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Review Article **Dentistry**

Pharmacological Aspects of Traditional Plant Extracts in Maintaining Oral Health: A Narrative Review

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Abstract

Dental complications are the main health problems worldwide and can cause harmful and irreversible loss to general human health. Therefore, there is a need to treat these problems. Most of the techniques for the prevention of these oral diseases are costly and lengthy; therefore, there is a need to introduce some effective, low-cost, and easy methods or medicine to deal with oral health issues. The combined mixture of extracts from *T. chebula* and *A. nilotica* proven to treat sore throat and ulcers of the mouth. Eucalyptol is one of the main compounds in the essential oil used for the preparation of an endodontic solvent and mouthwash. The important components present in the rhizome of the turmeric plant which can be used for the treatment of oral complications are essential oils (turmerones) and curcuminoids. Plant-based extracts can be used to prepare several types of mouthwash, toothpaste, and gel due to the presence of anti-microbial activities and a large number of beneficial compounds. This review paper aims to find the role of medicinal plants and their properties for the effective treatment of oral diseases in dentistry.

Keywords: Plant-based extracts, toothpaste, anti-microbial activities, beneficial compounds.

INTRODUCTION

Oral diseases are considered the main health issues in the world and due to their progressive and chronic nature; they affect almost 3.5 billion people worldwide. Among those oral diseases, most of them are preventable and can be treated after early detection. The main reasons for oral complications are having drinks and food that have high sugar content, low access to health care facilities, and less amount of fluoride in toothpaste. Dental caries, toothache, periodontal diseases, oral cancers, and oral mucosal lesions are the most common diseases that affect the teeth and mount. Almost, 20% of world population suffers from oral diseases. Their cure is expensive and lengthy which ultimately results in complications for facial growth [1].

Changes in the surface of the oral mucosa, swelling, red and white patches, and developmental defects, all are signs of oral mucosal lesions (OML) [2]. In 2003, WHO reported that OML as one of the major public health concerns [3]. It has been suggested that OML can be a reflection of a patient's general health [4]. Periodontal diseases, that include periodontitis and gingivitis, are the prevalent oral health complications that result in chronic conditions in the oral cavity. The inflammation of the gingiva is called gingivitis and when left untreated, it can turned into periodontitis [5, 6].

Dental caries is a big health issue that affects people globally. It has been found in Asian people around 58.8% in permanent and 52.6% in primary teeth. Without treatment, caries enter into pulp tissues, and ultimately the teeth will be lost [7, 8]. Dental plaque is a microorganism's biofilm that is naturally present on the surface of the tooth surface. As, it may cause many oral health problems and periodontal conditions, its removal can prevent many problems. The removal of dental plaque and reducing its recurring are the main preventive measures [9]. The orofacial pain that originates from a dental element or other adjacent structures is termed toothache. This pain is due to the

result of several conditions i.e, dental caries, abscess, trauma, periodontal disease, and occlusal dysfunction [10]. It has been recommended by WHO that reduction in toothache is one of the priority problems in the world health promotion agenda [11].

Medicinal Plants for Dental Problems

Plants-based natural products play an important role in reducing the oral health issues such as ulcers, halitosis, bleeding gum, gingivitis, and dental caries because these products have minimum adverse effects and maximum efficiency. Different types of secondary metabolites are produced by different plant species. About, 30% of all plant species are used for various medicinal benefits depending upon the secondary metabolites that are present in them [12]. Types of mouthwash that are prepared from plant products have antimicrobial activity and can be used for the treatment of plaque and gingivitis [13].

