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Tobacco (*Nicotiana tabacum*) - A Systemic Review

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ABSTRACT

Nicotine is responsible for the widespread narcotic habits in the world. Nicotine is the main active principle in Tobacco which is the most common overused product and the second major cause of death in the world. In India, tobacco use is characterized by a high prevalence of smoking and smokeless tobacco use. Consumption of tobacco is responsible for one of the highest rate of oral cancer in the world and the incidence rate is increasing every year in a steady manner among young users. Smoking is responsible for large number of premature deaths in India. Nicotine is a central nervous system stimulant, acts on peripheral autonomic ganglia but later depresses or blocks. These factors greatly intensified the need to investigate and explore the increasing demand and systemic effects of Tobacco consumption. The present article is an endeavor to review the systemic effects of tobacco in nutshell.

METHODS

Scientific literature regarding tobacco were collected from various data bases from PubMed, Google Scholar, Research Journals and Textbooks.

DISCUSSION

Unlike smoking, females are equally indulged on pan tobacco chewing in India as it has gained social acceptance especially in economically backward class. Nicotine which is a hygroscopic volatile bitter liquid alkaloid is a fast-acting cardiac poison. The molecular identity of nicotinic receptors is responsible for drug seeking behavior and addiction of tobacco.

CONCLUSION

Tobacco is major cause of addiction and disease occurrence in Indian population. Hence awareness about the health issues caused due to nicotine addiction is recommended.

Key Words *Tobacco, Nicotiana tabacum, Nicotine*

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INTRODUCTION

Tobacco (Tambaku) is the most common overused product in the world. Tobacco chewing is a very common practice in India even as a part of many religious and cultural rituals and hence gained a degree of social acceptance especially in

economically backward class. Unlike smoking, females are equally indulged in this habit especially on pan tobacco chewing. Tobacco is either chewed or simply placed between the cheek and gums¹. Recently there has been a rise of popularity in the use of snuff, paralleling the



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decline in cigarette smoking in most parts of the world as people generally believe that snuff is less harmful. But the fact is it contains (moist or dry) 14 mg of nicotine per gram of tobacco where 0.5 to 2 mg is delivered to a smoker on a single puff². Tobacco plant belongs to Solanaceae family and is prepared from cured leaves of *Nicotiana tabacum* (Commercial tobacco). *Lobelia inflata* is referred as Indian tobacco whereas *Nicotiana rustica* is known as Turkish tobacco. *Nicotiana tabacum* is the commercial variety but the more potent variety is *N. rustica*.

Other sources of tobacco are¹:

1. *Nicotiana attenuata* (Wild tobacco)
2. *Nicotiana glauca* (Tree tobacco)
3. *Nicotiana trigonophylla* (Desert tobacco)
4. *Nicotiana longiflora*
(Cultivated ornamental)

PREVALENCE OF TOBACCO CONSUMPTION

Tobacco has been recognized as the second major cause of death in the world³. According to WHO tobacco kills more than 8 million people each year⁴. High prevalence of smokeless tobacco (SLT) is evidenced in many populations across the world, in which a large share is from the low- and middle-income countries including India, Bangladesh, Nigeria, Philippines and Egypt. According to GATS among the 248 million global SLT users 232 million is from India and Bangladesh in which 83 % of the global burden is carried by India⁵. India accounts 12 % of tobacco smokers in the world and 74% of global burden of smokeless tobacco⁶.

In India, tobacco use is characterized by a high prevalence of smoking and smokeless tobacco use. According to GATS smokeless tobacco was the major form of tobacco use in India followed by smoking and dual tobacco. The prevalence varies significantly according to the states and had a strong association with sociocultural characteristics of individuals. Among the estimated 28.6% of total tobacco users in India, only 10.7% consumes in the form of cigarettes and bidis whereas 21.4% uses smokeless tobacco in the form of pan, pan masala, gutka and mishri (GATS 2017)⁷.

In Maharashtra, 46.5% of the population were reported to use tobacco in some form in a cross-sectional study in which male proportion was significantly higher than females. The use of SLT was found to be more common in less educated (75.47%) as well as females (28%). Smoking was reported common among educated male population (51.1%)⁷.

In a study conducted among industrial workers in Pune, it was found that 59.02% uses tobacco in different forms. Among this 77.68% were using smokeless tobacco and 8.26% were smokers. The study concluded that tobacco chewing is more prevalent than smoking⁸.

