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Benevolent role of spices in endodontic: A short reviewKinjal P. Patel[♦], Dilsar Gohil, Sweta B. Besh and Rajesh A. Maheshwari

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Abstract

The prevalence of oral illnesses is a global health crisis. The two most common oral health issues in the world are dental caries and periodontal disease. Quality of life is affected in ways that go beyond the craniofacial in how one's dental health is taking care of. Traditions of using spices and herbs for both food and medicine date back centuries. Spices have long been used to improve the flavour, fragrances, and color of food and drink, but now we know that they may also offer protection against both acute and chronic diseases. The use of spices and herbs as medicines and therapeutic remedies is gaining popularity in the particularly for the treatment of chronic illnesses. In addition to their effects on oral health, spices and herbs have been shown to have anti-inflammatory, anti-tumorigenic, anticarcinogenic, antioxidant capabilities. Bioactive substances such as vitamins, notably flavonoids and polyphenols, tannins, alkaloids, phenolic diterpenes, and sulfur-containing compounds have been studied extensively over the past decade for their wide variety of health benefits. However, the precise function of spices and herbs in health defence, particularly in preventing the onset of chronic, non-communicable diseases, is still up for discussion. Black pepper, cinnamon, ginger, turmeric, fenugreek, and garlic are only few of the typical spices and herbs that are discussed in this review for their possible oral health advantages.

1. Introduction

Today's youth face significant challenges maintaining good oral health. It does not discriminate on the basis of age or gender and may harm anyone at any age. Dental caries, periodontitis, and oral candidiasis are the three most common oral diseases. Tooth decay, sometimes called dental caries or just cavities, is the result of microorganisms eroding tooth enamel. The prevalence of oral illnesses is a global health crisis. The state of one's oral health is crucial to one's overall health and has implications for one's quality of life beyond simply being craniofacial (Torwane *et al.*, 2014). Periodontal disease and other dental illnesses are difficult to treat and prevent using traditional Western medicine. Natural phytochemicals derived from plants used in traditional medicine, are therefore, considered good alternatives to synthetic chemicals, and the search for such products continues. At present time there is a flood of food items in market. So, it become more difficult for us to choose better one for health. Now, we know the importance of food in our life. We also found many misconceptions around us about food. Therefore, the search for alternatives persists, and herbs and spices that were once employed as traditional medicines are now regarded as suitable substitutes. Several hundred to several thousand years of use have established the botanicals in Ayurvedic material medica to be safe and effective. Traditional medicinal plant research could provide unexplored possibilities for improving dental health, both preventatively and therapeutically. The use of spices and herbs in the treatment of illness is central to traditional medical practices such as Ayurveda.

Therefore, the purpose of this review is to examine the function of various spices in the prevention and treatment of several dental issues. Microbes are the primary cause of dental issues. There are more than 750 different types of bacteria in the mouth, and many of them have been linked to oral diseases. *Mutans streptococci*, most notably *Streptococcus mutans* and *Streptococcus sobrinus* and *lactobacilli* are the most prevalent bacteria linked to dental cavities. Periodontitis is caused by *Bacillus*, *Actinomyces comitans* and *Porphyromonas gingivalis* while oral candidiasis is caused by *Candida albicans*.

A number of factors, including infections where allopathic medications have no or minimal effects due to increased resistance exhibited by the pathogens to particular allopathic medications and the undesirable side effects of some antibacterial drugs such as nausea, vomiting, diarrhoea, headache, tooth staining, and so on. Both the lack of resources in less developed nations and the potential for these drugs to cause changes in the oral microbiota (which can lead to additional issues) make it necessary to look for alternate remedies.

Ayurveda is the name of the traditional healing and longevity system that is practiced in India. A comprehensive view of man's health and illness is required for this investigation. Ayurveda is now widely practiced across the entire Hindustan Peninsula, which includes India and the nations that are located in close proximity to it. In addition, in recent years, it has also received a substantial amount of attention in economically developed nations, such as those located in Europe, the United States and Japan. According to ayurveda or other ethnic practises, there are roughly 1250 medicinal plants in India are utilized. This 5000-year-old medical method suggests using particular herbs and minerals to treat various ailments. Several hundred to several thousand years of use have established the safety and efficacy of the botanicals used in Ayurvedic materia medica (Yuan *et al.*, 2016).

