



## Phytotherapy in Dentistry: A Literature Review Based on Clinical Data

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Authors TNAD, BLSP conceived the study. Authors TNAD, LCM, AALL, MSC participated in the data collection and interpretation, drafting and review. Author LRS managed data interpretation and review. Author BLSP providing inputs on its draft, review and final approval. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Aims:** Looking for scientific support with an updated review about herbal medicines usage in dentistry for clinical application, reinforcing the potential of phytotherapics to treat oral disorders and the need for new studies on the topic.

**Material and Methods:** The literature search was performed combining “phytotherapy” and “dentistry” in the PubMed, MEDLINE, BBO, LILACS and SciELO databases, covering the period from January 2017 to March 2020. The data extracted were: Alteration/oral disease, gender, age, number of participants, herbal medicine used, drug function and results.

**Results:** were selected 24 papers that employed different plants, such as Tulsi, *Aloe vera*, citronella, turmeric, propolis and cloves. The results found are promising and show the anti-inflammatory, analgesic, antibacterial, antioxidant, antifungal, antiviral and tranquilizer action of herbal drugs, and their use for treating burning mouth syndrome, oral submucous fibrosis, xerostomia and halitosis.

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**Conclusion:** despite the therapeutic activities of herbal medicines, additional studies with larger sample size and scientific rigor are necessary to prove their benefits for treating oral diseases.

**Keywords:** *Phytotherapy; dentistry; oral manifestations; medicinal plants.*

## 1. INTRODUCTION

Herbal medicines are active substances produced with plants and popularly used as an effective alternative for treating several ailments, including oral diseases [1]. Currently, approximately 40% of the available medicines use natural sources, directly or indirectly, 25% of which are obtained from plants [2]. Research on herbal medicines in dentistry has been expanded in the search for new alternatives that combine analgesic, anti-inflammatory, antimicrobial, curative and regenerative activity, with less toxicity, better biocompatibility and more affordable costs [3,4].

Morales-Bozo et al. [5] evaluated the effectiveness of a salivary substitute based on chamomile and flaxseed for treating xerostomia. Milani et al. [6] associated cognitive therapy with chamomile tea to treat patients diagnosed with burning mouth syndrome, concluding that there was an increase in well-being, maintenance of oral moisture and confidence in the therapeutic approach proposed. In 2019, Salehi et al. [4] reviewed works on plant-derived bioactives in the oral mucosa, citing the benefits of *Aloe vera* in regenerating tissue and increasing cell proliferation quickly and effectively; besides its anti-inflammatory, immunomodulatory, analgesic, bacteriostatic, bactericidal and antioxidant effects. The authors also cited green tea acting on chronic periodontitis activity, anti-caries and anti-fungal (candidiasis), reducing the adverse effects of conventional drugs, culminating in less fungal resistance [4]. The World Health Organization (WHO) also recommended and encouraged using plants as a tool for oral hygiene [7]. However, the role of herbal drugs in controlling oral changes is still undervalued when compared to other diseases, such as skin diseases [8]. Thus, this study is a narrative review that aimed scientific support about herbal medicines usage in dentistry for clinical application, reinforcing the potential of phytotherapies to treat oral disorders and the need for new studies on the topic.

## 2. MATERIALS AND METHODS

### 2.1 Search Strategies

Literature search performed combining “phytotherapy” and “dentistry”, after previously identifying the chosen descriptors in articles published on the topic and in the Medical Subject Headings (MeSH). The PubMed, MEDLINE, BBO, LILACS and SciELO databases were accessed covering the period from January 2017 to March 2020.

### 2.2 Inclusion and Exclusion Criteria

English-language publications with the title and abstract related to the topic were included. Incomplete articles, duplicated ones, studies on animals, and those that, when read, did not fit the proposed theme were excluded from the research.

### 2.3 Analysis

From the selected articles, *in vivo* or *in vitro*, the following information were extracted: oral alteration/disease, gender, age, number of participants, herbal medicine used, drug function and results. From the literature reviews, only the mentioned herbal medicines, their function, and the conclusion of the study.

## 3. RESULTS

The search resulted in 79 published papers, with 31 potentially eligible identified after applying the inclusion and exclusion criteria. Then reading these papers in full, 24 studies remained: 17 original studies, 01 case report, 02 systematic reviews and 04 literature reviews (Fig. 1).

The results found are promising and show the anti-inflammatory, analgesic, antibacterial, antioxidant, antifungal and antiviral action of herbal medicines, and their use for treating burning mouth syndrome, oral submucous fibrosis, xerostomia and halitosis (Table 1). These studies use several plants, such as Tulsi, *Aloe vera*, citronella, turmeric, propolis and cloves.

