

EXPLORING THE CONTROVERSIAL ROLE OF NICOTINE IN MEDICINE AND SOCIETY

Priya Lakshmi Narayanan and Ramesh Kumar Venkatesan

Master of Dental Surgery (MDS), Senior Lecturer, Department of Pediatrics and Preventive Dentistry,
Sri Venkateswara Dental College and Hospital, Thalambur, Tamil Nadu, India

DOI: 10.5281/zenodo.15649747

Abstract

Nicotine, which is a component of tobacco is often thought and educated to be hazardous. Even though they are hazardous and a risk factor for many diseases and malignancies they have some beneficial effects in our body. Some of them are to treat Aphthous ulcers, Alzheimer's, Parkinson's, Ulcerative cheilitis etc. Researchers have also found them to be useful in maintaining body weight. Considering Celsius definition for toxicity "All things are poison, and nothing is without poison; only the dose permits something not to be poison". Nicotine when consumed in a lower dose and in healthier forms, do a much of salubrious properties. All the adverse effects of nicotine were found when used in higher doses and various commercial forms. Nature provides us all we need; it is in our hand to make better use of it as in case of this nicotine. Nicotine is a boon from the nature that could cure and prevent various diseases and condition. When nicotine is used in a wholesome way it is the best drug that can be consumed, but when used in a non-healthy way it might cost your life. So be natural and be with nature, it provides us what we need!!!.

Keywords: Nicotine, Therapeutic Uses of Nicotine, Nicotine Toxicity, Dose-Dependent Effects

INTRODUCTION

Everything has a beauty! But not everyone sees it! This message is very closely related to the hazardous ciggy nicotine. Nicotine is taught, considered and educated to be a hazardous substance. Accept they are hazardous, but they do have some beneficial properties.

It is important to remember the definition for toxicity by Paracelsus: —All things are poison; nothing is without poison, only the dose permits something not to be poisonous (1). All the adverse effects of nicotine, at smaller doses have beneficial effects. Nicotine a natural component of various plants when used in a proper way is elite for various treatments.

WHAT IS NICOTINE?

Nicotine is a potent Para sympathomimetic alkaloid found in the night shade family of plants Solanaceae. They are colorless or yellowish liquid most commonly seen in tobacco. These are made in roots and accumulate in the leaves. It constitutes up to 3% of dry weight of tobacco (2) and 2-7 µg/kg of other edible plants (3). These are used as an insecticide especially neonicotinoids are widely used (4). They act as a stimulant in small doses but at high doses blocks the action of autonomic nerve and skeletal muscle cells. This stimulant effect is the reason for addiction among nicotine consumers in various forms (5).

Columbia Journal of Health Sciences and Nursing

Research Article

Nicotine once had in any of its forms; it reaches the blood stream quickly and then crosses the blood brain barrier within 10-20 seconds of its use (6). Nicotine acts on nicotine acetylcholine receptors which are present on autonomic ganglia and adrenal medulla and also on the central nervous system. They stimulate cholinergic receptors and indirectly on the dopamine release.

HISTORY OF NICOTINE:

Nicotine is named after its source plant *nicotiana tabacum* which is in turn named after a French ambassador Jean Nicot de Villemain, who presented tobacco and its seed to the French king in the year 1560 and promoted the medicinal use of it. The seeds were brought to ambassador Nicot from Brazil by a Portuguese colonist in Sao Paulo, Luis De Guis (7). This was introduced in Europe as a smoking agent as well as an insecticide. The chemical nicotine was first isolated by physician Wilhelm Heinrich Posselt and chemist Karl Ludwig Reimann of Germany in 1828. They considered it to be a poison (8). The first time synthesis of this nicotine was done by Amé Pictet and A. Rotschy in 1904 (9).