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2. Risk factor and side effect of recent treatment

Due to rising urbanization and shifting lifestyles, the world is seeing an increase in the prevalence of the most common oral disorders. Reasons for this include easy access to sugary food at low prices, insufficient exposure to fluoride (*via* water and dental hygiene products like toothpaste) and inadequate access to oral healthcare services. There has been an increase in the intake of products that lead to oral health issues due to the marketing of sugary food and beverages, cigarette products and alcoholic beverages.

Caries and periodontal disease, both of which are caused by dental plaque, can lead to tooth malfunction and eventual loss. Substantial work efforts have been made to include effective antiplaque agents from a variety of chemical and biological substances into dental products with the goal of decreasing plaque-mediated illnesses. The American Dental Association's Council on Dental Therapeutics has only ever approved chlorhexidine and listerine (a mixture of "essential oils"). However, many people report experiencing adverse effects from using these compounds, including tooth discoloration and an increase in calculus build-up. These shortcomings urge for more research and development into safe for the host alternatives that maintain antibacterial specificity and efficacy.

3. Benefits of natural medicine over conventional medicine

The price of natural therapy is much more affordable when compared to the price of contemporary medicine and therapy practiced in urban settings. In contrast to allopathic therapies, natural and traditional medicines, such as those that make use of spices, herbs, vegetables and fruits do not have any side effects, either intended or unintended. Natural remedies, which are generally thought of as general daily health supplements, not only help in curing the primary illness, but they also calm other bodily systems. This is because natural treatments include no synthetic chemicals. One of the many benefits that may be gained from pursuing natural remedies is that they may restore and rejuvenate the human body. Instead of concentrating exclusively on the signs and symptoms of the ailment, alternative and herbal treatments get to the root of the issue. As a result, this aids in the cessation of the health condition permanently (Mohd *et al.*, 2021).

4. Spices role in endodontic

4.1 Black pepper (*Piper nigrum* L.)

Spicy is beneficial to health, particularly when discussing about black pepper. Regular use of this Indian spice may help a number of ailments. Black pepper is belonging to the Piperaceae family. Black pepper has been considered to be the most widely used culinary ingredient in the world. Black pepper is indigenous to Kerala, a southern Indian state. The spiciness of black pepper comes from a chemical known as piperine which incorporates capsaicin. The components in black pepper crucial oil are limonene, pinene, myrcene, phellandrene, beta caryophyllene, beta bisabolene, sabinene, linalol, pinocarveol, alphatermineol, camphene and alpha terpenene.

Piperine is one of the maximum effective phytochemical provides in black pepper. Piperine act as an antioxidant and anticancers agent. It has anti-inflammatory, antibacterial and analgesic (ache killer) activity. Black pepper oil massages relieve toothache and other oral infections, due to piperine's antibacterial activity. Pepper additionally has anti-inflammatory homes that assist deal with gum infection. Mix

identical amounts of salt and pepper in water and rub the mixture on your gums for toothache, you may mix black pepper with clove oil and apply it to the affected vicinity. Black pepper is good for preserving dental health due to its anti-inflammatory and antibacterial qualities. Black pepper has been utilized in conventional remedy to treat gum inflammation and bacterial infections inside the mouth.

