IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Applications of Lemongrass Oil in Dentistry: A Review

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Abstract *:* The herb Cymbopogon citratus, which is popularly known as lemongrass, is a member of the Poaceae grass family. A wide range of health benefits are provided by lemongrass. Its antibacterial and antimicrobial qualities are well established in literature, thus making it applicable in medical and dental fields. The antioxidant defense function of the lemongrass herb guards against antibiotic-resistant Staphylococcus aureus and aids in preserving good cellular function, cholesterol levels, the neurological system, healthy skin, and the immune system. In addition, lemongrass aids in the oral cavity by eradicating bacteria from the mouth and preventing decay, gingivitis and periodontitis. The aim of this review article is to highlight various uses of lemongrass oil in dentistry.

Index Terms **- Essential oils; Dental caries; Periodontitis; Lemongrass oil; Gingivitis**

1.INTRODUCTION:

The extract of medicinal plants is also known as essential oils. An essential oil is a concentrated hydrophobic liquid containing volatile aroma compound from the medicinal plants. Research in phytoscience, an emerging multidisciplinary science, has revealed various medicinal plants possessing antimicrobial activity with fewer side effects and reduced toxicity (Kumar et al., 2019). Extracts of herbal plants offer a new choice for optimal antimicrobial therapy against various oral microorganisms (Khan et al., 2009). One of the commonly used essential oils in the field of medicine and dentistry is extracted from lemongrass.

LEMONGRASS:

Lemongrass, commonly known as citronella grass, is a plant in the Poaceae family and is a member of the Cymbopogon genus. The Greek words "cymbo" (boat) and "pogon" (beard) are combined to form the botanical genus name Cymbopogon for lemongrass. It describes the boat-shaped bulbous end and the long, blade-like green leaves that resemble a beard (Ranade et al., 2015).Lemongrass is also referred to as "Squinant" in English and is recognised by a number of other regional names worldwide. There are roughly 140 species in the genus Cymbopogon, and they are found growing widely in semiarid and tropical parts of the Asian, American, and African continents(Tovar et al., 2011).

There are two main types of lemongrass : Cymbopogon citrates and Cymbopogon flexuosus . The Cymbopogon genus's members produce volatile oils, earning them the nickname "aromatic grasses." This lemongrass is obtained from the leaves using the steam distillation method.The raw plant material is put into a distillation equipment and set over water to begin the distillation process. The volatile compound is vaporised and the emitted vapour passes via a coil and is eventually condensed back into liquid and gathered in a vessel(Sreenath et al., 1991).The volatile oil that is created has a strong, lemony, fresh aroma and is thin in consistency. This grass has a distinct lemon scent that predominates, which is caused by the oil's high citral concentration. The oil can be used in soaps, detergents, and other products because of its redolence. It finds its use in the food and perfume sectors because of its good source of citral (Sreenath et al., 1991).

Lemongrass has long been used to treat a wide range of medical ailments since it contains various bioactive chemicals that give it therapeutic significance (Warad et al., 2013). This is because it creates a wide range of secondary metabolites. Vitamins C, A, and E are abundant in lemongrass oil. Its chemical constituents, such as phenol and flavonoid compounds, are said to exhibit a wide range of biological actions both in vitro and in vivo, including antioxidant, anti-inflammatory, and antimutagenic effects (Warad et al., 2013).

In addition to these biological effects, lemongrass essential oil has a variety of antimicrobial properties, including those that are antibacterial against both gram-positive and gram- negative bacteria, antifungal, antimycobacterial, and antiamebic (Warad et al., 2013). Due to their antibacterial activity, lemongrass has been utilised as a replacement for medicinal drugs that could have adverse effects if taken for longer term (Kanduluru et al., 2013).

Lemongrass is used to treat medical diseases such sinusitis, bladder infections, respiratory infections, digestive issues, and connective tissue regeneration in addition to the dentistry field. In nations like China, lemongrass extract is also used to treat liver disorders and rheumatoid arthritis (Meenapriya., 2017) and also used in skin care. Hence, the objective of this review article is to highlight various uses and benefits of lemongrass oil in oral health.

2. USES OF LEMONGRASS IN DENTAL HEALTH

One of the commonly used essential oils in the field of medicine and dentistry is extracted from lemongrass. This literature review provides an insight into many applications and advantages of lemongrass oil in oral health.

2.1. Management of Dental Caries

Dental caries is an infectious microbiologic illness that affects the teeth and causes localised calcified tissue loss and breakdown. The four causes of dental caries are host, microflora, substrate, and time (Loesche WJ .,1986). Dental caries is more likely to occur when there is a high microbial load from plaque. The bacteria can endure in acidic environments (Warad et al.,2013).

