

MINI REVIEW

Ethnopharmacological Reflections in Oral Health: A Review on Current Concepts

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ABSTRACT

Healing power of plants had been explored from ancient time. Interest in the study of medicinal plants as a source of pharmacologically active components is increasing worldwide. Medicinal plants contain bioactive agents, which have fewer side effects. Hence, the incorporation of ethnopharmacology in dental practice will lead to the development of novel preventive and therapeutic strategies for oral health in a holistic way. This review is focused on description of the certain medicinal plants in the maintenance of oral health.

Keywords: Ethnopharmacology, Holistic treatment, Medicinal plants, Oral health.

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INTRODUCTION

Oral health is an integral part of general health and relates to the quality-of-life that extends beyond the functions of the craniofacial complex. Use of modern medicine in the prevention and treatment of a variety of oral diseases is decreasing nowadays because of side effects and drug resistance.¹ Hence, the search for alternative products continues, which are more holistic in nature. The ethnopharmacological approach by using natural phytochemicals isolated from medicinal plants are considered to be a safe, effective, and good alternative to synthetic drugs.^{2,3} The exploration of botanicals used in traditional medicine may lead to the development of novel preventive and therapeutic strategies for oral health. This review is focused on description of the certain medicinal plants in the maintenance of oral health in holistic way.

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Ginger

Ginger is a common spice which has many medicinal properties,⁴ ginger root (*Zingiber officinale*) and its main polyphenolic constituents (gingerols and zerumbone) have antioxidant, anti-inflammatory and anticarcinogenic activity. It is reported that the ethanol and n-hexane extracts of ginger exhibited antibacterial activities against three anaerobic Gram-negative bacteria, *Porphyromonas gingivalis*, *Porphyromonas endodontalis*, and *Prevotella intermedia*, which are causative agents for periodontal diseases. It is effective against viral disease, such as herpes and *Candida* infections. In xerostomia conditions, ginger helps to promote salivation.⁴⁻⁷

Neem (*Azadirachta indica*)

Neem is a popular medicinal plant from traditional time which has analgesic, anti-inflammatory, antioxidant and immunoregulatory effect. It is effective against many bacterial, viral, and fungal infections. Because of antimicrobial and antiadherence property, neem is used to treat gingival and periodontal diseases.⁸ Inhibitory effects of neem against *Enterococcus faecalis*, it is used as a herbal endodontic irrigant. Its biocompatibility to human periodontal ligament fibroblasts is an important factor favoring its clinical use.^{8,9}

Tulsi (*Ocimum sanctum*)

This medicinal plant was using for various disorders from ancient times. Its leaf extract is rich in essential oils and eugenol, which make it as an antifungal agent. Due to its eugenol content, it act as a potent cyclooxygenase 2 inhibitor. Chemicals, such as carvacrol and terpene in Tulsi extract exhibit antibacterial property. It is also reported that 4% Tulsi extract has maximum antimicrobial activity against *Streptococcus mutans*, which indicates its anticaries activity.^{10,11}

Noni (*Morinda citrifolia*)

It is also called as Indian Mulberry having therapeutic effects, such as antibacterial, anti-inflammatory, antiviral, antitumor, anthelmintic, analgesic, hypotensive, and immune-enhancing effects. Major components in the Noni plants are scopoletin, octanoic acid, potassium, vitamin C, terpenoids, alkaloids, anthraquinones, G-sitosterol, carotene, vitamin A, flavone glycosides, linoleic acid,

alizarin, amino acids, aucubin, L-asperuloside, caproic acid, caprylic acid, ursolic acid, rutin, and a putative proxeronine. Noni juice is used as a herbal endodontic irrigant, which is less harmful compared to sodium hypochlorite.¹²⁻¹⁴

Burdock (*Arctium lappa*)

This medicinal plant exhibits antibacterial, antifungal, and antioxidant action.¹⁵ Due to its antimicrobial potential against oral microorganisms, specifically those associated with endodontic infections, it is used in oral diseases.^{15,16}

Triphala (*Emblica officinalis*)

It is a combination of three herbals, such as Amalaki (*Emblica officinalis*), Bibhitaki (*Terminalia bellirica*) and Haritaki (*Terminalia chebula*).¹⁷ It has got anti-inflammatory, analgesic properties, and is effective in decreasing dental caries and gingival diseases. Its fruit is rich in citric acid, which may aid in removal of smear layer, thereby acting as chelating agent and also found to be alternative to sodium hypochlorite for root canal irrigation.^{17,18}