4.2 Cardamom (*Elettaria cardamomum* (L.) Maton)

The term "queen of spices" is often used to describe the cardamom. The cardamom spice comes from the western ghats mountain region in India. Multiple studies have shown its usefulness as a stimulant, diuretic, stomachic, and carminative. Cardamom has been used for centuries as a treatment for unpleasant breath and to promote better dental health. After a meal, swallowing an entire cardamom pod is a common way to improve breath in various cultures. Wrigley, maker of chewing gum, incorporates the spice in at least one of its products. Cardamom's potential to kill off common oral bacteria could be the reason why it can make your breath smell minty fresh. Cardamom seeds are used for preventing pyrosis (excessive mouth watering), bad breath, indigestion, sickness-related nausea and vomiting, and bad breath. During the contagious phase of influenza, pharyngitis, a sore throat and hoarseness can be alleviated by gargling with an infusion of cardamom and cinnamon. Cardamom powder added to tea water while it is boiling, not only gives the resulting drink, a lovely aroma, but it also has medicinal properties that can help with issues including constipation, diarrhea, heart palpitations, fatigue from overwork, depression, and more. The acetonic extract of *E. cardamomum* shown the maximum zone of inhibition (20.96 mm) and the lowest inhibitory concentration (MIC) (1.25 mg/ml) against *S. aureus*, while the methanolic and ethanolic extracts also showed activity against *S. mutans*, *S. aureus*, *C. albicans*, and *S. cerevisiae*. It has therapeutic potential as a plant-based treatment for dental caries-causing bacteria. Purifying the phytoactive components and figuring out an appropriate dose for administration might boost their antibacterial activity (Alam, 2019).

4.3 Cinnamon (*Cinnamomum verum* J. Presl)

Cinnamon is derived from a member of the Lauraceae plant family. It can relieve pain and reduce inflammation. The antibacterial effects of the yellow essential oil are a result of the presence of cinnamaldehyde. The essential oil from cinnamon comes from the bark. In endodontics, it is used as an irrigant for root canals. It kills microbes by stopping an important process inside their cells called amino acid decarboxylation. This process stops the cells from getting the energy they require to survive (Santhini *et al.*, 2014). Cinnamon's calcium content helps keep teeth strong. Because of its ability to kill bacteria, fungi and viruses, it is great for preventing illness. The anti-inflammatory characteristics of the flavonoids in cinnamon, make it useful for alleviating toothache pain and swelling. It is especially helpful for infants who are teething because it eases the discomfort of their gums. Inflammation of the gums, known as gingivitis, is not only uncomfortable but can progress to a more severe form of periodontal gum disease. Cinnamon bark oil can reduce the growth of *Porphyromonas gingivalis*, the bacteria responsible for gingivitis and gum disease. Studies have shown that cinnamon can inhibit the growth of bacteria that can lead to bad breath and tooth decay. Cinnamaldehyde, the main ingredient in cinnamon, kills the bacteria that cause gum disease. In addition, it has various antimicrobial compounds that work by disrupting the cell walls of bacteria and

stopping their reproduction. Cavity and enamel eroding *Streptococcus mutans* bacteria are suppressed by cinnamon bark oil (Liao *et al.*, 2012; Alshahrani *et al.*, 2020; Karadađlýođlu *et al.*, 2019; Wiwattanarattanabut *et al.*, 2017; Patel *et al.*, 2019).

4.4 Nutmeg (*Myristica fragrans* Houtt.)

Nutmeg is a spice that is commonly used in Indian cuisine. It is a member of the Myristicaceae family and was originally derived from the *Myristica fragrans* Houtt. plant. A little of this miraculous spice can do wonders for your health. This spice is a culinary staple for a wide range of foods due to both its medicinal and distinctive flavour profiles. Nutmeg's potent antibacterial properties make it an effective all natural therapy for addressing gum issues like pain and bad breath. This miraculous spice is also highly effective in treatment of tooth plaque and preventing gum disease. Applying nutmeg oil topically (a few drops on a cotton swab and rubbed into the gums) can prevent and treat dental health issues. Similar to cloves, nutmeg includes the chemical eugenol. That a 5% concentration of nutmeg oil has a good antimicrobial action against *Staphylococcus aureus* and so may be used in floss, wedges and root canal irrigant; however, it should not be used against oral ulcers since it slows the healing process (Thanoon *et al.*, 2013).

Extracts of nutmeg macelignan demonstrated preferential activity against oral microorganisms like *Streptococcus sobrinus*, *Streptococcus salivarius*, *Streptococcus sanguis*, *Lactobacillus acidophilus* and *Lactobacillus casei*, and had a minimal inhibitory concentration (MIC) against *S. mutans* compared to other anticariogenic agents.