In India 25.9% of adults use smokeless tobacco, 32.9% are males and 18.4% are females⁵. Men uses smokeless tobacco in the form of khaini and gutka and females uses mishri or betel quid (a mixture of leaf of *Piper betel*, pieces of areca nut or supari, aqueous calcium hydroxide or slaked lime and some spices⁹) with tobacco⁵. According



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to National Family Health Survey (NFHS II, 1998-99), prevalence of tobacco use was 37% in India among the population of 15 yrs and above¹⁰. In India consumption of tobacco is responsible for one of the highest rate of oral cancer in the world and the incidence rate is increasing every year in a steady manner among young users¹¹. Smoking is responsible for large number of premature deaths in India (almost 1 million smoking deaths a year¹²) majority coming in between the age group of 15-59 yrs. Whereas smokeless tobacco is associated with increasing risk of cancer mainly of neck, esophagus and pancreas along with several oral diseases¹¹.

HABITAT AND BOTANICAL DESCRIPTION

N. tabacum is a native of tropical and subtropical America but it is now cultivated commercially all over the world. *Nicotiana tabacum* is an annual herb or shrub which is cultivated indiscriminately all over India on commercial basis which is now having a setback as government is not encouraging its cultivation¹³. The plant may grow up to 1-2 m height. It is sensitive to temperature, humidity, air, and type of land. The leaves are elliptical, flowers are clustered at end of branches and fruits have different forms with seeds globular in shape¹. Whole part of the plant is poisonous except the ripe seeds¹⁴.

In India it is mainly cultivated in Andhra Pradesh (34%), Gujarat (22%), Karnataka (11%), Maharashtra, Bihar Tamil Nadu, Orissa, Uttar Pradesh and West Bengal. Among which 90 % of

production is from Andhra Pradesh, Gujarat, Karnataka and Uttar Pradesh¹⁵.

HISTORY

The plant is native to Caribbean where Arawak people used and cultivated it. Later in 1560, a French Ambassador introduced tobacco seeds and leaves to French court as 'wonder drug'. In 1586, a botanist Jaquez Dalechamps gave the name *Herba nicotiana* to the plant. It was considered as decorative plant before it become popular as snuff. In the beginning of 17th century tobacco arrived Africa. In 1851, a Belgian chemist documented the use of tobacco extract as a murder poison. Up to the beginning of 20th century the leaf extract was a popular pest control method².

The Maya people in America use to consume these plants for ritual purposes since 10th century¹⁶. The use of tobacco leaves was introduced to Columbus by Native Americans to create and satisfy the nicotine addiction and thus spread rapidly to Europe¹⁵. It was introduced to France by Gin Nicot of Nimas from where it was taken to Philippines by Spanish traders and it reached India via China¹⁴.

ACTIVE PRINCIPLES

1. Nicotine
2. Nornicotine
3. Anabasine
4. Anabatine

Every part of the plant contains nicotine except the seeds. The leaves are having the maximum concentration of nicotine. Dried leaves of tobacco(tambaku) contain 1-8% of nicotine and



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another alkaloid Anabesine which is equally toxic. In *Lobelia inflata* variety the main constituent is lobeline which is an alkaloid similar to nicotine but less potent and sometimes used as a substitute and also in antismoking tablets and lozenges³.

NICOTINE

Nicotine is a colorless, volatile hygroscopic bitter liquid alkaloid found in almost all species of tobacco which turns amber on exposure to light³ and is an extremely fast acting poison. It is a cardiac poison as well as a potent addictive which is responsible for widespread narcotic habits in the world. Even though nicotine has no medicinal value, some of its derivatives are widely used as insecticides and also for fumigating and spraying in agricultural and horticultural work. Nicotine is the oldest insecticide known¹⁵.

MODE OF ACTION

Nicotine is a stimulant of central nervous system. Nicotine acts on peripheral autonomic ganglia which is initially stimulated but later depressed or blocked¹⁷. It also acts on nicotine receptors present in central nervous system, spinal cord, neuromuscular junction, adrenal medulla etc¹⁸. Nicotine stimulates the reticular activating system with favorable effects on memory, attention and anxiety, when taken at moderate doses. But on high doses it leads to convulsion and tremors. It mimics the endogenous neurotransmitter acetylcholine and produce agonistic effects on nicotinic acetylcholine receptors¹⁶.

Nicotine is widely used in 2 forms - smoke (cigarettes, beedi, pipe, and cigar) and smokeless

tobacco¹⁹ (snuff, chewing etc.). The commonest source of nicotine poisoning results from smoking in the form of cigarettes. After cigarettes, the next common source of nicotine toxicity results from smokeless tobacco which is not smoked or burned during the time of use but commonly consumed orally or nasally. The following table shows the nicotine content present in different sources of tobacco:

SR No	SOURCE	NICOTINE CONTENT IN VARIOUS SOURCES ¹
1	Cigarette	13-19mg
2	Cigar	15-40 mg
3	Chewing tobacco	2-8 mg/gm
4	Snuff -dry	12-15 mg/gm
5	Snuff- wet	5-30 mg/gm
6	Tobacco leaf	1-6% per leaf
7	Insecticide	Up to 40%

ABSORPTION AND EXCRETION

Nicotine is absorbed through skin, oral mucosa, mucous membrane and lungs. It is detoxified and metabolized mainly in the liver (80-90%) and also by the kidney and lungs and is excreted in urine. The elimination takes 16 hrs to complete. Cotinine is the major metabolic product of nicotine¹⁷. In lactating women nicotine is excreted in the milk also. Nicotine and some compounds in smokeless tobacco can cross the placental barrier affecting development of brain, lungs and CNS of fetus⁵.