Table 1. Data found in the studies

Author, Year	TS	Evaluation	no.	Gender	Age	Herbal medicine	Result
De Souza et al. [9]	LR	Burning mouth	7 studies	-	-	Catuama, capsaicin 0.02%, chamomile gel, urea 10%, spray containing lycopene-enriched virgin olive oil (300ppm), <i>Aloe vera</i> 70% and <i>Hypericum perforatum</i> extract 300 mg	Significant improvement observed in catuama and capsaicin 0.02% oral rinse when compared with placebo. The others reported effectiveness in symptom reduction, but without statistical difference when compared with the placebo/control groups.
Resende et al. [10]	LR	Repair, regeneration, proliferation, mineralization, wound healing, and induced differentiation	35 studies (In vitro)	-	-	Propolis, <i>Cocos nucifera</i> , <i>Aloe vera</i> , <i>Cammelia sinensis</i> , <i>Punica granatum</i> , <i>Nigella sativa</i> , <i>Ricinus communis</i> , <i>Croton lechleri</i> , <i>Marmosa rubra</i> , <i>Salvia officinalis</i> , <i>Capparis spinose</i> , <i>Curcuma longa</i> and soy milk	The plants showed potential effect on cell viability and proliferation. The articles evaluated mainly the action of plants on cells of the periodontal ligament. Propolis, coconut water and <i>Aloe vera</i> were the most common storage medium.
Santi et al. [11]	LR	Dental plaque and gingival inflammation in patients with gingivitis	-	-	-	<i>Camelia sinensis</i> , <i>Azadirachta indica</i> , <i>Anacardium occidentale</i> Linn, <i>Schinus terebinthifolius</i> and <i>Curcuma longa</i>	Five herbal products showed better results than chlorhexidine in dental plaque and gingival inflammation reductions.
Moro et al. [12]	LR	Chronic periodontitis	7 papers	-	-	<i>Aloe vera</i> gel, 10% <i>Emblica officinalis</i> gel, bark of <i>Mimusops elengi</i> , bark of <i>Acacia arabica</i> and seeds of <i>Punica granatum</i> , <i>Garcinia mangostana</i> gel, <i>Centella asiatica</i> (1.4 and 1.9) and <i>Punica granatum</i> (0.2 and 0.3) extracts.	In systemically healthy patients with periodontitis, the local use of phytotherapies as adjuncts to scaling and root planning may have additional benefits in the reduction of probing pocket depth and clinical attachment level gain, when compared with scaling and root planning alone.
Al-Maweri et al. [13]	SR	Submucous fibrosis	6	-	-	<i>Aloe Vera</i>	<i>Aloe vera</i> may be effective in managing submucous fibrosis, without any side effects.

Author, Year	TS	Evaluation	no.	Gender	Age	Herbal medicine	Result
Aumeeruddy et al.[14]	SR	Phytochemistry, pharmacological properties, and bio-applications	Not reported	-	-	<i>Salvadora persica L.</i>	<i>Salvadora persica L.</i> showed a wide scope of application and its uses extended beyond the traditional uses of its roots, stems, and twigs in oral care.
Dantas et al. [15]	OS	Control of anxiety in patients undergoing dental extraction	40 patients	27 F (67,5%) / 13 M (32,5)	Younger than 18 years	<i>Passiflora incarnata</i>	<i>Passiflora incarnata</i> showed an anxiolytic effect similar to midazolam, and was safe and effective for conscious sedation in adult patients who underwent extraction of their mandibular third molars.
Patri & Sahu [16]	OS	Cavity Disinfectant Adjuncts in Minimally Invasive Dentistry	40/ divided into four groups	-	-	Tea tree oil and <i>Aloe vera</i>	Natural antibacterial agents like tea tree oil and <i>Aloe vera</i> could be effectively used as cavity disinfectants which will help in minimizing secondary caries and rendering a long term restorative success.
Wiatrak et al. [17]	OS	Hygienic agent and Periodontal health.	37	54% F/ 46% M	41-82 years	Ethanol extract of propolis and tea tree oil.	Improvements in hygiene and the condition of periodontium were observed in patients using toothpastes with ethanol extract of propolis and tea tree oil. No influence on the reduction of denture plaque and influence on microorganism's composition in oral microflora.
Purohit et al.[18]	OS	Pulpotomy medicament in primary teeth	50	-	4-9 years	Turmeric	Pulpotomy treatment using turmeric powder in primary teeth has shown good clinical and radiographic success.
Lolayekar & Kadkhodayan, [19]	OS	Change in salivary pH and viability of <i>S. mutans</i>	30 patients	Not reported	9 to 12 years	<i>Ocimum sanctum</i>	<i>Ocimum sanctum</i> has an antimicrobial effect on <i>S. mutans</i> present in the saliva, without causing any known systemic side

