

REVIEW PAPER

Antibacterial Property of few Plants used as Chewing Stick

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ABSTRACT

Healthy environment of the oral cavity reflects the health of the oral tissues and teeth. Good oral health and healthy teeth results in overall health and well being of our body. Apart from the impact on nutritional status, poor oral health can adversely affect speech and self-esteem and may lead to different oral diseases.

The use of herbs and plants for cleaning teeth and treating different oral diseases has been practiced in India since time immemorial. Different population of India uses the traditional toothbrush or chewing stick, known as datun. Pencil-sized sticks are fashioned from certain plant-parts and end parts of the plants are chewed until it looks like a brush. The brush-end is used to clean teeth in similar way like the use of a toothbrush. Studies done on different parts of plants reported to have antibacterial property. Most of the oral diseases are due to bacterial infections and it has been well documented that medicinal plants possess significant antibacterial activity against various microorganisms. This paper reviewed the finding relating to the studies of few commonly used plants.

Keywords: Antibacterial, Extract, Chewing stick

INTRODUCTION

The knowledge of the consequences of maintaining oral hygiene is not new for Indians. The great physician and surgeon Sushruta, who lived in the 6th century, described the use of dental fiber pencil by the Indians. The Hindu Vedas contain description of oral hygiene procedures, where twice a day mouth cleaning was suggested. Twigs of various aromatic shrubs are used for cleaning teeth. Traditionally various ayurvedic preparations were also made specifically for dental application to get relief from oral diseases.¹

It has been observed that sticks used for cleaning teeth helps to inhibit the growth of certain oral pathogens associated with development of dental caries, gingival and periodontal diseases.² Natural products have been in use for thousands of years in folk

medicine for several purposes and are now recognised universally as basis for number of critical human health, social, and financial benefits. According to World Health Organisation 70% of Indian population, rely on traditional medicine.³ There are approximately 1,250 Indian plants used for medicinal purpose. Researchers reported that natural photochemical could offer an alternative natural remedy by replacing antibiotics and represents a promising approach in prevention and cure for dental caries and other oral infections.⁴

Few plants used as chewing stick are: Azadirachta Indica (Neem): The taxonomic hierarchy of it is mentioned in Table 1.

Table 1 Taxonomic Hierarchy of Azadirachta indica

Kingdom	Plantae	Plants, planta, vegetal, plants	
Subkingdom	Viridiplantae	Infrakingdom	Streptophyta-land plants
Superdivision	Embryophyta	Division	Tracheophyta--Vascularplants, tracheophytes
Subdivision-	Spermatophytina	Spermatophytes- seed plants, phaneogames	
Class	Mangoliopsida,	Superorder- Rosanae	Order- Sapindales
Family	Maliaceae- Mahogany		Genus- Azadirachta A Juss
Species	- Azadirachta indica A Juss-neem		

Neem grows well in tropical and sub-tropical regions. It is found in India, Bangladesh, Thailand, Nepal and Pakistan. Neem is known as 'arista'. The Sanskrit- meaning of arista is perfect, complete and imperishable.

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Fruit, seeds, oil, leaves, roots, bark and almost every part of the neem tree is bitter and contain compounds with proven antiseptic, antiviral, antipyretic anti-inflammatory, anti-ulcer and antibacterial, antifungal, anti plasmodial, and anti diabetic properties.⁵ The use of neem twigs as tooth brush is an age old method practiced by Indian population. *Neem* contains the alkaloid margosine, resins, gum, chloride, fluoride, silica, sulfur, oils, tannins, saponins, flavenoids, sterols and calcium.⁶ Presence of fluoride in *neem* stick is known to exert an anti-cariogenic action. Silica acts as an abrasive and prevents plaque accumulation. Alkaloids are considered to exert an analgesic action, which also contributes towards oral health. The oils have carminative, antiseptic, and analgesic effects.⁷