FORMS OF NICOTINE:

There are both commercial and medicinal forms of nicotine available in the market. They are sold in a very high number in various shops all around the world. Economically commercial products of nicotine have high profit and a rapidly selling product in the market. Some of the commercial products of nicotine are cigarettes, bidi, various types of pan etc. There are few medical products available with this nicotine which are used for various treatments and most importantly nicotine replacement therapy (10). The medicinal products of nicotine are

- Nicotine gums
- Nicotine patches
- Nicotine tablets
- Nicotine lozenges
- Nicotine gums are chewing gums that deliver nicotine to our body when chewed. Nicotine is delivered to bloodstream via tissues of oral cavity. It is said that when these gums are used about 3 mg is absorbed into the bloodstream from the 4 mg gum, and 1 mg from the 2 mg gum (11).
- Nicotine patches are transdermal patches, which when applied over skin nicotine is taken to the bloodstream via skin. The first study about these patches was first published in 1984 (12), showing that it reduced craving for cigarettes (13).
- Nicotine tablets are used mostly sublingually. These nicotine tablets are soluble once placed sublingually and then nicotine is taken to blood stream. These are more easy to use than that of nicotine gums (14).
- Nicotine lozenges are dissolved mouth for the nicotine release. The effect of these lozenges is present even after when complete lozenges is diluted (15).

NICOTINE AND APHTHOUS ULCERS:

Recurrent aphthous ulcers also called aphthous stomatitis or canker sores, is a common disease characterized by development of painful recurring solitary or multiple ulcerations of oral mucosa. It is multi factorial and stress is considered the most important cause (16). This is a type ulcers at least once in a life time people would have experienced. Nicotine has been found to be a cure for these aphthous ulcers. It has been found that persons who consume nicotine in various commercial forms are seen to be not affected by these kinds of ulcers. More interestingly it has been found that these ulcers are less common among users of smokeless tobacco than non-

Columbia Journal of Health Sciences and Nursing

Research Article

users and among smokers than non-smokers (17). There are two theories that say about the preventive effects of nicotine towards recurrent aphthous ulcers (18):

- A. It causes increased keratinization of oral mucosa especially when smoked.
- B. Nicotine via several mechanisms can modulate immune mechanism, especially causing immune suppression. It also stimulates release of adrenocorticotrophic hormones and cortisol causing further suppression of inflammatory changes.

To support this beneficial effect of nicotine against aphthous ulcers two case reports can be considered

- i. Early in 1991 three non smokers who had these RAU'S where asked to consume nicotine tablets and it was found that they recovered from these ulcers and where also found to be not affected by these ulcers during the nicotine tablet consuming period. He prescribed about 8mg of nicotine per day (19).
- ii. A case study in which a women who is chronic smoker was found to have these aphthous ulcers once she quit smoking. She was given a nicotine lozenges of 15mg per day initially and then 5mg per day which resolved the aphthous ulcer in 24hrs (20).

The interesting part of these case study was that in the second one 5mg of nicotine lozenges on regular use was found to cause no adverse effects and are completely safe (20). Thus nicotine provides a quick cure for aphthous ulcers without any adverse effects on limited dosage consumption.

NICOTINE AND NEUROLOGICAL DISORDERS:

Nicotine has been found beneficial in various neurological disorders. One such neurological disorder is Parkinson's disease. Parkinson's disease is a chronic and progressive movement disorder. Nearly one million people in US are affected by Parkinson's disease (21). In India these are common among Parsi community of Bombay (22). Dopamine is a chemical that controls the movement and coordination via brain. Parkinson's disease first affects these neurons which produce dopamine in brain. This causes a deficiency in dopamine production. As the disease progresses dopamine production is much reduced and the person affected will not be able to control their movements (21).

Interestingly it was found that commercial nicotine consumers of various forms are seen to be less affected by these Parkinson's disease (23). Nicotine, a major component of tobacco smoke, could exert either nonreceptor-mediated biological effects or, more importantly, act on the different subtypes of nicotinic brain receptors, in particular those associated with the nigrostriatal dopaminergic pathway. These stimulate the dopamine release. Though the exact relation between dopamine release and nicotine receptors are of controversy, researchers are sure of nicotine impact on dopamine release (24). Also nicotine has clear motor effects when associated with L-DOPA, reducing L-DOPA-induced dyskinesias (23). Know researches are going on for using nicotine as a treatment for Parkinson's disease. Presently in UK doctors give their patients nicotine patches as a treatment for Parkinson's and found 90% symptoms are reversible (25).

