mimic of neurotransmitter acetylcholine, nicotine binds with nicotinic acetylcholine receptors, stimulates the release of hormones and neurotransmitters. Thus, nicotine causes a strengthening Nucleus accumbens which leads to the release of dopamine. This is the reward process, applied by the brain to enforce the addictive behavior and nicotine stimulates this process, encouraging repetitive nicotine intake (Benowitz 1986). As a burning cigarette, the combustion of cured tobacco leaves under different thermal degradation conditions with the concomitant exposure to varying degree of oxygen concentrations, releases thousands of toxic gases and particulate matter, which are rapidly absorbed into the body. The organs involved in metabolism and/or excretion of metabolites also get doses of toxic substances. Therefore, the impact of tobacco is very widespread, causing multiple diseases and impairing many internal organs of the body. In addition, smoke from an unfiltered cigarette contains 5 billion particles per mm² with the size ranging from 0.1-1.0 mm. When condensed, these particulate matter species form a sticky fluid like mass called tar (IARC 1987). Tar initiates the damage of respiratory system by paralyzing and destroying cilia irreversibly, ultimately destroys the alveoli or air sacs, diminishing the efficient absorption of oxygen and the release of carbon dioxide. This also causes the heart to beat faster and subsequently raises the blood pressure.

Northeast India is one of the most ethnically and culturally diverse regions of Asia and the home for more than 166 tribes. The peoples of north east use alkaline food additives like soda (baking soda) frequently. In Mizoram, for the preparation of bai (an alkaline soup like preparation), normally soda is used as additive. Kalakhar (an alkaline preparation), consumed in Assam, was concerned as a risk factor for esophageal cancer (Phukan et al. 2001). Processed pork fat (sa um) is frequently consumed in mizoram which may form carcinogenic compounds during long storage, as in other preserved increasing risk of stomach cancer (Chen et al. 2002). The 2006–2008 report of National Cancer Registry Program of Indian Council of Medical Research (NCRP 2010). reveals that in India, the highest incidence of gastric cancer was in Aizawl district followed by rest of Mizoram and Sikkim. Stomach cancer is the most common cancer in Mizoram, and the prevalence is high [age-adjusted rate (AAR), 39.1/105 for men and 14.4/105 for women], which is one of the highest incidence that was reported (Phukan et al. 2005). In India, tobacco is mostly smoked or chewed but other forms of tobacco use are also prevalent. The prevalent smokeless tobacco products used in India are: khaini, mishiri, zarda, kiwam, pan-masala, gutkha, etc. There is sufficient data that explained smokeless tobacco causes oral and pancreatic cancer in humans and sufficient evidence of carcinogenicity from animal studies (IARC 2007). The use of tobacco snuff increases about 50 fold risk of gum and buccal cancer with duration of its use. Tobacco smoking and use of smokeless tobacco such as khaini and tobacco smoke infuse water are common among both the sexes in Mizoram. The high rates of stomach cancers in Mizoram may be attributed to relatively high prevalence of consumption of tobacco in various forms. Tobacco smoke contains various kinds of carcinogens including tobacco specific N-nitrosamine compounds, while nitrogen oxides/nitrate in tobacco smoke may also promote endogenous formation of various N-nitroso compounds including tobacco specific N-nitrosamines which have been linked to gastric tumorigenesis. IARC has also revealed that smoking is causally associated with cancer of the stomach. For smokeless tobacco products, a common factor undoubtedly capable of inducing and sustaining nicotine addiction, is delivering nicotine to the oral cavity and nasal passages rapidly, albeit some absorption occurs through the gastrointestinal tract from swallowed nicotine-infused saliva. Primarily, the nicotine concentrations in the smokeless products used vary by more than 100-fold (Henningfield et al. 1995). The plasma levels of nicotine and the speed of delivery usually depend on pH and buffering capacity: raising the oral pH into the alkaline range results in
more rapid nicotine absorption through the buccal mucosa (Richter et al. 2008) and hence, tobacco smoke infuse water is designed indigenously in such a manner as it is alkaline in character and is a capable toxic tobacco product.

CONCLUSION

In conclusion, tobacco smoke infuse water is commonly used among both sexes of Mizoram. Relatively high prevalence of the consumption of tobacco smoke infuse water in Mizoram may have contributed to the high rates of stomach cancer (Phukan et al. 2005). Nevertheless, misconceptions about the benefits of using tobacco smoke infuse water are widespread. The major alkaloid component of Tobacco smoke infuse water is nicotine. It is a pharmaco logically active and addictive alkaloid component of most of the smokeless tobacco products, and its effects on male reproductive system and fertility have been reported previously. Nicotine has also been associated with decreased sperm count, alteration in motility of the sperms, and overall increase in the number of abnormal sperms in humans. Wide body of literature has indicated that nicotine decreases the level of testosterone (Sarrazin 2010) through the inhibition in the multiple steps of testosterone biosynthesis in the rats and the mouse. It has also been established that nicotine administration decreases the testicular androgenic enzymes along with plasma testosterone and sperm counts in mature male albino rats (Yamamoto et al. 1998). In conclusion, additional, well-designed studies are necessary to further validate the tobacco smoke infuse water toxicity.

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