



Application of Spices in Dentistry- A Literature Review

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Abstract:

Diseases of the oral cavity are very prevalent; they can occur in the young and the old and carries no gender predilection. Commonest oral diseases are dental caries, periodontitis and oral candidiasis. All these diseases are predominantly caused by micro organisms and their treatment involves anti microbials. Excessive usage of these drugs can lead to development of resistance by the microbes and also, these drugs can lead to many unnecessary side effects, like headaches, GIT disturbances, nausea, vomiting etc. Modern medicine is moving towards researching herbal remedies for medical treatment, to prevent unnecessary bacterial resistance.

Spices are edible products of plants used to improve the aroma and flavor of food. In the beginning of 20th century, they were employed in various traditional medicine systems to cure various diseases. Various studies done on the property of these spices also prove their medicinal properties. This article reviews the uses of select spices like *Curcuma longa*, *Zingiber officinale*, *Piper Nigrum*, *Elettaria cardamom*, *Cinnamomum Vernum*, *Syzygium aromaticum*, *Trigonella foenum graecum*, *Myristica fragrans* and their applications in dentistry.

Keywords: Spices, dental caries, oral candidiasis, common oral problems, herbal remedies

AIM OF THE LITERATURE REVIEW

The excessive usage of anti microbials is leading to drug resistance of microbes and also many unwanted side effects in patients. Modern medical research is moving towards natural remedies for treating common ailments, as the side effects are minimal and the patient is treated in a holistic way. The aim of this literature review is to list the application of common household spices and their applications in dentistry.

INTRODUCTION

Oral diseases like dental caries, periodontitis, oral tissue lesions, infections and oral cavity cancers are major health problems worldwide ¹. Oral health influences general quality of life and poor oral health is linked to systemic conditions. In some countries dental diseases are the fourth most expensive diseases to treat. The oral cavity is

colonized by 750 species of microbes and a number of these are implicated in oral diseases. ²

Dental caries is an infectious microbiological disease that results in localized dissolution and destruction of the calcified tissues and the etiology of dental caries and periodontal diseases has been linked to microbes. Research has shown that caries is a site specific dietomicrobial disease which requires interaction with host, substrate and cariogenic bacteria, its primary pathogens are *Streptococcus mutans* and other non streptococcus species like *Lactobacillus*, *actinomyces* and *Veillonella* species³. Current treatment for dental caries is operative which involves removing the decayed tooth structure and filling it with resin cement. Research is being carried out for preventing dental caries in young children with topical anti microbial agents.

Oral candidiasis is a condition where the fungus *Candida Albicans* accumulates in the linings of the mouth. It can cause a cottony white lesion on the tongue or the inner cheeks. They are painful

lesion and can bleed slightly when scraped. The condition occurs mostly in immunocompromised individuals. The method of treating candidiasis includes treatment with Anti fungal drugs, its common side effect include abdominal pain, diarrhea, nausea.

Periodontitis is an inflammatory disease of the supporting tissues of the teeth caused by specific microorganisms or groups of specific microorganisms, leading to destruction of the periodontal ligament and alveolar bone, Etiology of periodontal diseases are pathogens which include *porphyromonas gingivalis*, *Actinobacillus sp.*, *Tannerella forsythensis*, *Treponema denticola* and *fusobacterium*. Given the current trend, emerging resistance to antimicrobial agents used in dentistry and adverse effects like staining of teeth and restoration has also been reported. Thus the need to find alternative solutions arises. Finding healing powers from plants is an ancient idea. Reports of plants used for medicinal purposes dates back to the Bible. Phytochemicals or biologically active ingredients have been isolated from plants, flower, fruits and even spices. Spices are dried seeds, fruit, root and bark, flower of plant or herb used in small quantities for flavor, color or preservative and forms an important part in culinary art to improve the flavor and aroma of food⁴. Traditional systems of medicines like ayurveda employ the use of these spices to treat various diseases, based on practical experiences passed on from generations. Research done on the chemicals present in these spices have confirmed their use in medicine⁵. This paper reviews the use of *Curcuma longa*, *Zingiber officinale*, *Piper Nigrum*, *Elettaria cardamom*, *Cinnamomum Vernum*, *Syzygium aromaticum* *Trigonella foenum graecum*, *Myristica fragrans* and their applications in dentistry.