Neem mouthwash is observed to inhibit the growth of *S. mutans*. Tannins exert an astringent effect and form a coating over the enamel, thus protecting tooth decay.⁸ Flavenoids have an anti-cariogenic property, which is also present in tea. Wolinsky *et al.*, reported that pretreatment of saliva-conditioned hydroxyapatite with neem-stick extract prior to exposure to bacteria, yielded significant reduction in bacterial adhesion.⁹ Prashant *et al.*, undertook an *in-vitro* study of the effect of mango and neem extract on four micro organisms causing dental caries, *Streptococcus mutans*, *Streptococcus salivarius*, *Streptococcus mitis*, and *Streptococcus sanguis* and emphasized the fact that neem extract produced the maximum zone of inhibition on *Streptococcus mutans* at 50% concentration. In 5% concentration also, neem extract showed some inhibition against all the four species of organisms.¹⁰

Mangifera Indica L (Mango tree): The Taxonomic Hierarchy is mentioned in **Table 2**.

Table 2 Taxonomic Hierarchy of Mangifera Indica L

Kingdom	Plantae – Plants	Subkingdom	Tracheobionta – Vascular plants
Superdivision	Spermatophyta- Seed plants	Division	Magnoliophyta – Flowering plants
Class	Magnoliopsida- Dicotyledons	Subclass - Rosidae	
Order	Sapindales	Family	Anacardiaceae – Sumac family
Genus	<i>Mangifera</i> L. – mango	Species	<i>Mangifera indica</i> L. – mango

Mango tree is found mainly in South Asia and are found in nature as wild mangoes. It may produce fruits for 40 years or more. Mango trees are deep-root evergreen trees that achieve the height of 90 feet and width of 80 feet.

Mango seed kernels contain considerable quantity of phenolic compounds, lipid, unsaponifiable matter and a small quantity of crude protein, but the quality of protein was good because it's rich essential amino acids content with maximum values of leucine, valine and lysine. Eight phenolic compounds were identified within mango seed with tannin and vanillin in highest amount. Stearic acid is the main saturated fatty acid while oleic acid is unsaturated fatty acid. It is a good source of polyphenols.¹¹

Mirghani *et al.*, reported from their study that mango seed kernel showed good antibacterial activity against four strains of gram positive and gram negative bacteria.¹² Prakash *et al.*, reported that antibacterial effect of two variety of mango seed kernel extract against several bacteria has been recognised and considered as one of the most important property associated with their probable biological applications.¹³ In vitro antibacterial activities of ethanol

and methanol extracts of mango bulb showed inhibitions to tested organisms with variable inhibition zones against *Mycobacterium smegmatis*, *Candida albicans* and *Aspergillus niger*.¹⁴

Elongvan *et al.*, found aqueous extract of mango was effective against both *S. mutans* and *L. acidophilus* at high (50%) concentrations.¹⁵

Camellia Sinensis L. (Tea tree):

Table 3 Taxonomic Hierarchy of Camellia sinensis L

Kingdom	Plantae – plants, planta, vegetal, plants	Subkingdom-Viridiplantae
Infra kingdom-	Streptophyta- land plants	Superdivision-Embryophyta
Division-	Tracheophyta-vascular plants	tracheophytes
Subdivision-	Spermatophytina,	
Class-	Mongoliopsida	Superorder-Asteranae, Order-Ericales
Family-	Theaceae – tea	Genus-Camellia L. – tea
Species	<i>Camellia sinensis</i> (L.) Kuntze – tea	

Tea is cultivated worldwide and of the total amount of tea produced and consumed, 78% is black, 20% is green, and 2% is oolong tea. Black tea is popular in western and in south Asian countries such as Sri Lanka and India, while green and oolong teas are used in East Asian countries such as China, Japan, and Taiwan. Assam is the world's largest tea-growing region. Though Assam generally denotes the black teas, the region also produces small quantities of green and white teas as well with their own distinctive characteristics. It contains small amount of xanthine, tannin, flavenoids, quercetin, kaempferol and saponin.¹⁶