Garlic (*Allium sativum*)

Garlic has been used as a flavor food and it has medicinal benefits, because it contains a sulfur-rich derivative of cysteine.^{19,20} *In vitro* and *in vivo* studies showed that garlic contains allicin as active agent and it is effective against *S. mutans*. It has antibacterial and immune regulatory functions. Allicin destroys cell wall and cell membrane of root canal bacteria, so this can be used as intracanal irrigant.^{21,22} Planktonic growth of the tested Gram-negative periopathogenic species *Aggregatibacter actinomycetemcomitans* and *Fusobacterium nucleatum* was also inhibited by allicin.^{21,23}

Bloodroot (*Sanguinaria canadensis*)

Bloodroot is a perennial, herbaceous flowering plant which contains the chemically reactive iminium ion, which is probably responsible for its antimicrobial activity.²⁴ It was proved that sanguinarine at a concentration of 16 microgram per milliliter completely inhibit 98% of microbial isolates from human dental plaque and that sanguinarine and zinc act synergistically in suppressing the growth of various oral strains of streptococci. Many studies reported that alkaloid has a long retention period in mouth, favoring more resistance to gingivitis.^{24,25}

Green Tea (*Camellia sinensis*)

Green tea is rich in health-promoting flavonoids (which account for 30% of the dry weight of a leaf), including catechins and their derivatives.²⁶ The most abundant

catechin in green tea is epigallocatechin-3-gallate, which is thought to play an important role in the green tea's anticancer and antioxidant effects. By decreasing inflammation, preventing bone resorption and limiting bacterial growth, green tea enhances periodontal health.²⁷ It also inhibit the production of toxic metabolites of *P. gingivalis*.^{28,29}

Licorice (*Glycyrrhiza glabra*)

This plant root exhibited reduction of cariogenic bacteria in oral cavity when applied on lollipop and also effective in treatment of lichen planus.^{30,31} It has also shown greater biocompatibility with fibroblasts cells compared to calcium hydroxide.³²⁻³⁴

Turmeric (*Circuma longa*)

Turmeric contains active compounds, such as curcuminoids, cyclocurcuminoids, tumerones, and essential oils. Dried turmeric powder has antioxidant, anti-inflammatory and antimutagenic actions. In dentistry, it is used to reduce postsurgical inflammation. It was proved that turmeric has anticariogenic action against *S. mutans*. Mouthwashes are prepared with turmeric as an ingredient because of its anti-inflammatory and antimicrobial action.³⁵⁻³⁷

Tender Coconut Water (*Cocos nucifera*)

Many studies showed that coconut water contains amino acids, minerals, vitamins, growth hormones, and various enzymes.³⁸ Its electrolyte content is similar to human plasma so, it is used as natural sports drink for oral dehydration. It enhances immune function, possesses antiaging properties, decreases swelling, relieve spasm, used as a root canal irrigant (antiviral, antifungal, and antimicrobial properties), and storage media for avulsed tooth.³⁸⁻⁴⁰

Orange Oil

It is mainly used in dissolving endodontic sealer and gutta-percha softening in dentistry. Originally, chemical like xylene and chloroform were used for this purpose. However, this oil, which is composed mostly of D-limonene is a better alternative. It also has long-chain aliphatic hydrocarbon alcohols, aldehydes, such as octanal.^{41,42}

Aloe Barbadosis (*Aloe Vera*)

Aloe vera exhibits anti-inflammatory, antibacterial, antifungal, antiviral, and wound healing properties. Aloe vera gel inhibits the growth of *Streptococcus pyogenes* and *S. faecalis*.⁴³ It has also got antioxidant effects and free radical scavenging activity. Aloe vera contains six

antiseptic agents: Lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenols, and sulfur. In dentistry, aloe vera preparations are used to treat mucositis, lichen planus, aphthous stomatitis, and herpes infection.^{43,44}

German Chamomile (*Matricaria chamomilla*)

A popular medicinal plant, which has analgesic, anti-inflammatory, and antimicrobial properties. It is used in various mouthwashes and dentifrice to improve oral health. Extract of this plant has the ability to decrease inflammatory response, enhance granulation, and regeneration of tissues after topical application, which in turn enhance its wound healing capacity.^{45,46}

Cinnamon

This common spice has antiseptic, astringent, and fungicidal action. Extract of cinnamon contains volatile oils, tannin, proteins, calcium oxalate, starch, and minerals. It has antimicrobial activity against *S. mutans* and it decreases the viable bacterial count. It also exhibited the capacity of altering salivary flow and salivary pH regulation.⁴⁷