TURMERIC

Botanical name: *Curcuma longa*

Family: *Zingiberaceae*

Active components: curcuminoids, cyclocurcuminoids, tumerones, essential oils⁶

Pharmacological actions:

Anti oxidant, Anti inflammatory, anti mutagenic, anti platelet, protects the liver, reduces stiffness in symptoms of arthritis and tendonitis, inhibits HIV in test tubes, Used to alleviate post surgical inflammation, Antibacterial, anti parasitic, facilitates process of scabbing in chickenpox, for treatment of otorrhoea, Treats indigestion⁷.



Figure 1 – Turmeric (*Curcuma longa*)

Applications in dentistry:

- Pit and fissure sealants:

A pit is a small pinpoint depression located on the junction of developmental groove and fissures are deep clefts between adjoining tooth cusps. A pit and fissure sealant is a thin plastic coating placed on the posterior tooth surface forming a mechanical barrier between tooth and oral environment. A brand of tinted pit and fissure sealant is produced containing a polymerisable resin and Annatto extract, turmeric extract, and β -Apo-8.-Carotenol⁸

- Plaque detector:

Periodontal disease is due to bacteria present in dental plaque, dental plaque refers to a gelatinous mass of bacteria adhering to tooth surface which is invisible to naked eye. They are stained with plaque staining agents which contains various dyes to determine their exact location. This dental-plaque detection system

includes a dental-plaque staining agent, which contains at least one selected from yellow pigment of beni-koji, turmeric extracts, and curcumin; and a light-emitting apparatus, which outputs light having a wavelength within a range of 250 to 500 nm. The dental-plaque detection method includes application of the plaque detector and irradiating the oral cavity with light of the same wavelength⁹.

- Dental problems:

Turmeric can be used in following ways offer relief from dental problems:

- Rinsing the mouth with turmeric water (boil 5 g of turmeric powder, two cloves, and two dried leaves of guava in 200 g water) gives instant relief.
- Massaging the aching teeth with roasted, ground turmeric eliminates pain and swelling.
- Applying the powder of burnt turmeric pieces and bishop's weed seed on teeth and cleaning them makes the gums and teeth strong¹⁰.
- Applying a paste made from 1 tsp of turmeric with ½ tsp of salt and ½ tsp of mustard oil provides relief from gingivitis and periodontitis. Rub the teeth and gums with this paste twice daily.
- Studies by Kwang-Hee lee *et al* show that Curcuma longa essential oil inhibits *S.mutans* acid production and growth at concentrations from 0.5 to 4 mg/mL, this oil also inhibited the adhesion to saliva coated hydroxyl apatite beads at concentrations higher than 0.5 mg/mL¹¹.
- Jeon *et al* showed that fractions of turmeric separated using methanol extract showed inhibitory effects on the virulence properties of *S. mutans* biofilms, such as bacterial adherence, acidogenicity and aciduricity¹²

- Curcumin also exhibits phototoxic effects against gram positive and gram negative bacteria, they can be used for photo dynamic therapy in root canal treatment¹³

- Studies also show that curcumin inhibits *E.fecalis* biofilm formation, Showing that it has potential to be used as an irrigant for root canal treatment¹⁴

GINGER

Botanical name: *Zingiber officinale*

Family: *Zingiberaceae*

Active components: Volatile oils, Shogaols, Gingerols, Diarylheptanoids¹⁵

Pharmacological actions:

Anti emetic, to stimulate appetite and improve digestion, analgesic, antipyretic, expectorant, in treatment of migraines and headaches, piles, cholera, colicky pain¹⁶



Figure 2: Ginger (*Zingiber officinale*)

Applications in Dentistry

- As a sialogogue to promote salivation
- For treatment of toothache and gingivitis
- Antifungal : Studies done by Atai *et al* show that ethanol extract of ginger was effective on *Candida albicans* at concentrations of 1:5 , this shows that ginger extracts can be used in treatment of oral candidiasis¹⁷
- Anticancer effect: Studies done by Hsu *et al* show that a phenolic compound, 6 paradol, showed a dose dependent cytotoxicity against oral carcinoma cell line with caspase 3 mediated apoptosis.¹⁸

- Roopal V Patel demonstrated that combined extracts of ginger and honey showed maximum inhibitory concentration against *S.mutans* and *S.aureus* and were least effective against *L.acidophilus* in comparison with gentamycin, showing , there is a significant synergistic effect of antimicrobial activity from the combination of ginger and honey, against isolates from carious teeth.¹⁹