Author, Year	TS	Evaluation	no.	Gender	Age	Herbal medicine	Result
Ferreira-Filho et al. [20]	OS	Caries	3	Not reported	5.67 years	<i>Bauhinia forficata</i> Link	effects and chewing of <i>Ocimum sanctum</i> leaves has no significant effect on the salivary pH levels.
Dar-Odeh et al. [8]	OS	Oral diseases among female patients	232 patients	100% F	18 to 69 years	Most of the natural remedies used (n = 17) were herbal, with cloves (71.1%) and <i>Salvadora persica</i> (26.7%)	Majority of patients use natural remedies to treat their oral disease. Patients were mostly satisfied with natural remedies in terms of effectiveness and lack of complications
Albaptain et al. [7]	OS	Dental plaque, sub-gingival microbiota, and gingival inflammation	28	57% F	18 to 71 years	<i>Salvadora persica</i> L.	There were no significant differences in the microflora after using active and inactive <i>Salvadora persica</i> .
Milani et al. [6]	CR	Burning mouth	2	100% F	59 and 68 years	<i>Matricaria recutita</i> (Camomile)	Psychological treatment along with <i>Matricaria recutita</i> phytotherapy displayed excellent results in the control of BMS.
Isola et al. [21]	OS	Surgical removal of impacted mandibular third molar	82	53% M	26.8 years	Herbal medicine: composed of baicalin ( <i>Scutellaria baicalensis</i> Georgi) 190 mg; bromelain ( <i>Ananas comosus</i> ) 50 mg; aescin ( <i>Aesculus hippocastanum</i> ) 30 mg	The herbal mixture of herbal extract with anti-inflammatory activity has shown to be safe and simple in controlling post-surgical discomfort after surgical removal of the third molar. There were favorable effects on the inflammatory process parameters.
Lee et al. [22]	OS	Periodontal disease	<i>In vitro</i>	-	-	<i>Terminalia chebula</i>	<i>Terminalia chebula</i> may be a beneficial supplement to help prevent dental plaque bacteria-mediated periodontal disease.
Silva et al. [23]	OS	Antifungal Activity	<i>In vitro</i>	-	-	<i>Chrysobalanus icaco</i>	<i>Chrysobalanus icaco</i> was shown to possess antifungal activity

Author, Year	TS	Evaluation	no.	Gender	Age	Herbal medicine	Result
							against <i>Candida</i> species with clinical importance in the development of oral candidiasis, and these activities may be related to its chemical composition.
Tonea et al. [24]	OS	Antibacterial and antifungal properties	<i>In vitro</i>	-	-	Mix extract between <i>Arctium lappa</i> root powder and <i>Aloe barbadensis</i> Miller gel, Amoxicillin with clavulanic acid and Fluconazole (as control substances)	The experimental mix extract of <i>Arctium lappa</i> root powder and <i>Aloe vera</i> gel is able to inhibit very resistant microorganisms, like <i>Enterococcus faecalis</i> and <i>Candida albicans</i> .
Veloso et al. [25]	OS	Potential antibacterial and anti-halitosis activity	<i>In vitro</i>	-	-	<i>Caesalpinia ferrea</i> Mart, <i>Cinnamomum cassia</i> B., <i>Mallow sylvestris</i> L., <i>Punica granatum</i> L., <i>Rosmarinus officinalis</i> , <i>Aeolanthus suaveolens</i> , <i>Syzygium aromaticum</i> L. and <i>Tamarindus indica</i> L.	The extracts displayed antimicrobial activity against the tested microorganisms. The investigated plants have the potential to reduce the main substances related to halitosis of oral origin.
Guandalini Cunha et al. [26]	OS	Evaluation of cytotoxicity and antimicrobial efficacy	<i>In vitro</i>	-	-	<i>Cymbopogon nardus</i>	Citronella oil and alcohol-free chlorhexidine completely inhibited the growth of <i>S. aureus</i> and <i>C. albicans</i> biofilms in the adhesion phase. All solutions showed inhibitory activity against 24h biofilm formation. However, citronella led to greater microbial reduction and presented the lowest cytotoxic effect.
Da Silva et al. [27]	OS	Antibacterial and Cytotoxic Activities	<i>In vitro</i>	-	-	<i>P. elliotii</i> e <i>P. tropicalis</i>	Data reveal the <i>in vitro</i> antibacterial activity of the <i>P. elliotii</i> and <i>P. tropicalis</i> resins against cariogenic bacteria in the planktonic and in the sessile modes.

<b>Author, Year</b>	<b>TS</b>	<b>Evaluation</b>	<b>no.</b>	<b>Gender</b>	<b>Age</b>	<b>Herbal medicine</b>	<b>Result</b>
De Araújo et al. [1]	OS	Caries	<i>In vitro</i>	-	-	<i>Anacardium occidentale</i> L. and <i>Anadenanthera macrocarpa</i>	<i>Anacardium occidentale</i> extract has potential as an antimicrobial agent with low eukaryotic cell toxicity or mutagenic activity. <i>Anadenanthera macrocarpa</i> extract, although absent of antibacterial activity might be a safe and effective phytotherapeutic alternative.
Teodoro et al. [28]	OS	Antifungal activity	<i>In vitro</i>	-	-	<i>Buchenavia tomentosa</i>	The Acetone fraction presented the best antifungal activity among several extracts from <i>Buchenavia tomentosa</i> .