Nicotine is also found useful in Alzheimer's dementia. Alzheimer's also called senile dementia is a progressive disease that destroys memory and other important mental functions. Nicotine is seen to mimic the action of the neurotransmitter acetylcholine, a dearth of which is the main cause of this disease (26). But it has been found by some reviewer's that they couldn't find any evidence conveying nicotine is useful in Alzheimer's and they also say that it might be due to the poor quality of trials they had for the review (27). Though nicotine has controversies

Columbia Journal of Health Sciences and Nursing

Research Article

in various neurological disorders it is believed by some researchers that it is useful in treatment and prevention of neurological disorders like Parkinson's, Alzheimer's, Tourette's, ADHD and schizophrenia. Even depression had been targeted as an area in which nicotine could prove useful (26).

While we all feel sad, moody or low from time to time, some people experience these feelings intensely, for long periods of time (weeks, months or even years) and sometimes without any apparent reason. Depression is more than just a low mood – it's a serious condition that affects your physical and mental health (28). Nicotine consumption has been found to be a cure for these depressions. In a study, researchers recruited 11 people who did not smoke but who were experiencing symptoms of depression and administered them nicotine patches. The researchers used a standardized method, a 20-item questionnaire called the Center for Epidemiological Studies Depression scale, to measure depression symptoms among the study participants. Researchers found that persons who wear nicotine patch for seven days have shown declination in depression they experienced. They also found that smokers though smoke to get relieved of depression; smokers are the one who get depressed twice the time than the nonsmokers (29). Thus nicotine helps relieve from depression, but has equal risk of getting addicted making the condition still worse than before.

NICOTINE THE BEST TREATMENT FOR WEIGHT LOSS:

It is interesting to know that diet of a fashion model consists of coffee, vodka, cigarettes and champagne with a very low calorie diet and other diet pills. They are chain smokers (30). Why they do this, it's because nicotine is an appetite suppressor. They act on specific receptors in brain causing appetite suppression. Interestingly it is found that once a smoker quits smoking he is seen to gain weight. Also a smoker is found to be a bit thin than the nonsmoker (31). It has been found that nicotine has impact on reward and behavior reinforcement in brain. Few researchers found a weight loss in an experiment with mice and found body fat dropped 15 to 20% percent in 30 days (32). Smoking is hazardous and so for maintaining body weight nicotine replacement therapy with nicotine gums, patches etc can be followed because nicotine is an appetite suppressor and not the smoke. Obesity is one of the causes for heart and knee problems. Thus nicotine can be used to control weight thus preventing from various diseases. The most important to be noted is the dose and addiction behind it. Dose plays a major role because high doses though causing the above benefits they are more prone to cause adverse effects. For a model to have all these benefits the nicotine dose they should consume is high. So nicotine is to be consumed with precautions that it doesn't cause any adverse effects and more importantly ADDICTION.

NICOTINE AND ULCERATIVE COLITIS:

Ulcerative colitis is an inflammatory bowel disease that causes inflammation and ulcers of GIT. The main symptom of active disease is diarrhea mixed with blood (33). The risk of developing the disease being significantly lower in smokers than in non-smokers or former smokers (34). The fact that patients with ulcerative colitis who resume or start smoking often experience clinical improvement prompted attempts to verify the hypothesis that nicotine might be the active component of smoking responsible for the beneficial effects on the course of the disease (35). In an open trial 16 patients with left-sided colitis receiving various types of therapies (mesalazine, sulphasalazine, steroids) were given in addition nicotine 30 mg daily in transdermal patches for 4 weeks. The majority of patients reported clinical, endoscopic and histological improvement during nicotine administration (36). It is curious to know that these nicotine patches when compared with prednisolone treatment on a daily basis both showed improvement, but endoscopic and clinical response favoring steroids (37). In another