There are many different types of bacteria in the oral cavity, but only a small number of them contribute to the development of dental caries. The oral cavity frequently harbours the facultative gram-positive anaerobe Streptococcus mutans. It is the main factor causing dental caries. By starting acid production by forming extracellular polysaccharides from sucrose diet, S. mutans can firmly cling to the tooth surface and quickly colonise the tooth. Limiting tooth demineralization by dietary changes, stopping or reducing oral bacteria growth, and adjusting salivary pH and buffering capacity are the main goals of dental caries management (Chouhan et al.,2017).

Essential oils inhibit microorganisms due to their hydrophobicity, in which they get partitioned into the lipid bilayer of the cell membrane, rendering it more permeable, leading to leakage of vital cell contents. Impairment of bacterial enzyme systems may also be a potential mechanism of action (Chouhan et al.,2017).

In a study by Khirtika, et al., the antimicrobial activity of homemade mouthwash produced with lemongrass oil and 0.2% chlorhexidine was compared to that of 2% iodine and 0.2% chlorhexidine as an antibacterial agent. According to the study's findings, essential oils had the highest antibacterial effectiveness, followed by chlorhexidine and iodine (Khirtika et al.,2017). The growth of S. mutans is severely restricted by the aqueous extract of essential oils. Due to their effective antibacterial action and lack of side effects, essential oils can be used to remove cariogenic bacteria from the oral cavity and prevent dental caries (Fazeelath Banu et al.,2015).

2.2. Management of Halitosis (Bad Breath)

Several factors, including food particles, plaque buildup, tongue coating, gingivitis and periodontitis, can contribute to halitosis (Cortelli et al.,2008). According to Tonzetich et al., the volatile sulphur compounds, particularly hydrogen sulphide, methyl mercaptan, and less significantly dimethyl sulphide, are the principal cause of the halitosis (Lee H et al.,2006).

However, in conditions like xerostomia, additional substances in the mouth air, such as diamines, indoles, skatoles, and volatile organic acids (butyric or propionic acid), may also produce halitosis (Lee H et al.,2006). These substances are actually the product of salivary peptides being broken down by a microbe in the mouth through a process called proteolysis. In particular, Gram-negative anaerobic bacteria are responsible for proteolytic breakdown (De Silva et al., 2017).Since lemongrass has high citral concentration, it has been used as a mouthwash to reduce bad breath .Additionally, because lemongrass has an antibiotic effect on Gram-negative bacteria, the bacterium's ability to degrade proteins can be inhibited, which helps to manage bad breath (De Silva et al., 2017).

2.3. Control of Dental Plaque

Gram-positive cocci at the tooth surface and Gram-negative rods in the plaque matrix's outer layer make up the majority of the bacteria in dental plaque (Newman et al., 2014).One of the key elements in the prevention of caries, gingivitis, and periodontitis is the daily removal of dental plaque. Plaque-related oral diseases including gingivitis and periodontitis can be prevented and their disease progression can be slowed down by removing dental plaque (Newman et al., 2014).

Disclosing agents, which are available as tablets, lozenges, or wafers which contain a dye or other colouring agents, make the plaque visible (Kukkamalla et al., 2012).Plaque control can be achieved by mechanically removing the biofilm using correct dental cleaning and flossing techniques. The prevention and control of plaque formation with chemical agents, most frequently in the form of mouth rinses, is seen as a complement to mechanical oral hygiene practices (Rüdiger et al., 2012).

The most efficient antiplaque and antigingivitis agent is chlorhexidine digluconate, which is used as a supplement to maintain oral hygiene. However, its usage is also accompanied by a number of negative side effects, including discoloration of teeth, an unpleasant taste, and taste changes that have prompted the search for suitable substitutes (Gjermo P et al., 1989).Essential oils such as lemongrass are ideal for use in oral care products because they are both antibacterial and non-toxic which is a rare combination. Lemongrass oil can be used as an adjunct to mouthwash to prevent the growth of plaque and eliminate it. Lemongrass can be used as toothpaste and mouthwash to get rid of biofilm, which eventually turns into plaque, because it is efficient at cutting through the strong biofilm that Candida hides behind (Rajeswari et al., 2013).

At a concentration of 2%, lemongrass prevents the growth of numerous bacteria. Comparing a lemongrass oil mouthwash to a slurry toothpaste and a chlorhexidine mouthwash, lemongrass oil is the most effective in removing plaque. The terpenes in lemongrass oil change cell permeability by penetrating between membrane lipid bilayers, rupturing lipid packing, and altering membrane fluidity, leading to significant surface alterations and morphological modifications and decreasing the ability of oral pathogens to adhere to host cells (Boukhatem et al., 2014).

Citral, limonene, citronellal, B-myrcene, linalool, and geraniol are only a few of the compounds that give lemongrass its anti-biofilm properties. Thus, it can be concluded that using mouthwash infused with lemongrass oil as an adjuvant to mechanical and other chemical plaque management can be done without any side effects (Anand et al., 2011).