(\*Type of Study (TS); Literature review (LR); Systematic review (SR); Original studies (OS); Case reports (CR)

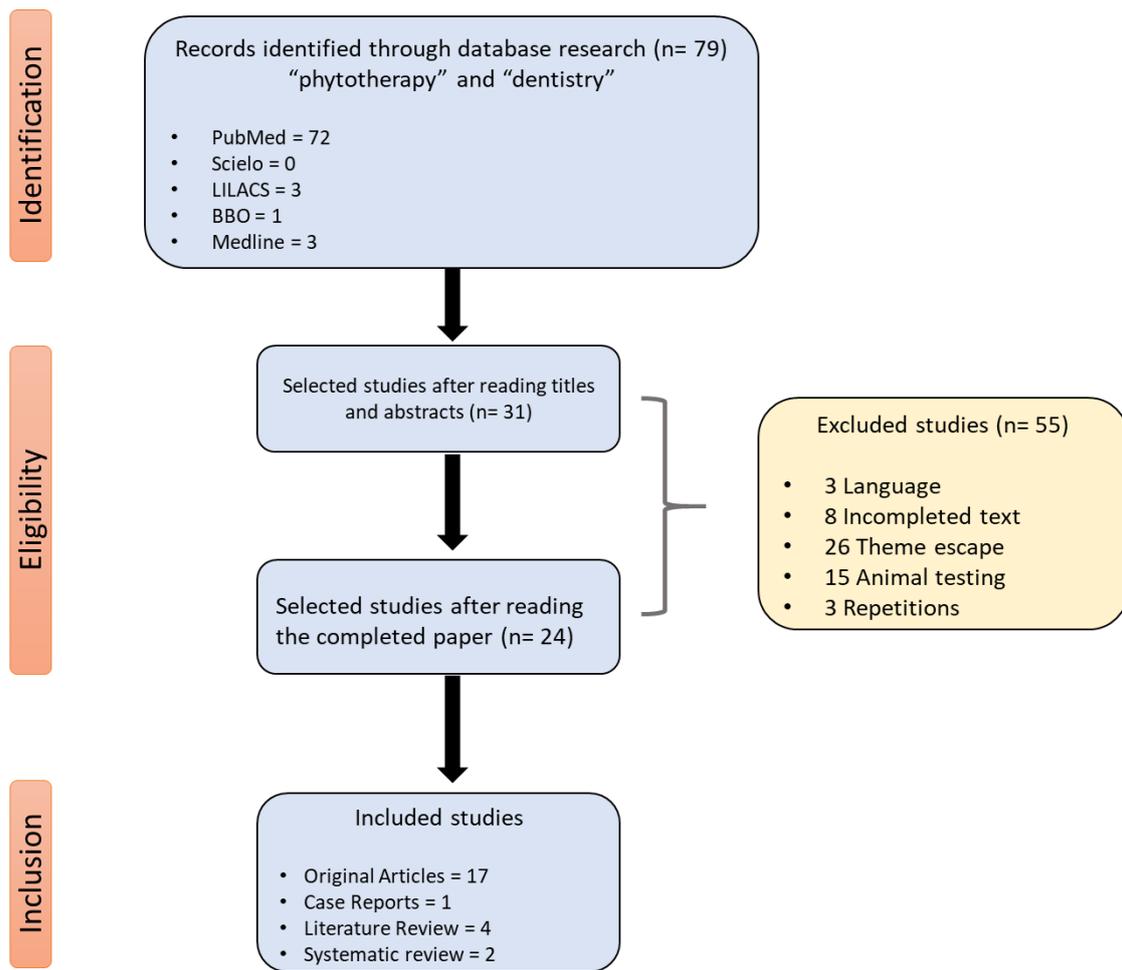


Fig. 1. Flowchart of the selection and result of the papers

#### 4. DISCUSSION

Ancient practice, the use of herbal agents has been increasingly investigated with greater scientific rigor to confirm its beneficial effects [9]. The main reason for more controlled studies is that differences in the cultivation, harvesting, processing and storage of the leaves result in a considerable change in the amount of therapeutic constituents, which can influence the final effect of the drug [19]. However, the studies found in the literature show promising results and effects in the herbal medicines usage in Dentistry.

Lolayekar & Kadkhodayan [19] evaluated the effect of chewing Tulsi leaves (*Ocimum sanctum* – “holy basil”) on salivary pH and viability of *S. mutans*, considered one of the factors for the development of tooth decay – which changes the pH of the biofilm resulting in the demineralization of the tooth surface – in children aged 9 to 12

years. The study confirmed the antimicrobial effect of the plant in *S. mutans* and the absence of side effects, but without changes in salivary pH. In 2020, Ferreira-Filho et al. [20] also studied the antimicrobial and dental demineralization effect *in vitro*, using the tincture of *Bauhinia forficata* Link, popularly known in Brazil as “cow’s foot”. The study aimed to evaluate initial *Streptococcus spp*, total count of microorganisms and the final superficial microhardness of the tooth [20]. The authors concluded that, despite the limitations of *in vitro* work, the tincture of *B. forficata* L. is a potential substance against caries, due to its antimicrobial activity in mature biofilm and possible inhibitory mechanism of tooth demineralization [20]. Patri & Sahu [16] compared the efficacy of herbal antibacterial agents - Tea tree oil and *Aloe vera* with commercially available 2% chlorhexidine as cavity disinfectant for use in minimally invasive dentistry. They found that natural antibacterial agents could be effectively used as cavity

disinfectants, which will help in minimizing secondary caries and rendering a long-term restorative success. Aside from Tulsi, Tea tree oil and *Aloe vera* and tincture of *B. forficata* L., using chamomile to control dental plaque and treat gingivitis has been studied and proven [6]; propolis also showed an anti-inflammatory effect in osteogenic differentiation and bacterial growth reduction, maintaining the viability of oral cells [10].