Columbia Journal of Health Sciences and Nursing

Research Article

study when nicotine and mesalamine used together, showed 60% effective than when used separately (38). There is little mechanism that has been found about nicotine's beneficiary effect in these colitis and they are:

- It has been reported that nicotine increases the thickness of colonic mucus, thus enhancing the protection of the intestinal mucosa (39).
- A reduction in intestinal blood flow by nicotine has also been described (40), but it is unlikely that this phenomenon may account for the favourable effects of nicotine in ulcerative colitis, since rectal blood supply in ulcerative colitis patients is already lower than normal (41).
- It has been suggested that nicotine influences the cellular and the humoral immune system and interferes with the inflammatory response (42). Thus Nicotine is a choice of treatment in Ulcerative Colitis.

NICOTINE REPLACEMENT THERAPY:

It is important to convey about nicotine replacement therapy as medical forms of nicotine plays a role in this. Also all the beneficial effects said above are best when used in its medical forms like nicotine gums, patches, lozenges etc. Nicotine replacement therapy abbreviated as NRT is a way of getting nicotine into the bloodstream without smoking (45). There are nicotine gums, patches, inhalers, tablets, lozenges, and sprays as said before are used in this therapy. You can buy most of these from pharmacies and other retail outlets. Most are also available on prescription. These help in smoking cessation as smoke also contain hazardous substance like carbon monoxide, tar etc. These are treatment are for better health and better social behavior for a patient. They are seen to be effective and best way for smoking cessation. More than this these are the effective way for experiencing beneficial property of nicotine.

ILL EFFECTS OF NICOTINE:

There are hundreds and hundreds of adverse effects of nicotine. As said before only the dose decides whether nicotine is healthy or hazardous. A lot of adverse effect to quote but some of them includes atherosclerosis, enlargement of aorta in vascular system; muscular tremor and pain in muscles; High insulin and insulin resistance; Nausea , dry mouth, dyspepsia, peptic ulcer, diarrhea, heart burn in gastro intestinal system; Lightheadedness ,sleep disturbance, head ache, abnormal dreams, irritability, dizziness and risk of blood restriction of blood in central nervous system; Tachycardia ,arrhythmia, coronary artery disease etc in cardio vascular system (43). During pregnancy when consumed the child is expected to have type 2 diabetes, obesity, hypertension, respiratory dysfunction and infertility in later half of life (44). They are also seen to be a potent carcinogen and are found to cause various premalignant and malignant conditions (43). Commercial forms might cause stains in tooth surface thus affecting esthetics. They also cause increased periodontal pocket depth, no bleeding in gingival inflammation etc. The most important of all is the addiction. People say addiction causes adverse effects, but addiction by itself an adverse effect. It is fascinating to know that all these ill effects are experienced in high doses and chronic consumers. More fascinating is that this nicotine when consumed in commercial forms show more adverse effects than used in it medical form. As said before 5mg per day is absolutely safe for consumption (20). The dose and ill effects are like; they are directly proportional to each other. Consuming in limited dose makes nicotine a salubrious drug.

Columbia Journal of Health Sciences and Nursing

Research Article

CONCLUSION:

Nicotine is sterling drug in treatment of various diseases like aphthous ulcer, ulcerative cheilitis, various neurological diseases etc. But it should be noted that when these nicotine is used in its commercial form and in high doses they cause various adverse effects and they might lead to the dangerous life threatening crab like disease, the cancer. Commercial withdrawal of nicotine is to be encouraged and has to be implemented, meanwhile medical use of these nicotine are also to be considered. This article doesn't favor nicotine consumption, but not to miss the beneficial properties as it has impact on many disease and conditions where other drugs are not as effective as this nicotine. One thing for sure, if the use of commercial nicotine in various forms continues and continues will cause the end of life.

Nature provides a lot of remedies for various disease and condition. It is in our hand to make better and proper use of it as in case of this nicotine. Nothing is useless in this universe when used in a proper way.