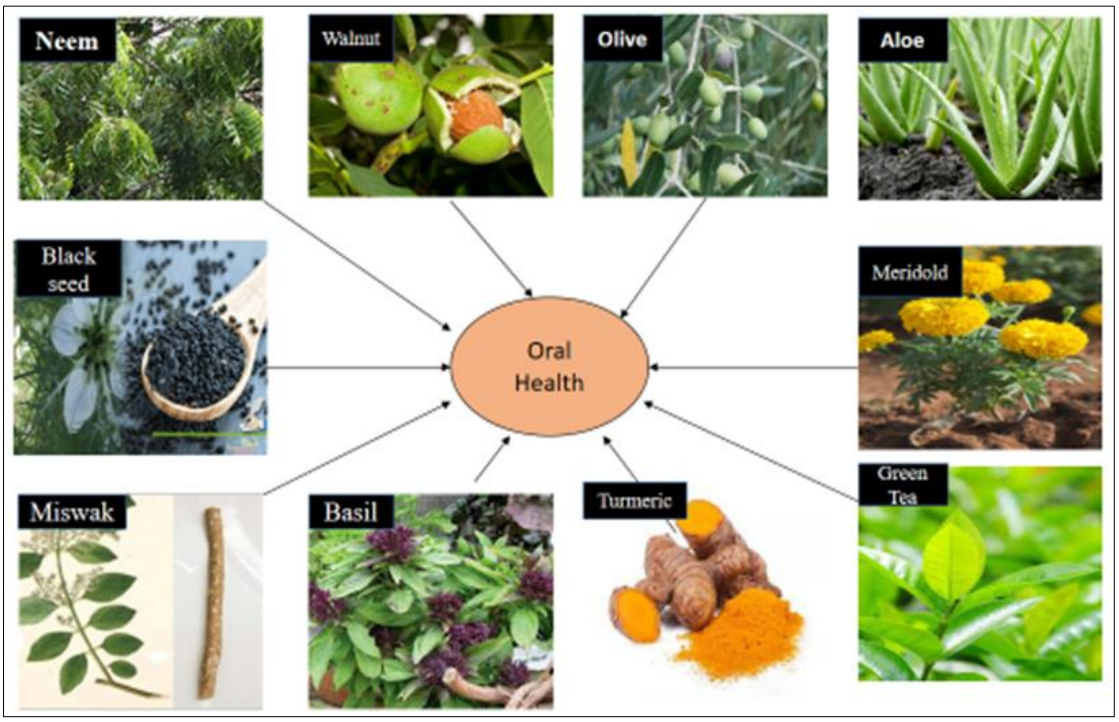

Fig. 1: Medicinal plants used for the Maintainance of oral health

Currently, plant extracts from neem leaf, noni fruit, burdock root, and propolis have been used as intra-canal medications and due to effective results and they provide a novel function in dental therapy worldwide. It has been suggested that herbal extracts have been used in dentistry for the reduction of inflammation, to inhibit the growth of pathogens in the oral cavity, to prevent histamine release and as antioxidants, antiseptics, and analgesics [14-16].

Neem (*Azadirachta Indica*)

Azadirachta indica (A. Juss), is an evergreen tropical tree, commonly called Neem, and is native to the subcontinent of India.The major components with the antibacterial activity of this plant include azadirachtin, nimbnin, and nimbidin [17, 18]. Different parts of Neem have been used in local Indian medicine for its antiviral, antibacterial, antifungal, antipyretic, antiparasitic, antacid, antidiabetic, anticancer, contraceptive, anti-inflammatory, antidermatitic, anti-inflammatory, antioxidant, dental, and other protective and healing properties. Its twigs have been used by millions of people as chewing sticks for maintaining oral hygiene [19-21].

The anti-toothache effect of Neem (*A. indica*) was examined and it has been suggested that its extract can reduce the effect of caries and even reverse it by reducing the amount of *S. salivarius*, *S. mitis*, *S. mutans*, and *S. sanguinis*. This plant extract significantly reduced bacterial count and dental plaque. It has also been indicated by two studies that *A. indica* based oral gel and toothpaste may reduce the count of S. mutans in the mouth and decrease the gingivitis and plaque same as a chlorhexidine gel [22]. It has been reported by many previous studies that *A. indica* has the same effect as hypochlorite or chlorhexidine against pain, gingivitis, and plaque and bacteria (e.g., *S. aureus*, *Streptococcus viridans*, and *C. albicans ex vivo* or *in vivo* [23-31]. Neem extract has greater anti-bacterial activity than *Cinnamomum verum* (cinnamon), *Commiphora myrrha* (myrrh), *Zingiber officinale* (ginger), *Curcuma longa* (turmeric), *Syzygium aromaticum* (clove), Acacia tree (e.g., catechu), *Salvadora persica* (miswak) and *Allium sativum* (garlic) to prevent dental caries and few species of bacteria [32-34].