*Aloe vera*, *Cymbopogon citratus*, *Quercus brantii*, *Coriandrum sativum*, *Mimusops elengi*, *Acacia arabica* showed anti-inflammatory, antibacterial and antioxidant properties, which may help control gingivitis and periodontal disease. [29–32]. The topical use of herbal medicines, allows for greater concentrations of active agents for long periods in periodontal pockets, which act as a regular drug storage [30]. Treatment with the ethanol extract of *Terminalia chebula* inhibits the growth of dental plaque bacteria (DPB) as well as DPB-induced inflammation, and effectively abolishes DPB-lipopolysaccharides-induced osteoclastic bone resorption *in vitro*. It is an effective botanical chemopreventive agent that can modulate DPB-induced inflammatory factors involved in gingivitis and periodontal disease [22].

Santi et al. [11] stated in their literature review that, in the studies found, herbal mouthwashes achieved significant reductions in dental plaque and gingival inflammation when compared with placebo rinses. Five products based on *Camelia sinensis*, *Azadirachta indica*, *Anacardium occidentale* Linn, *Schinus terebinthifolius* and *Curcuma longa* showed better results than chlorhexidine in reducing dental plaque and gingival inflammation. However, they cautioned that the majority of randomized controlled trials included in the review did not reach definitive conclusions [11], and the need for further studies to better assess the effect and clinical relevance of natural mouthwashes on gingival inflammation and biofilm control [11]. Already, Wiatrak et al. [17] investigated the influence of a propolis and tea tree oil-containing hygienic agent on selected oral health parameters, oral microflora and the condition of periodontal health. They concluded that toothpaste with active ingredients improved hygiene and the condition of periodontium demonstrated the beneficial influence on microorganisms composition in oral microflora [17].

Regarding fungal infections, *Candida albicans* is a versatile microorganism that, under certain

systemic conditions, can cause oral complications such as candidiasis and mucositis, especially in older, diabetic or immunocompromised patients [26]. Traditional antifungal drugs, such as azoles, amphotericin B and echinocandin are generally used to treat candidiasis [33]; but the limited number of antifungal agents and misuse of the available drugs resulted in many cases of resistance to treatment [33]. Thus, natural products are promising alternatives for solving these infections, presenting less toxicity and significant antimicrobial activity [34].

Tonea et al. [24] compared the antibacterial and antifungal properties of different endodontic products, two commercially available, one experimental plant based extract and two control substances. The disc diffusion assay was used to determine the antibacterial and antifungal properties of chlorhexidine, calcium hydroxide, a mix extract between *Arctium lappa* root powder and *Aloe barbadensis* Miller gel, Amoxicillin with clavulanic acid and Fluconazole (as control substances) [24]. And, as result, the experimental mix extract of *Arctium lappa* root powder and *Aloe vera* gel was able to inhibit very resistant microorganisms, like *Enterococcus faecalis* and *Candida albicans* [24]. A new idea of using powdered turmeric as a material of pulpotomy procedure in primary teeth showed good clinical and radiographic success [18]. In this study, with 50 children aged between 4 and 9 years, who were having carious unilateral or bilateral deciduous molar in maxillary and mandibular arch, Purohit et al. [18] fixed the pulp stumps with the mixture of turmeric powder distilled water and radiopaque material with the help of cement carrier. In the observation after 3 weeks, 2, 4, and 6 months follow-up, only one patient (6.66%) reported pain after 6 months and none of the patients reported tenderness, mobility, and sinus/ fistula after 6 months [18]. Silva et al. [27] investigated the antibacterial activity of two resins of the genus *Pinus* and of an isolated compound, the diterpene dehydroabietic acid (DHA). This study was the first that has verified the *P. tropicalis* resins exhibit significant antibacterial activity against cariogenic bacteria. Besides that, assessment of the antibiofilm activity of DHA against endodontic bacteria revealed significant results and prevented all the bacteria from forming a biofilm. Regarding cytotoxicity, all the promising concentrations of the resins were below the cytotoxic concentrations [27].

Considering the need for new methods to help control biofilm, aiming for maximum antimicrobial and antifungal efficacy with minimal side effects, Guandalini et al. [26] studied the effectiveness of two solutions based on citronella oil in biofilms formed by *S. aureus* and *C. albicans*, compared with two commercial rinses without alcohol, one based on 0.12% chlorhexidine (Periogard) and the other with essential oils (LT, Listerine Zero). The authors concluded that citronella-based compounds had a greater anti-biofilm effect when compared with commercial solutions, regarding *S. aureus* and *C. albicans*. Considering the concentrations of active ingredients in commercial mouthwashes, citronella showed less cytotoxic effect [26], appearing as an active phytocomplex with antimicrobial and antifungal action, viable for creating a new mouthwash to help control biofilm.