CLINICAL FEATURES^{5, 15}

ACUTE POISONING - Acute poisoning may be mild, moderate or severe in nature. Burning in mouth and throat, excessive salivation, lacrimation, sweating, vomiting, increased pulmonary secretions, tachypnoea, bronchospasm, hypertension, bradycardia, reduced thirst and appetite etc. are the features of mild to moderate



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in toxification. In severe intoxication stimulatory features are shown initially followed by prolonged and persistent depolarization. Patient may develop hypotension and seizures. Death may occur due to vagal excitation and cardiac arrest or due to exhaustion of nervous system and respiratory failure.

CHRONIC POISONING - This result from continuous use of smoke or smokeless tobacco or from exposure to nicotine which may occur during processing or extraction of tobacco while mixing or spraying of insecticides. Common symptoms are chronic cough, bronchitis, laryngitis etc. in those who chew tobacco. Tobacco heart is a condition seen in habitual smokers characterized by irregular and occasional attacks of pain. Risk of oral and pharyngeal cancers, esophageal cancer, cancer of gums and buccal mucosa are observed. Use of smokeless tobacco during pregnancy may have adverse health effects on development of fetus, various pregnancy complications, increased placental weight and low birth weight, infertility, pre-term delivery, increased risk of stillbirth, cancer in developing fetus etc.

NICOTINE AS ADDITIVE

Drug addiction is a state of chronic intoxication which is produced by the repeated consumption of a drug causing harm to the individual as well as society. Drug habituation occurs due to repeated consumption of some drugs resulting in psychological or emotional dependency on it. Nicotine and caffeine come under this category¹⁷. Nicotine is the major addictive component in tobacco products. Nicotine binds to nicotinic

acetylcholine receptors (nAChRs) which are allosterically regulated ligand-gated ion channels widely distributed throughout the central nervous system and are normally activated by the endogenous neurotransmitter acetylcholine leading to activation of reward centers in the CNS ultimately leading to addiction^{20,21}. The nicotine influence on the synaptic mechanisms contribute to addiction process. The molecular identity of nicotinic receptors is responsible for drug seeking behavior and addiction of tobacco²².

NICOTINE AS INSECTICIDE

Nicotine is a natural insecticide and acts as anti-herbivore chemical in tobacco plants. It is also been used as archetype for the large range of synthetic neonicotinoid insecticides. Nicotine is highly toxic to crustaceans and insects whereas in human it acts as stimulant in low doses¹⁶. The neonicotinoids is a newest class of insecticide which is having outstanding potency and systemic action for crop protection against piercing sucking pests. It also has effect on controlling flea on cats and dogs²³.

CESSATION OR QUITTING TOBACCO

Limited researches are conducted on intension to quit and the barriers to cessation. Associated stigma and low support for cessation acts as a barrier for quitting. In India only 5.8% people are able to successfully quit smokeless tobacco among which percentage of women is lower than that of men. According to the study more than 50% women are not interested in quitting the habit⁵.

Nicotine Withdrawal - Symptoms includes mood swings, insomnia, restlessness, weight gain and



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difficulty in concentrating. Symptoms are peak at first 3 days and may last for 3-4 weeks.

Nicotine Replacement - It is helpful in increasing cessation rate as they reduce nicotine withdrawal. They include Nicotine Gum, Nicotine patch, Nicotine nasal spray and inhalers¹⁵.

AYURVEDIC CORELATION

Tobacco is known as *Tamraparna* in Ayurveda. It is a non- classical herb in Ayurveda with large leaves and white flowers which originally belongs to South America Yogaratnakara was the first one to mention this drug¹⁴.

Tamraparna is a drug with *Tikta & Katu Rasa*, *Usna Virya* and *Katu Vipaka*. *Laghu*, *Vikasi* & *Vyavayi* are the *gunas*. It is a drug which performs *Karmas* like *Kapha Vatahara*, *Sukrahara*, *Vastisodhana* and *Anulomana*. There are no much references available in the classical textbooks and its utility as a medicine is not proven. But it may be effective in *Dantasula*, *Swasa*, *Kandu* and *Krimidanta*¹⁴.



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