- Cinnamon and ginger have excellent antimicrobial activity on the growth of *Mutans streptococci* and *lactobacilli*, but their effects are more on lactobacilli than mutant streptococci. Cinnamon should be prescribed prior to ginger because it has more antibacterial activity on the growth on both bacteria types even in small concentration (50mg/ml).²⁰

BLACK PEPPER

Botanical name: *Piper Nigrum*

Family: *Piperaceae*

Active components: Volatile oils, Piperine, pinenes, d-limonene, caryophylline²¹

Pharmacological actions:

Improve appetite, cure cold, cough, and dyspnea, diseases of the throat, intermittent fever, colic, dysentery, worms and piles²²

Applications in dentistry

- For treatment of oral abscesses, tooth decay and tooth aches.
- Jayashankar *et al* showed that brushing with a herbal toothpaste with *Piper nigrum*, *syzyium aromaticum*, *Ziniber officinale* as one of the major components for a period of 12 weeks ,showed a significant reduction in the gingival bleeding, oral hygiene and salivary anaerobic bacteria count and overall improvement in oral hygiene²³

- Yona Siddhartha *et al* showed that pepper extracts affected the growth extracts of *S.mutans* in vitro thus proving its antibacterial properties²⁴



Figure 3: Black pepper (*Piper Nigrum*)

CARDAMOM

Botanical Name: *Eletteria cardamom*

Family: *Zingiberaceae*

Active components: Volatile oils and non volatile ether

Pharmacological actions:

Flatulence, indigestion, carminative, diuretic, digestive, kidneys and urinary disorders



Figure 4: Cardamom (*Eletteria cardamom*)

Applications in dentistry

- To treat infections of teeth and gums
- Oil of its seeds is used in the treatment of toothache²⁵
- Extracts of *E.cardamom* showed anti microbial activity against *S.mutans* and *C.Albicans*, which are the primary pathogens of dental caries and oral candidiasis²⁶
- The n-hexane extract of *E.cardamom* exhibits broad spectrum antimicrobial activity against *S.mutans*, *Propionibacterium acnes*, *Pityriosporum ovale*, and *Trichophyton*

mentagrophytes. ,microorganisms that cause dental caries, acne and dandruff²⁷

- The in vitro antimicrobial activity of *Amomum subulatum* and *Elettaria cardamomum* fruit extracts were studied against *Streptococcus mutans*, *Staphylococcus aureus*, *Lactobacillus acidophilus*, *Candida albicans* and *Saccharomyces cerevisiae* .The most susceptible microorganisms were *S.aureus* was followed by *C.albicans*, *S.cerevisiae* and *S.mutans*.²⁸

CINNAMON

Botanical name: *Cinnamomum Vernum*

Family: *Lauraceae*

Active components: volatile oil, fixed oil, tannin, resin, proteins, cellulose, pentosans, mucilage, starch, calcium oxalate and mineral elements. The volatiles are monoterpenes, sesquiterpenes and phenylpropenes.²⁹

Pharmacological actions:

Anti pyretic, antiseptic, astringent, balsamic, carminative, diaphoretic, fungicidal, stimulant, stomachic.



Figure 5: Cinnamon (*Cinnamomum Vernum*)

Applications in dentistry:

- Studies by Shaymaa Al Joubori showed that ultrasonic and oil cinnamon extracts have high activity against *Streptococcus mutans* and decreased the viable bacterial count. They were also shown to increase salivary Ph and flow rate.³⁰
- M Vinitha *et al* performed studies on *Cinnamomum vernum* , *Curcuma longa* and

Myristica fragrans, and demonstrated that *Cinnamomum verum* possessed a strong anti candidal effect at concentrations of 25 to 50 mg/L, and both *Curcuma longa* and *Myristica fragrans* did not show any anti candidal activity at 25 to 50 mg/L³¹

- A study by Lalith Kumar D chaudhari on 9 essential oils, wintergreen oil, lime oil, cinnamon oil, spearmint oil, peppermint oil, lemongrass oil, cedar wood oil, clove oil and eucalyptus oil against *S.mutans* showed that Cinnamon oil showed highest activity against *Streptococcus mutans*.³²

CLOVE

Botanical name: *Syzygium aromaticum*

Family: *Myrtaceae*

Active components: Volatile oil, non volatile ether, crude fibre carbohydrates, mineral matter

Pharmacological actions:

Pesticidal and nematicidal, molluscicidal activity, enzyme activity, Anti platelet activity, antiviral activity, anticancerous activity.³³