*Salvadora persica* L. (*S. persica*), considered an important medicinal plant with bioactive compounds and several pharmacological properties, appears as an alternative for treating oral diseases [7,14]. The main antimicrobial of *S. persica* is benzyl isocyanate (BITC), an antiviral against Herpes simplex, which inhibits the growth and production of acids by *Streptococcus mutans* and is fungistatic for *Candida albicans*. However, it is highly volatile and rapidly evaporates from the oral cavity [7,14]. *Buchenavia tomentosa* and *Chrysobalanus icaco*, natural plants from central Brazil, showed promising antifungal activity for *Candida albicans*, reducing its ability to form biofilms, hyphae and adhere to oral epithelial cells [23,35,36]. Just like cloves, used since antiquity to relieve dental pain and to treat oral candidiasis and herpes infections [8].

Burning mouth syndrome—a condition characterized by burning or pain symptoms, especially in the tongue, lips, hard and soft palate, without clinical signs – is managed by numerous treatments: Drugs, laser therapy, acupuncture, and psychological counseling. Aside from traditional therapies, chamomile (*Matricaria recutita*) has shown satisfactory results in maintaining oral moisture, with no reported adverse effects [6], as well as catuama and 0.02% capsaicin rinse, suggesting that these therapies should be studied in greater depth [9]. However, this syndrome requires the patients' psychological characteristics assessment, not just the treatment employed [9].

Another disease that includes pain/burning sensation is oral submucous fibrosis, a debilitating chronic disease with a high risk of

malignant transformation: pain/burning, vesicle formation, hypomobility of the hard palate and tongue, loss of taste and sensitivity, intolerance to spicy foods, speech and swallowing problems and severe limitation on mouth opening. Hence, a recent study employed *Aloe vera* as a natural alternative for controlling the complications of this disease, for its several therapeutic benefits: analgesic, anti-inflammatory, immunomodulatory, antioxidant, anti-neoplastic and wound regeneration actions, without reported side effects. However, its effectiveness in controlling submucous fibrosis is still controversial [13].

Regarding the feeling of dry mouth and halitosis, the study by Dar-Odeh et al. [8] reported the use of olive oil for dry mouth and halitosis and tahini (sesame paste) for dry mouth and oral ulcers. Veloso et al. reported that pomegranate and jucá (*Libidibia ferrea*) can potentially combat microorganisms related to halitosis, as the studied extracts inhibited oral microorganisms that produce volatile sulfur compounds [25].

In relation to pain, numerous strategies have been developed to manage postoperative discomfort, such as the pharmacological approach, which inhibits the synthesis and/or release of mediators of acute inflammation. Corticosteroids and non-steroidal anti-inflammatory drugs (NSAIDs) have shown immunosuppression, anti-inflammatory and analgesic effects [37]; but these cause a subsequent decrease in the renewal of serotonin in the central nervous system, leading to central inhibition of prostaglandin, resulting in undesirable adverse effects [38]. As an alternative to these medications, studies proposed natural substances such as bromelain, which has shown anti-inflammatory activity, mainly anti-edema action due to proteases present in its composition.

Isola et al. [21] proved the effectiveness of a herbal medicine composed of baicalin, 190 mg; bromelain, 50 mg; aescin, 30 mg. Baicalin has antibacterial [39], antiviral [40], anti-tumor [41] and anti-inflammatory properties [42], in addition to improving osteoblasts activity in bone formation [43] and negatively regulating inflammation pathways. Aescin showed anti-inflammatory action with an anti-edematous effect through its antihistamine and anti-serotonergic components, which reduces the adhesiveness and migration of neutrophils. The authors found a more favorable response to

postoperative pain, when compared with the placebo group and the group that received ibuprofen. However, reduction in facial edema and improvement in mouth opening was observed in the three groups, with no significant difference in the results after extraction of impacted lower third molars [21]. Already the cloves, has analgesic effect attributed to the activation of calcium and chloride channels in ganglion cells and the agonist activity of capsaicin [8]. However, natural drugs, when applied topically, can result in complications such as burns caused by garlic to relieve toothache [8].

Regarding to pre-surgical anxiety, Dantas et al. [15] compared the effects of *Passiflora incarnata* and midazolam for the control of anxiety in patients undergoing mandibular third molar extraction. *Passiflora incarnata* showed an anxiolytic effect similar to midazolam, and was safe and effective for conscious sedation in adult patients who underwent extraction of their mandibular third molars[17].