Grape Seed Extract

Grape seed extract contains proanthocyanidins, which are potent antioxidants and are known to possess anti-inflammatory, antibacterial, and immune-stimulating effects. It strengthens collagen-based tissues by increasing collagen cross-links. Studies showed that it is a potent remineralizing agent in primary artificial enamel lesions.^{48,49}

Cardamom

Cardamom belongs to Zingiberaceae family and it is used to treat infections of teeth and gums from the traditional time. Oil from its seeds is used in the treatment of toothache. Studies showed that it is effective against *S. mutans* and *Candida albicans*, which are common oral pathogens.^{50,51}

Tea Tree (*Melaleuca alternifolia*)

Tea tree oil's major active component is terpinen-4-ol (typically 30–40%), which is responsible for its antibacterial and antifungal properties. It has a mild tissue solvent action, promoting its applications in root canal treatment for dissolving the necrotic pulp tissue. It is a promising endodontic irrigant.^{52,53}

Myrrh (*Commiphora opobalsamum*)

This medicinal plant, which has astringent and antiseptic property are used to treat various disease. It promotes wound healing, reduce mouth infections, and prevent the

development of dental plaque. It is also proved that oral rinse or brushing with myrrh will reduce gum diseases.^{54,55}

Cranberry

From ancient time, cranberry is used for medicinal purpose as it contains numerous biologically active compounds, such as flavonoids, phenolic acids, anthocyanins, and condensed tannin.⁵⁶ Cranberry extracts are rich source of polyphenols and flavonoids. It is used to prevent dental decay because of its ability to inhibit colonization and acid production of *S. mutans*. It inhibit the adherence and coaggregation of periodontal pathogens.^{57,58}

Rosmarinus officinalis (Labiatae)

It is a small shrub whose leaves have small glands containing essential oils which have inhibitory effect on the adherence of *S. mutans*.⁵⁹ Anticariogenic action of this plant is due to its potential in reducing bacterial growth and glucan producing capacity. The alcoholic extract proved to be efficient in inhibiting the adherence of *Streptococcus mitis* also.⁵⁹⁻⁶¹

Propolis

Propolis, a natural antibiotic, is a resinous yellowish-brown to dark-brown substance collected by bees (*Apis mellifera*) from tree buds and is mixed with secreted beeswax which contains flavonoids, steroids, sugars, and amino acids.⁶² Propolis exhibits several pharmacological properties, such as antimicrobial, anti-inflammatory, healing, anesthetic, cytostatic, and cariostatic properties. It has been used for the treatment of aphthous ulcers, *Candida* infection, acute necrotizing ulcerative gingivitis, gingivitis and periodontitis, and, recently as a storage medium for avulsed teeth to maintain the viability of the periodontal ligament cells.^{63,64} The anti-inflammatory property of propolis is due to the presence of caffeic acid and phenethyl ester in propolis. It is also effective as an endodontic irrigant and herbal root canal medicament.⁶³

Lemon Grass Oil

The essential oil extracted from this plant's leaves contains main components of citral, geraniol, methyleugenol, myrcene, and citronellal which exhibit antibacterial, anti-inflammatory, and antifungal properties.⁶⁵ Studies have been conducted to evaluate the essential oil extracted from this plant to be effective against *S. mutans* and *Lactobacillus casei*.⁶⁵

Psidium Guajava (Myrtaceae)

Commonly called guava, belongs to the family Myrtaceae has been used traditionally to maintain oral hygiene. Its

important constituents are vitamins, tannins, phenolic compounds, flavonoids, sesquiterpene alcohols, and triterpenoid acids.⁶⁶ It has been reported that the guava pulp has a rich supply of carotenoids (beta-carotene, lycopene, and beta-cryptoxanthin), vitamin C, and polyphenol and it also has anti-inflammatory, antioxidant, antidiarrheal, and antimutagenic properties. Leaf extract of guava contains guaijaverin which inhibit the growth of *S. mutans* and *S. aureus*, thus proving its anticaries potential. Ethanolic leaf extracts have shown antimicrobial activity against *E. faecalis*.^{66,67}