4.5 Clove (*Syzygiu maromaticum* (L.) Merr.)

Clove is a member of the Myrtaceae family, which also includes the myrtle, eucalyptus as well as more than 3000 other species. Madagascar, Sri Lanka, Indonesia, and China are all major producers of cloves (Tunc *et al.*, 2019; Golmakani *et al.*, 2017). Cloves have an essential oil content of 14-20% and a length range of 1/2 to 3/4 inches. Cloves' potent aroma and flavour come from the essential oil, which is obtained by distilling the spices to remove the eugenol. When used medicinally, clove buds have been found to be safe for oral consumption. The medicinal usage of cloves dates back more than 2,000 years. An alternative to using benzocaine before needle insertion is clove essential oil, the results of which were published in 2006 in the Journal of Dentistry. Pain after tooth extraction is often accompanied with dry socket, which can be alleviated with clove oil. It can be used as a remedy for teething infants when mixed with coconut oil. Eugenol is a chemical found in clove oil (Gupta *et al.*, 2021).

In 1837, a filling material was developed from a mixture of eugenol and magnesium oxide. ZOE (zinc oxide eugenol) is a popular temporary filler cement made by replacing magnesium oxide with zinc oxide. Clove, also known as laung, has stimulating, aphrodisiacal, antibacterial, antifungal, and antiseptic effects. Because of its germicidal characteristics, the oil is great for treating dental issues like tooth pain, gum inflammation, mouth sores, and bad breath. Clove is also useful for preventing tooth decay and other dental issues. Therefore, several dental aids, such as mouthwash and Dabur Red Toothpaste, use clove oil for teeth. The clove oil displays antibacterial activity against *Actinobacillus actinomycetem comitans*, *Capnocytopha gagingivalis*, *Fusobacterium nucleatum*,

Porphyromonas gingivalis, *Prevotella intermedia*, *Prevotella mela ninogenica*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Candida albicans*, *Escherichia coli*. Clove oil may be used as an adjunct to periodontal therapy due to the antibacterial effect. The over growth of *Candida albicans*, which can spread from the mouth, is inhibited by taking clove by mouth (Shehata *et al.*, 2011). It has been shown that using clove oil can help lessen the amount of plaque that builds up on teeth and gums. Reduced root canal bacteria is one benefit of using clove extracts (Mustafa *et al.*, 2011).

4.6 Garlic (*Allium sativa* L.)

The bulbous flowering plant known as garlic, is a popular horticulture crop that originated in central Asia and is a member of the Amaryllidaceae family (Tsai *et al.*, 2012). Garlic has potent capabilities against inflammation, free radicals, bacteria, viruses, fungi and even mutations. The increased incidence of oral disorders such gingivitis, periodontitis, oral cancer, receding gums and plaque margin accumulation owing to infection by gram-negative and gram-positive bacteria is a global health crisis. The quality of life, economic productivity, and overall health are all negatively impacted by poor dental health. In industrialized nations, treating oral health issues accounts for almost 10% of healthcare budgets (Bin *et al.*, 2020). The oral cavity is being invaded by a wide variety of microorganisms (Shetty *et al.*, 2013). The formation of biofilm on dentition is a typical phase in the etiology of dental diseases, as is bacterial adherence to biomatter. *Porphyromonas gingivalis*, *Staphylococcus aureus*, *Streptococcus sanguis*, *Streptococcus salivarius* and *Streptococcus mutans* are all examples of common oral pathogenic bacteria that contribute to the development of dental caries (Banvar *et al.*, 2017). These bacteria in our mouth ferment the carbohydrates they obtain from the leftovers of the food we eat, chiefly producing lactic and acetic acids. Furthermore, the demineralization of enamel, the tooth's hard tissue, is caused by these acids, leading to the development of cavities.

Periodontitis, caused by the bacteria, *Fusobacterium nucleatum* and *Porphyromonas gingivalis* in human gums, causes inflammation and connective tissue damage. By increasing saliva production and suppressing bacterial development in the mouth, GE (garlic extract) may reduce the risk of dental caries. The bioactive chemicals that make up GE are: alliin, allicin, SAC, DAS, allmethyl trisulphide, and ajoene. Garlic contains the sulfur-containing chemical alliin. The crushing of this molecule yields the active component known as "allicin". Allicin, which is derived from alliin, is a highly reactive chemical. Allicin's interaction with thiol groups on several enzymes accounts for its antibacterial activity. Allicin kills bacteria in the root canal by destroying their cell walls membranes. Sodium hypochlorite is more commonly employed in irrigation; however, this has been shown to be an effective alternative in some studies (Sinha *et al.*, 2014; Manjunatha *et al.*, 2016; Gopalkrishna *et al.*, 2014).