## 5. CONCLUSION

Although herbal medicines have been used since ancient times for treating oral diseases and have important therapeutic activities, such as anti-inflammatory, analgesic, antibacterial, antioxidant, antifungal, antiviral and tranquilizer actions, additional studies, with greater sample sizes and scientific rigor, are necessary for proving their benefits in treating oral diseases.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

- de Araújo JSC, de Castilho ARF, Lira AB, Pereira AV, de Azevêdo TKB, de Brito Costa EM de M, et al. Antibacterial activity against cariogenic bacteria and cytotoxic and genotoxic potential of *Anacardium occidentale* L. and *Anadenanthera macrocarpa* (Benth.) Brenan extracts. Arch Oral Biol. 2018;85:113–9.
- Brasil, Ministério da Saúde. Revista Fitos: pesquisa, desenvolvimento e inovação em fitoterápicos. 4th Ed. Rio de Janeiro: Fundação Oswaldo Cruz; 2015.
- Kleryson FMS. Fitoterapia: uma opção para o tratamento odontológico. Revista Saúde - UNG-Ser. 2009;4:18–24.
- Salehi B, Lopez-Jornet P, Pons-Fuster López E, Calina D, Sharifi-Rad M, Ramírez-Alarcón K, et al. Plant-Derived Bioactives in Oral Mucosal Lesions: A Key Emphasis to Curcumin, Lycopene, Chamomile, *Aloe vera*, Green Tea and Coffee Properties. Biomolecules. 2019;9.
- Morales-Bozo I, Ortega-Pinto A, Rojas Alcayaga G, Aitken Saavedra JP, Salinas Flores O, Lefimil Puente C, et al. Evaluation of the effectiveness of a chamomile (*Matricaria chamomilla*) and linseed (*Linum usitatissimum*) saliva substitute in the relief of xerostomia in elders. Gerodontology. 2017;34:42–8.
- Milani AMC, Macedo CLR, Bello MDC, Klein-Júnior CA, Dos Santos RB. A successful approach to control burning mouth syndrome using matricaria recutita and cognitive therapy. J Clin Exp Dent. 2018;10:e499–501.
- Albabbtain R, Ibrahim L, Bhangra S, Rosengren A, Gustafsson A. Chemical effects of chewing sticks made of *Salvadora persica*. Int J Dent Hyg. 2018; 16:535–40.
- Dar-Odeh NS, Gasim RA, Binsaad SM, Abu-Hammad S, Abu-Hammad OA. Use of natural remedies to treat oral diseases among female patients in Al Madinah, western Saudi Arabia. J Complement Integr Med. 2019;16.
- de Souza IF, Mármora BC, Rados PV, Visioli F. Treatment modalities for burning mouth syndrome: A systematic review. Clin Oral Invest. 2018;22:1893–905.
- Resende KKM, Faria GP, Longo DL, Martins LJO, Costa CRR. In vitro evaluation of plants as storage media for avulsed teeth: A systematic review. Dent Traumatol. 2020;36:3–18.
- Santi SS, Casarin M, Grellmann AP, Chambrone L, Zanatta FB. Effect of herbal mouthrinses on dental plaque formation and gingival inflammation: A systematic review. Oral Dis; 2019.
- Moro MG, Silveira Souto ML, Franco GCN, Holzhausen M, Pannuti CM. Efficacy of