Walnut (*Juglans Regia* L)

Juglans regia (Walnut) is a member of the Juglandaceae family and possesses several pharmacological activities. Its distribution is throughout the countries like USA and China. The bark of walnut is used as a medicine to maintain oral hygiene, teeth cleaning, and to treat dental plaque and gingivitis. Various medicinal activities such as diuretic, depurative, laxative, anthelmintic, astringent, and anti-microbial activity are present in different parts of the walnut tree. A piece of a green husk can relieve tooth pain and stem bark can be used for any dental complaints. The presence of alkaloids, phenolic compounds, terpenoids, flavonoids, and steroid makes *J. regia* a potential medicine for oral hygiene [35-37].

Olive (*Olea Europaea*)

O. europaea is belong to the family Oleaceae and is commonly called an olive tree. It is reported as a significant agent against microbes [38, 39]. The extract of olive stem showed a wide range of activities against the microbes that are responsible for many dental issues. The extracts from the leaf exhibited activity against some microbes and its range of actions is not as vast as the stem. The phenolic compounds present in leaf extract also had anti-microbial activities against *C. albicans* and *S. mutans* [40].

Aloe Vera (*Aloe Barbadensis* Miller)

Aloe vera (L.) is a perennial plant belonging to the family Asphodelaceae. It is native to South Africa but also cultivated in dry tropical and sub-tropical regions i.e, southern USA. Phenolic compounds, vitamins (fat and water soluble), minerals, polysaccharides, and organic acids are potential compounds present in leaves of Aloe vera. Mouthwashes that contain aloe vera are equally effective to prevent dental complications as chlorhexidine mouthwash. The effectiveness of aloe vera has been proven to reduce plaque and treat inflammation [41-44].

Marigold (*Calendula Officinalis*)

Calendula officinalis L. commonly known as marigold is a member of the family Asteraceae and is native to Southern and Central Europe, the US, and Western Asia but in other regions of the world, it is cultivated as an ornamental plant. The plants possess quinones, coumarines, flavonoids, carotenoids terpenoids, and volatile oil that can be used to maintain oral health [45, 46].

Green Tea (*Camellia Sinensis*)

Camellia sinensis (L.) called green tea is a plant from the Theaceae family. Its origin starts in China but after that, it spread to other regions of the world as well. Methylxanthine alkaloids such as theophylline, theobromine, and caffeine, as well as Polyphenols such as flavonoids and catechins, are the main chemical components of tea. The benefits of green tea in the maintenance of oral health. Bacterial-induced dental caries can be treated with green tea. Not only this but polyphenols present in it have antiviral properties and eliminate bad breath. According to a popular notion in Japan, green tea cleans the mouth, and those people who drink large amounts of green tea seldom had tooth decay [47, 48].

Turmeric (*Curcuma Longa*)

Curcuma longa L. commonly known as turmeric belong to the family Zingiberaceae. It is originally native to sub-tropical and tropical environments and cultivated in large amounts in Asia i.e, India and China [49]. The important components present in the rhizome of the turmeric plant which can be used for the treatment of oral complications are essential oils (turmerones) and curcuminoids (bisdemethoxycurcumin, methoxycurcumin, and curcumin) [50, 51].

Basil (*Ocimum Spp.*)

Basil or *Ocimum* spp. are plants from the family Lamiaceae. The *Osimum* species are native to Asia, Brazil, and Africa. Methyl eugenol, carvacrol, and eugenol are present in the volatile oil of leaves. Extract from the fresh stem and leaves possess phenolic compounds i.e, circimaritin, rosmarinic acid, cirsilineol, apigenin, and isothymusin, which exhibited antioxidant activity. The effective activities against bacteria present in the oral cavity have been found in the essential oil extracted from *Ocimum sanactum* and *Ocimum basilicum* [52-54].

In dentistry, for the treatment of pulpitis and toothache, eugenol is used which is the main active component of the basil plant. The leaves of basil have 0.7% essential oil, comprising 70% eugenol and 20% methyl eugenol, henceforth; it provides relief from pain in teeth [55, 56]. The ethanolic extract of Ocimum sanctum has antibacterial efficiency that can work against pathogenic bacteria (*Streptococcus mutans*) that cause dental caries. This is due to the eugenol, carvacrol, and ursolic acid which are present in leaf extract [57].