4.7 Fenugreek (*Trigonella foenumgraecum* L.)

Fenugreek is a member of the legume family. The notable spices used in human food. Fenugreek is a herb whose seeds and green leaves have been used for centuries in both culinary and medicinal applications. Flavour, colour and even texture can all be altered by adding this ingredient. Fenugreek's antibacterial, anti-inflammatory and antioxidant activity can help to control microbial development and relieve gingival inflammation. Fenugreek is rich in the antioxidant selenium. Fenugreek contains mucilagens, which calm inflamed

tissues. Since their discovery, antibiotics have been used extensively as first-line treatments for bacterial infections. However, overuse of antibiotics has resulted in microbial resistance, rendering many standard therapies ineffective and leading to infection recurrence (Fair *et al.*, 2014; Landecker *et al.*, 2016). Antibacterial plant extracts are increasingly being used due to the concerning rise in bacteria's ability to acquire resistance. While both the ethanol and aqueous fenugreek seed extracts were effective against bacteria, the ethanol extract was more effective against gram-positive and gram-negative bacteria (Kumar *et al.*, 2012; Khorshidian *et al.*, 2019; AL-Timmi, 2019). Extracts from fenugreek seeds have been studied for their ability to raise salivary pH to 7.83 in as little as ten minutes, which not only helps to lubricate and moisten the mouth but also protects against dental caries. All of this helps to prevent further enamel demineralization; therefore, it is really important (Khan *et al.*, 2012).

4.8 Turmeric (*Curcuma longa* L.)

Curry from India typically includes the spice turmeric. The yellow-orange spice turmeric (haldi) is made from the rhizome of the plant *Curcuma longa* L. The plant itself grows in a thick rhizome or underground stem and reaches a height of 3 feet. It has lance-shaped leaves and spikes of yellow flowers. Pain and swelling in sore teeth are gone after a massage with roasted, crushed turmeric. Curcumin (diferuloylmethane), flavonoid and volatile oils including tumerone, atlantone, and zingiberone are turmeric's active ingredients. Curcumin inhibits the growth of *E. faecalis*, *Streptococcus intermedius* and *Escherichia coli*. Curcumin's antibacterial activity was shown to be comparable to that of sodium hypochlorite in one another testing.

Applying a paste made from roasted, crushed turmeric to painful teeth reduces inflammation and pain. Roughly one hundred people were chosen at random to participate in the study by Waghmare *et al.* (2017) At days 0, 14, and 21, data on gingival index and plaque index were collected. It was established that both chlorhexidine gluconate and turmeric mouthwash are useful in preventing plaque and gingivitis when used in conjunction with mechanical plaque management methods. The usage of the spice for a few days at a time on a regular basis has the potential to help your teeth become whiter and brighter naturally by reducing the appearance of stains. In addition to traditional mechanical plaque reduction measures, using a turmeric mouthwash to help keep your teeth and gums healthy, is a great idea (Praveen *et al.*, 2020; Naikodi *et al.*, 2021).



Figure 1: Pictorial summary of review.

5. Conclusion

It stands to reason that India, with its very different temperatures and landscapes, would likewise have a wide range of spices. Spices were often regarded as some of the most valuable products in the ancient and medieval economies. Plant medicines have been used by ancient physicians and herbalists for centuries, but only recently have scientists begun investigating the possible health advantages of commonly used spices and herbs. Inflammation and tissue irritation can be treated with herbs and other remedies that are natural. Due to their inexpensive cost, low toxicity and lack of germ resistance, these substances have found widespread use. The phytochemicals found in the afore mentioned spices and their products have been studied for their activity against oral bacteria like *S. mutans* and *C. albicans*. Garlic, cinnamon, clove, cardamom, black pepper and nutmeg, all common spices in Indian cooking, contribute positively to good dental hygiene. There has to be more study before they can be used in regular endodontics.

Conflict of interest

The authors declare no conflicts of interest relevant to this article.

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