In several animal experiments green tea and black tea have been shown to decrease plaque score and caries index. Antibacterial activity of tea polyphenol decreases, when the extent of tea fermentation is long, implying stronger activity in green tea than black tea.¹⁷ Green tea catechins, particularly epigallocatechin gallate EGCG and epicatechin gallate (ECG), have antibacterial activity against both Gram-positive and Gram-negative bacteria.¹⁸ Catechins and theaflavins, polyphenolic compounds derived from tea have been reported to prevent tooth decay and oral cancer.¹⁹ Extracts of tea have shown significant bactericidal activity against methicillin resistant *Staphylococcus aureus* (MRSA) concentrations available in ordinarily brewed tea.²⁰

Vitex Nigundi L (Posotia):

Table 4 Taxonomic Hierarchy of Vitex Nigundi L

Kingdom	Plantae – Plants	Subkingdom	Tracheobionta –vascular plants
Superdivision	Spermatophyta –Seed plants	Division	Magnoliophyta – Flowering plants
Class-	Magnoliopsida – dicotyledons	Subclass-Asteridae	Order-Lamiales
Family-	Verbenaceae – Verbena family		
Genus-	<i>Vitex</i> L. – chastetree		

Posotia (*Vitex negundo*) is an important medicinal plant widely distributed throughout India, Sind, Ceylon, Afghanistan, Philippine Islands and Tropical Africa, Madagascar and China. It is commonly known as five-leafed chaste tree or monk's pepper. It has many flowers with bluish purple colour. The fruit is rounded; when ripe it becomes black and juicy, and about 4 mm in diameter. The plant is bitter. It is used as astringent, antiseptic, anti-inflammatory, antipyretic etc. Though almost all of its parts are used in Ayurveda and Unani medicine, the extracts from its leaves and roots are the most important in the field of medicine and drug.

Phytochemical studies of *Vitex negundi* have afforded several types of compounds, such as volatile oils, terpenes (triterpenes, diterpenes, sesquiterpenes), lignans, flavonoids and steroids.²¹

Study of *vitex nigundo* extracts were evaluated for antibacterial potential against *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli* and *Pseudomonas aeruginosa* strains by Khokra *et al.*²² Crude extract of hexane, chloroform and methanol of leaf and flower of *vitex nigundi* exhibited potential bactericidal properties.²³ Oral administration of *vitex nigundi* claimed to have anti-inflammatory, analgesic and antibacterial property. It is used as a mouthwash to treat periodontal disease and to get relieve from toothache. Srinivas *et al.*, found from their study that crude extract of hexane, chloroform and methanol of leaf and flower of *vitex nigundi* exhibited potential bactericidal properties.²³ Renuka *et al.*, observed that aqueous extract of *Vitex negundo* has more antibacterial property against *staphalococcus Aureus*, E coli and *Klebsilla pneumoni* than the methanol and chloroform extract.²⁴ Nagarsekar *et al.*, concluded from their study that *Vitex negundo* has antimicrobial activity against gram positive microorganisms and suggests that it can be developed as indigenous antimicrobial agent.²⁵

Jatropha Curcas L (Bhotera):

Table 5 Taxonomic Hierarchies of *Jatropha Curcas L*

Kingdom	-Plantae – Plants	Subkingdom	Tracheobionta – vascular plants
Superdivision-	Spermatophyta – Seed plants	Division	-Magnoliophyta – Flowering plants
Class	Magnoliopsida Dicotyledons	Subclass-	Rosidae
Order-	Euphorbiales		
Family-	Jatropha L – Nettlespurge		
Genus	Jatropha carcass L. – Barbados nut		

Jatropha grows in tropical and sub tropical regions. *Jatropha* is not sensitive to day length (flowering is independent of latitude) and may flower at any time of the year. It is a succulent deep-rooted shrub that sheds its leaves during the dry season, which make it well suited for semi-arid conditions.