Pomegranate (*Punica granatum*) used in traditional medicine has active compounds, such as anthocyanins, glucose, ascorbic acid, ellagic acid, gallic acid, caffeic acid, catechin, epigallocatechin, quercetin, rutin, iron, and amino acids.⁶⁸ Toothpaste obtained from the alcoholic extract of *P. granatum* showed activity against cariogenic *S. mutans*, *Streptococcus sanguinis*. The antibacterial agents in Pomegranate-hydrolysable tannins form complexes of high molecular weight with soluble proteins, increase bacterial lysis, and interfere with bacterial adherence to tooth surfaces. The anti-inflammatory effect is due to its immunoregulatory activity over macrophages and T and B lymphocyte subsets. The flavonoids present in the pomegranate juice have shown antibacterial action against microorganisms causing gingivitis. A 10% topical pomegranate gel has been shown to relieve pain from recurrent aphthous stomatitis and reduce time for complete healing of ulcers.⁶⁸⁻⁷⁰

Fenugreek

Its medicinal properties are due to its unique phytochemicals, such as polysaccharides, complex carbohydrates, galactomannans, steroidal sapogenins, amino acids, lysine, fibre, protein, fatty acids, vitamin C, niacin, and potassium.⁷¹ Fenugreek showed its anti-inflammatory property probably due to the presence of saponins and flavonoids. Flavonoids act as antioxidant and potential inhibitors of cyclooxygenase, lipoxygenase, and nitric oxide synthase. It is also suggested that the presence of diosgenin in fenugreek plays a key role in producing anti-inflammatory action probably by acting as the precursor of various steroid hormones, such as progesterone and cortisone that prevents inflammation. An infusion of fenugreek leaves is used as a gargle for recurrent mouth ulcers.^{72,73}

Calendula officinalis

Commonly known as pot marigold, is a medicinal herb with excellent antimicrobial, wound healing, and anti-inflammatory activity.⁷⁴ It is rich in quercetin, carotenoids, lutein, lycopene, rutin, ubiquinone, xanthophylls, and

other antioxidants. It is reported that *C. officinalis* is effective in chronic gingivitis, presenting significant improvement in the gingival tissues, and cause reduction of biofilm formation by *S. mutans* and fungistatic actions against *C. albicans*.⁷⁵⁻⁷⁷

Papain

From the latex of the leaves and fruits of the green adult papaya, proteolytic enzyme-papain is isolated. It has got anti-inflammatory, bacteriostatic, bactericidal action, and is effective against gram positive and gram negative organisms.⁷⁸ Papain acts as a chemical debridement anti-inflammatory agent, which does not damage healthy tissues and accelerates cicatrization process. Papain acts only in infected tissue as it lacks a plasmatic antiprotease called alpha-1antitrypsin. The absence of this enzyme in infected tissues allows papain to break the partially degraded collagen molecules only, contributing to the degradation, and elimination of fibrin "mantle" formed by carious process.^{78,79} It is a promising agent in minimum intervention dentistry.

Clove (*Syzygium aromaticum*)

Clove is a popular spice with potent antiseptic, stimulant and antiemetic action. Clove oil is used for gum and teeth pain from ancient times. It is also used to prevent halitosis.⁸⁰ Eugenol in clove essential oil has analgesic and antiseptic properties. The eugenol and other constituents of clove, such as vanillin and iso-eugenol, have also been reported to have antimicrobial effect.^{80,81}

Nutmeg (*Myristica fragrans*) Nutmeg is widely used in traditional medicine with antithrombotic, antifungal and anti-inflammatory action. Its main constituents include alkylbenzenes (myristicin, elemicin, safrole, etc.); terpenes (α -pinene, β -pinene, myristic acid, trimyristin); and neolignans (myrislignan and macelignan).⁸² The active compound macelignan, isolated from *M. fragrans*, also presents an antibacterial activity against *S. mutans* and other oral microorganisms, such as *Streptococcus sobrinus*, *Streptococcus salivarius*, *S. sanguinis*, *Lactobacillus acidophilus*, and *L. casei*, which indicates that it can be used as a natural antibacterial agent in oral hygiene products.^{82,83}

CONCLUSION

Restoring and maintaining good health of the oral cavity in holistic way can empirically solve our overall quest for well-being. There is a long and venerable history with the use of plants to improve dental health and promote oral hygiene. The judicious use of ethnopharmacological approach in dental practice can serve as a valuable adjunctive in future. However, there exist only a limited

information about quality, safety, and greater efficiency of these products for use in dentistry. As most of the studies are carried out *ex vivo*, more animal and human studies have to be conducted to determine their effectiveness, side effects, and toxicity and drug interactions.

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