Figure 6: Cloves (*Syzygium aromaticum*)

Applications in Dentistry

- Anti microbial: Cai L reported that MeOH extract of *S. aromaticum* inhibited the growth of periodontal oral pathogens, including *Porphyromonas gingivalis* and *Prevotella intermedia*.³⁴ .Pachori *et al* demonstrated that soaked and boiled extracts of cloves showed a

positive anti microbial activity against *S.mutans* and *C.Albicans* ³⁵

- **Anti fungal:** Pinto *et al* have reported the antifungal activity of clove oil from *Syzygium aromaticum* against *Candida*, *Aspergillus* and dermatophyte species. Studies done by Ahmad *et al* also show that clove oil possess strong antifungal activity against opportunistic fungal pathogens such as *Candida albicans*, *Cryptococcus neoformas* and *Aspergillus famigatus*. ³⁶

- **Anti oxidant:** Eugenol has a scavenging effect i.e., it helps to prevent cell and tissue damage that could lead to disease, It also acts an enzyme activator and this property is effectively used in treating toothaches. ³⁷

- The antimicrobial activity of clove and clove bud oil were investigated by agar well diffusion method against five dental caries causing microorganisms namely *Streptococcus mutans*, *Staphylococcus aureus*, *Lactobacillus acidophilus* (bacteria), *Candida albicans* and *Saccharomyces cerevisiae* (yeast). It was finally concluded that clove oil emerged as the potent agent exhibiting even much higher antibacterial and antifungal activity than the standard antibacterial and antifungal drugs ciprofloxacin and amphotericin-B respectively. ³⁸

FENUGREEK

Botanical name: *Trigonella foenum graecum*

Family: *Leguminosae*

Active components: Volatile oils, Steroid glycosides, saponins, alkanoids, flavanoids, miscellaneous compounds

Pharmacological actions:

Aphrodisiac, astringent, demulcent, carminative, stomachic, diuretic, emmenagogue, emollient, expectorant, lactagogue, restorative, and tonic. It

is used for a variety of health conditions like digestive problems, bronchitis, tuberculosis, fevers, sore throats, wounds, arthritis, abscesses, swollen glands, skin irritations, diabetes, and loss of appetite, ulcers and menopausal symptoms, as well as in the treatment of cancer. ³⁹



Figure 7: Fenugreek (*Trigonella foenum graecum*)

Applications in dentistry

An infusion of fenugreek leaves is used as a gargle for recurrent mouth ulcers

NUTMEG

Botanical name: *Myristica fragrans*

Family: *Myristicaceae*

Active components: terpenoids, fatty acids, phenolic acids, lignans, neolignans and miscellaneous compounds.

Pharmacological actions:

Indigestion and stomach problems, used in case of massage oil in case of cold and skin laxity, used when fever and diarrhea occur simultaneously, hallucinogen, ⁴⁰



Figure 8: Nutmeg (*Myristica fragrans*)

Applications in dentistry:

- Routine teeth cleaning with Jaiphah (local name) powder benefits dental and gum problems. ⁴¹
- Oljadic *et al* showed nutmeg extracts has effect on different types of oral sores and anti inflammatory activity and anti microbial properties ⁴²
- Shima Thanoon *et al* showed reported that 5% concentration of nutmeg oil has a good anti microbial action against *staphylococcus aureus* and can be incorporated in floss, wedges and root canal irrigant, but not against oral ulcer as it delays healing. ⁴³
- Chung *et al* (2006) reported that extracts of macelignan obtained from nutmeg showed a low MIC to *S.mutans* compared to other anti cariogenic agent and also show a preferential activity against oral microorganisms such as *Streptococcus sobrinus*, *Streptococcus salivarius*, *Streptococcus sanguis*, *Lactobacillus acidophilus* and *Lactobacillus casei* showing that it could be incorporated in oral health care products. ⁴⁴

CONCLUSION

It is clear from the above review that common spices like *Curcuma longa*, *Zingiber officinale*, *Piper Nigrum*, *Elettaria cardamom*, *Cinnamomum Venum*, *Syzygium aromaticum* *Trigonella foenum graecum*, *Myristica fragrans* not only have application in culinary art to impart flavor to food, but also have medicinal properties and in treatment of various diseases. Research done on the phytochemicals present in these spices show that they have action against oral microorganisms like, *S.mutans*, *C.Albicans* and various periodontal pathogens. Further research is necessary to

incorporate these chemicals in oral health care products.

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