Jatropha curcas leaves, which show antileukemic activity contain a-amyrin, campesterol, stigmasterol, beta sitosterol and its derivatives. Further, leaves contain rare C-Glucosyl-flavonoids like vitexin and isovitexin. Protein (mostly lectins), and oil, largely of oleic acid, linoleic acids, curcacin, arachidic, myristic, palmitic, and stearic acids are also reported.²⁶

In various study, it is reported that *J. curcas* contains rare natural component, like cyclic peptides, which are known to be strong antibacterial, anticancer and immunosuppressive drugs. The two major cyclopetides isolated from *J. curcas* latex consists of nine amino acids. The people of Africa, Asia and Latin America use it in medicinal folklore to cure various diseases. *Jatropha* have been popular to cure stomachache, toothache, swelling, inflammation, leprosy, dysentery, vertigo, anemia, diabetes, as well as to treat HIV, ringworm, ulcers, malaria, skin diseases, bronchitis, asthma and as an aphrodisiac.²⁷ Preparations of all parts of the plant are used in traditional medicine and veterinary purposes.⁵⁰ Methanol, ethanol and water extract of the plant showed varying degree of antibacterial activities against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Streptococcus faecalis*, *Klebsiella pneumonia* etc.²⁹ The anti-inflammatory activity of paste form of *J. curcas L.* root powder is

confirmed through the investigation conducted on albino mice.³⁰

CONCLUSION

Worldwide twigs of many trees have been in use for teeth cleaning from long back. During cleaning anti-microbial constituents may get released in the oral cavity and protect teeth and its associated parts against oral microbes. Some of the constituents of these plants have already established and gained popularity because of its antibacterial properties against various organisms and fungi and many more are yet to be experimented and discovered.

REFERENCES

1. Sushrata. An English translation of Shuruta Samhita. Sutrasthanam. vol 1, Bhisgratna KK. Calcutta No 10 Kashi Ghose lane: Published by author; 1907.
2. Enwonwu CO. Socio-economic factors in dental caries prevalence and frequency in Nigerians. An epidemiological study. Caries Res 1974;8:155–71.
3. World Health Organization (WHO) National Policy on Traditional Medicine and Regulation of Herbal Medicines. Geneva: 2005. Report of WHO global survey.
4. Singh J, Kumar A, Budhiraja S, Hooda A. Ethnomedicine : Use in dental caries. Braz J Oral Sci 2007;6(21):1308-12.
5. Subapriya R, Nagini S, Medicinal properties of Neem leaves: A Review Source, Current Med Chem -Anti-Cancer Agents 2005;5(2):149-156.
6. Biswas K, Chattopadhyay I, Banerjee RK, Bandyopadhyay U. Biological activities and medicinal properties of neem (*Azadirachta indica*) Curr Science 2002;82:1336–1345.
7. Abhishek S, Sankhla B, Hongal SMS, Thanveer K, and Ajithkrishnan CG. Effect of Traditionally Used Neem and Babool Chewing Stick (Datun) on Streptococcus Mutans: An In-Vitro Study. J Clin Diagn Res 2014;8(7):ZC15–ZC17.
8. Khalid A, Taha RAL. The Natural Toothbrush. World health forum 1995;16:206-10.
9. Wolinsky LE, Mania S, Nachnani S, Ling S. The inhibiting effect of aqueous *Azadirachta indica* (Neem) extract upon bacterial properties influencing in vitro plaque formation. J Dent Res 1996;75:816–822.
10. Prashant GM, Chandu GN, Murulikrishna KS, Shafulla MD. The effect of mango and neem extract on four organisms causing dental caries: Streptococcus mutans, Streptococcus salivarius, Streptococcus mitis, and Streptococcus sanguis: an in vitro study. Indian J Dent Res 2007;18:148–151.
11. Karunanithi B, Bogeshwaran K, Tripuraneni M, Reddy SK. Extraction of Mango Seed Oil From Mango Kernel. International J Eng Res Dev 2015;11(11):32-41.
12. Mirghani MES, Yosuf F, kabbashi NA, Vejayan J, Yosuf ZBM. Antibacterial activity of Mango kernel extracts. J Appl Sci 2009;9(17):3013- 3019.
13. Prakash A, Keerthana V, Kumar JC, Kumar R Agrawal DC. Antibacterial Property of Two Different Varieties of Indian Mango (*Mangifera indica*) Kernel Extracts at Various Concentrations against some Human Pathogenic Bacterial strains. Int Res J Biological Sci 2013;2(4):28-32.