**—BE NATURAL AND BE WITH NATURE, THE NATURE PROVIDES ALL WE
NEED!!!!!!”**

REFERENCES:

- Thiriez, C., Villafane, G., Grapin, F., Fenelon, G., Remy, P., & Cesaro, P. (2011). Can nicotine be used medicinally in Parkinson's disease? *Expert Review of Clinical Pharmacology*, 4(4), 429–436. <https://doi.org/10.1586/ecp.11.28>
- Cohen, R. D., & Hanauer, S. B. (1996). Nicotine in ulcerative colitis—How does it work and how can we use it? *Clinical Immunotherapeutics*, 5, 169–174.
- Zijlstra, F. J., Srivastava, E. D., Rhodes, M., van Dijk, A. P., Fogg, F., Samson, H. J., Copeman, M., Russell, M. A., Feyerabend, C., & Williams, G. T. (1994). Effect of nicotine on rectal mucus and mucosal eicosanoids. *Gut*, 35(2), 247–251. <https://doi.org/10.1136/gut.35.2.247>
- Srivastava, E. D., Russell, M. A. H., Feyerabend, C., & Rhodes, J. (1990). Effect of ulcerative colitis and smoking on rectal blood flow. *Gut*, 31(9), 1021–1024. <https://doi.org/10.1136/gut.31.9.1021>
- Kershbaum, A., Pappajohn, D. J., Bellet, S., Hirabayashi, M., & Shafiiha, H. (1968). Effect of smoking and nicotine on adrenocortical secretion. *JAMA*, 203(4), 275–278. <https://doi.org/10.1001/jama.1968.03140040025007>
- Fraga, X. F., Vergara, M., Medina, C., Casellas, F., Bermejo, B., & Malagelada, J. R. (1997). Effects of smoking on the presentation and clinical course of inflammatory bowel disease. *European Journal of Gastroenterology & Hepatology*, 9(7), 683–687.
- Thomas, G. A., Rhodes, J., & Green, J. T. (1998). Inflammatory bowel disease and smoking—A review. *American Journal of Gastroenterology*, 93(2), 144–149. https://doi.org/10.1111/j.1572-0241.1998.144_b.x

Columbia Journal of Health Sciences and Nursing

Research Article

- Kalra, R., Singh, S. P., Savage, S. M., Finch, G. L., & Sopori, M. L. (2000). Effects of cigarette smoke on immune response: Chronic exposure impairs antigen-mediated signaling in T cells. *Journal of Pharmacology and Experimental Therapeutics*, 293, 166–171.
- Mayer, B. (2014). How much nicotine kills a human? Tracing back the generally accepted lethal dose to dubious self-experiments in the nineteenth century. *Archives of Toxicology*, 88(1), 5–7. <https://doi.org/10.1007/s00204-013-1127-0>
- Rang, H. P., Dale, M. M., Ritter, J. M., Flower, R. J., & Henderson, G. (2007). *Rang and Dale's pharmacology* (6th ed., p. 598). Elsevier.
- Shafer, W. G., Hine, M. K., & Levy, B. M. (2014). *Shafer's textbook of oral pathology* (7th ed., Chapter 9, p. 665). Elsevier.
- Parkinson's Disease Foundation. (n.d.). What is Parkinson's disease? http://www.pdf.org/about_pd
- Parkinson's UK. (n.d.). New clues about effects of nicotine in Parkinson's. <http://www.parkinsons.org.uk/content/new-clues-about-effects-nicotine-parkinsons>
- Stop-Tobacco.ch. (n.d.). Soluble nicotine tablets (microtabs). <http://www.stop-tobacco.ch/en/nicotine-replacement-therapy/soluble-nicotine-tablets>
- Nicorette. (n.d.). What is a nicotine lozenge? <https://www.nicorette.com/what-is-a-nicotine-lozenge.html>
- Posselt, W., & Reimann, L. (1828). Chemische Untersuchung des Tabaks und Darstellung eines eigenthümlich wirksamen Prinzips dieser Pflanze. *Magazin für Pharmacie*, 6(24), 138–161.
- Pictet, A., & Rotschy, A. (1904). Synthese des Nicotins. *Berichte der Deutschen Chemischen Gesellschaft*, 37(2), 1225–1235.