Miswak (*Salvadora Persica*)

Salvadora persica L. known as Miswak belongs to the family Salvadoraceae and is an important medicinal plant that has a broad distribution in Africa and Asia. In its native areas, miswak is traditionally used as a toothbrush for improving oral health. The essential oil obtained from this plant has main components like 1, 8-cineole (eucalyptol), 9- epi-(E)-caryophellene, β-sitosterol, β-pinene, and α-caryophellene[58-59]. Small branches and roots of *S. persica* have been used for the preparation of toothbrushes and it proved very useful as a teeth maintainer. For the treatment of toothache and cleaning of teeth, Miswak is used globally. Many oral diseases linked with dental care and oral hygiene has been

treated with the use of *S. persica* due to the presence of many unique and important active compounds such as minerals and phytochemicals. It is used in the preparation of probiotic spray, chewing sticks, chewing gum, mouthwash, dental cement, aqueous extract, ethanol extract, toothpaste, essential oil, and dental varnish. It has been reported that essential oil from *S. persica* has antimicrobial activities in maintaining oral maianatence [60-63].

Eucalyptus (*Eucalyptus Globulus*)

Eucalyptus globulus is a shrubby plant from the family Myrtaceae. This plant is distributed in many countries like the United Kingdom, Spain, Nepal, Albina, Cambodia, and Uganda where it is used for many different purposes. For the treatment of toothache, halitosis, and sore throat, the mouthwash gargle of Eucalyptus is used in the Cameroon region. The anti-microbial activity against *E. coli* (Gram-negative) and *S. aureus* (Gram-positive) bacteria found in the oral cavity has been observed in essential oil obtained from *E. globulus* leaves [64-66]. The main compounds present in extract are, pinene 11.46%, pinene 18.54%, gamma-eudesmol 1.20%, eucalyptol (1,8-cineole) 54.79%, para cymene 1.60%, phellandrene 2.06% and eudesmol 4.68% (Joshi, 2016). Eucalyptol is one of the main compounds in the essential oil of Eucalyptus that is used for the preparation of an endodontic solvent and mouthwash [67].

Gum Arabic Tree (*Acacia Nilotica L)*

Acacia nilotica is an evergreen tree commonly known as the gum Arabic tree (Babul) and belongs to the family Leguminosae. It is distributed in many countries such as Saudi Arabia, Iran, Oman, Pakistan, Nepal, India, Egypt, Libya, Ethiopia, Angola, Kenya, Mali, Botswana, Israel, Angola, Ghana, Malawi, Uganda, Somalia, Mozambique, Sudan, Tanzania, Senegal, South Africa, Zimbabwe, and Nigeria. The bark and stem of *A. nilotica* can be used in tooth cleaners and toothpaste [69, 70]. To treat the bleeding of gum and to make strong gums, the paste of the bark and stem of this plant is used. To cure the problems of the throat and relieve toothache, the extract obtained from the bark and stem of *Acacia nilotica* is used through gargling. The combined mixture of extract from *Terminalia chebula* and *A. nilotica* is proven to treat sore throat and ulcers of the mouth. Its extract provides toothache relief, and its branches are used for teeth cleaning [70-72].

Black Seed (*Nigella Sativa* L)

Nigella sativa or black seed is known for its important health benefits. It is distributed among North Africa, Southern Europe, the Middle East, and India [71, 72]. The Main components present in the essential oil of *N. sativa* are ucarvacrol (5.8–11.6%), t-anethole (0.25–2.3%), cymene (7.1–15.5%), longifolene (1.0–8.0%), thymoquinone (27.8– 57.0%) and 4-terpineol (2–6.6%). The important compound found in this plant is thymoquinone ($C_{10}H_{12}O_2$) in black seed oil having medicinal properties i.e, antihypertensive, antioxidant, antimicrobial, anticarcinogenic, analgesic, and anti-inflammatory. Periodontal diseases can be prevented with the help of thymoquinone [73].

CONCLUSION

It has been found that many studies used a crude extract from plants to combat oral pathogens. However, there is a need to purify the active component to clarify the aid and mechanism for future drug development. The extracts from medicinal plants can be helpful in dentistry and contribute to the improvement of dental treatments. It can be concluded that essential oils from medicinal plants can be used potentially to prevent several oral diseases, but further clinical trials are required to confirm the efficiency and safety regarding their use in the treatment of oral complications.

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