2.4. Management of Gingivitis

Gingivitis is gum inflammation caused by plaque buildup, which happens naturally as a result of bacterial interactions with the acquired salivary pellicle that forms over the surface of the tooth shortly after brushing. In susceptible individuals, gingivitis may progress to periodontitis; consequently, periodontitis can be successfully prevented by preventing gingivitis (Kukkamalla et al.,2012). The use of chemical plaque treatment as a supplement to mechanical plaque control is necessary because mechanical techniques' effectiveness depends on the individual's skills and expertise and has shown to be quite time-consuming(Fine et al., 1995). Mouthwash infused with essential oils deactivates bacteria's ability to aggregate, decreases their growth, and removes endotoxins (Riep et al., 1999).

The potent anti-inflammatory and antibacterial properties of lemongrass oil, which aids in the clinical cure of gingival inflammation, can prevent the recolonization of bacteria in periodontal pockets. Additionally, the antioxidant action of the same prevents periodontal tissue deterioration and promotes recovery (Seymour et al.,2003). A study by Anand et al., assessed the lemongrass oil's antioxidant property. The levels of salivary and gingival crevicular fluid, superoxide dismutase, and thiol were assessed before and after the administration of lemongrass oil. The results suggest that superoxide dismutase and thiol levels increased along with a decrease in gingivitis. The mentioned results suggest that when used in conjunction with non-surgical periodontal treatments, lemongrass oil mouthwash may have an adjuvant influence on the treatment outcome (Battino et al., 2005).

2.5. Management of Periodontitis

Periodontitis is an inflammatory condition caused due to oxidative stress along with microbial toxins.It is characterised by inflammatory tissue surrounding the teeth that may or may not bleed, and there will be a loosening of the collagen fibres around the teeth that will cause superinfections and then tooth mobility(Haffajee et al.,1994).The use of antimicrobial agents in periodontal therapy has been directed by the failure of mechanical instrumentation to completely eradicate the penetrating bacteria from the sulcus and the surrounding tissue, as well as the simultaneous role of certain specific bacteria in the aetiology or progression of periodontal disease (Slots et al., 1990).

The majority of the bacteria that cause periodontitis are anaerobic or facultatively anaerobic, including Tannerella forsythia (previously known as Bacteroides forsythus), Aggregatibacter actinomycetemcomitans, Prevotella intermedia, Porphyromonas gingivalis, and Aggregatibacter actinomycetemcomitans (Shahidi et al., 1992).

In addition to mechanical therapy, a number of antimicrobial medications, such as tetracycline, minocycline, clindamycin, metronidazole, and chlorhexidine, have been employed. Utilising local and systemic antibiotics in conjunction with nonsurgical periodontal therapy is one of the treatment methods used to primarily reduce or eradicate bacteria responsible for periodontitis (Nakamura et al., 2003).

Citral (neral and geranial) and citronellal, two components of lemongrass oil, have antioxidant properties. Neral and geranial stereoisomers found in citral are able to reduce oxidative stress by inducing the antioxidant mechanism in GSH (Shahidi et al., 1992). Lemongrass oil contains a molecule called flavonoid, which has a variety of biological effects, including antioxidant, anti-inflammatory, antibacterial, antimutagenic, and anticancer properties.In addition to being a key ingredient in lemongrass oil, citral aids in the production of vitamins A and C, which act as secondary antioxidants to scavenge free radicals and also prevents damage by stopping the chain reaction.

Using the broth dilution and antibiotic-sensitivity tests, Khongkhunthian et al., conducted an in vitro study to examine the antimicrobial activities of the essential oil from Cymbopogon citratus (lemongrass) against some periodontal pathogens, such as Actinomyces naeslundii (WVU 45), P. gingivalis (WP 50), and the clinical isolates from three gingivitis. The outcome demonstrates that lemongrass oil exhibits strong antibacterial action (Khongkhunthian et al.,2009). Additionally, 2% lemongrass essential oil can be employed as a local drug delivery agent for the treatment of periodontitis, following a study by Warad et al. In addition to mechanical nonsurgical periodontal therapy, 2% lemongrass essential oil gel looks to be a desirable alternate agent that can be employed for efficient and secure local medication administration (Ayub et al.,2013).

3. **CONCLUSION:**

The antibacterial, antiviral, and antioxidant activities of lemongrass have been demonstrated in previous studies. The dental and medical industries have benefited greatly from their use. In the realm of dentistry, lemongrass is used to treat halitosis, gingivitis, periodontitis, and dental plaque. Therefore, it can be inferred from this review that lemongrass oil can be a useful adjuvant to chemical medications in treating a variety of oral health diseases.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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