- local phytotherapy in the nonsurgical treatment of periodontal disease: A systematic review. *J Periodont Res.* 2018; 53:288–97.
13. Al-Maweri SA, Ashraf S, Lingam AS, Alqutaibi A, Abdulrab S, Alaizari N, et al. *Aloe vera* in treatment of oral submucous fibrosis: A systematic review and meta-analysis. *J Oral Pathol Med.* 2019;48:99–107.
  14. Aumeeruddy MZ, Zengin G, Mahomoodally MF. A review of the traditional and modern uses of *Salvadora persica* L. (Miswak): Toothbrush tree of Prophet Muhammad. *J Ethnopharmacol.* 2018;213:409–44.
  15. Dantas L-P, de Oliveira-Ribeiro A, de Almeida-Souza L-M, Groppo F-C. Effects of *Passiflora incarnata* and midazolam for control of anxiety in patients undergoing dental extraction. *Med Oral Patol Oral Cir Bucal.* 2017;22:e95–101.
  16. Patri G, Sahu A. Role of herbal agents - tea tree oil and *Aloe vera* as Cavity disinfectant adjuncts in minimally invasive dentistry-An *in vivo* Comparative Study. *J Clin Diagn Res.* 2017;11:DC05–9.
  17. Wiatrak K, Morawiec T, Rój R, Mertas A, Machorowska-Pieniążek A, Kownacki P, et al. Oral Health of patients treated with acrylic partial dentures using a toothpaste containing bee product. *Evid Based Complement Alternat Med;* 2017. Available:<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5317110/> [Cited 2020 Jun 8]
  18. Purohit RN, Bhatt M, Purohit K, Acharya J, Kumar R, Garg R. Clinical and radiological evaluation of turmeric powder as a pulpotomy medicament in primary teeth: An *in vivo* study. *Int J Clin Pediatr Dent.* 2017;10:37–40.
  19. Lolayekar NV, Kadkhodayan SS. Estimation of salivary pH and viability of *Streptococcus mutans* on chewing of Tulsi leaves in children. *J Indian Soc Pedod Prev Dent.* 2019;37:87–91.
  20. Ferreira-Filho JCC, Marre AT de O, de Sá Almeida JS, Lobo L de A, Farah A, Romanos MTV, et al. Therapeutic Potential of *Bauhinia forficata* Link in Dental Biofilm Treatment. *J Med Food;* 2020.
  21. Isola G, Matarese M, Ramaglia L, Iorio-Siciliano V, Cordasco G, Matarese G. Efficacy of a drug composed of herbal extracts on postoperative discomfort after surgical removal of impacted mandibular third molar: A randomized, triple-blind, controlled clinical trial. *Clin Oral Investig.* 2019;23:2443–53.
  22. Lee J, Nho YH, Yun SK, Hwang YS. Use of ethanol extracts of *Terminalia chebula* to prevent periodontal disease induced by dental plaque bacteria. *BMC Complement Altern Med.* 2017;17. Available:<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5312597/> [Cited 2020 Jun 8]
  23. Silva JPB, Peres ARMN, Paixão TP, Silva ASB, Baetas AC, Barbosa WLR, et al. Antifungal activity of hydroalcoholic extract of *Chrysobalanus icaco* against oral clinical isolates of *Candida* Species. *Pharmacognosy Research.* 2017; 9:96.
  24. Tonea A, Badea M, Oana L, Sava S, Vodnar D. Antibacterial and antifungal activity of endodontic intracanal medications. *Clujul Med.* 2017;90:344–7.
  25. Veloso DJ, Abrão F, Martins CHG, Bronzato JD, Gomes BPFA, Higino JS, et al. Potential antibacterial and anti-halitosis activity of medicinal plants against oral bacteria. *Arch Oral Biol.* 2020;110:104585.
  26. Guandalini Cunha B, Duque C, Sampaio Caiaffa K, Massunari L, Araguê Catanoze I, Dos Santos DM, et al. Cytotoxicity and antimicrobial effects of citronella oil (*Cymbopogon nardus*) and commercial mouthwashes on *S. aureus* and *C. albicans* biofilms in prosthetic materials. *Arch Oral Biol.* 2020;109:104577.
  27. da Silva KR, Damasceno JL, Inácio M de O, Abrão F, Ferreira NH, Tavares DC, et al. Antibacterial and Cytotoxic Activities of *Pinus tropicalis* and *Pinus elliottii* resins and of the diterpene dehydroabiatic acid against bacteria that cause dental caries. *Front Microbiol.* 2019;10. Available:<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6514049/> [Cited 2020 Jun 8]
  28. Teodoro GR, Gontijo AVL, Salvador MJ, Tanaka MH, Brighenti FL, Delbem ACB, et al. Effects of acetone fraction from *Buchenavia tomentosa* Aqueous extract and gallic acid on *Candida albicans* biofilms and virulence factors. *Front Microbiol.* 2018;9:647.
  29. Bhat G, Kudva P, Dodwad V. *Aloe vera*: Nature's soothing healer to periodontal disease. *Journal of Indian Society of Periodontology.* 2011;15:205.
  30. Clark DT, Gazi MI, Cox SW, Eley BM, Tinsley GF. The effects of *Acacia arabica*

- gum on the *in vitro* growth and protease activities of periodontopathic bacteria. *Journal of Clinical Periodontology*. 1993; 20:238–43.
31. Gami B, Pathak S, Parabia M. Ethnobotanical, phytochemical and pharmacological review of *Mimusops elengi* Linn. *Asian Pacific Journal of Tropical Biomedicine*. 2012;2:743–8.
  32. Yaghini J, Shahabooei M, Aslani A, Zadeh MR, Kiani S, Naghsh N. Efficacy of a local-drug delivery gel containing extracts of *Quercus brantii* and *Coriandrum sativum* as an adjunct to scaling and root planing in moderate chronic periodontitis patients. *J Res Pharm Pract*. 2014;3:67–71.
  33. Pappas PG, Rex JH, Lee J, Hamill RJ, Larsen RA, Powderly W, et al. A prospective observational study of candidemia: Epidemiology, therapy, and influences on mortality in hospitalized adult and pediatric patients. *Clin Infect Dis*. 2003;37:634–43.
  34. Abreu AC, Serra SC, Borges A, Saavedra MJ, Salgado AJ, Simões M. Evaluation of the best method to assess antibiotic potentiation by phytochemicals against *Staphylococcus aureus*. *Diagn Microbiol Infect Dis*. 2014;79:125–34.
  35. Brighenti FL, Salvador MJ, Gontijo AVL, Delbem ACB, Delbem ÁCB, Soares CP, et al. Plant extracts: Initial screening, identification of bioactive compounds and effect against *Candida albicans* biofilms. *Future Microbiol*. 2017;12:15–27.
  36. Teodoro GR, Brighenti FL, Delbem ACB, Delbem ÁCB, Khouri S, Gontijo AVL, et al. Antifungal activity of extracts and isolated compounds from *Buchenavia tomentosa* on *Candida albicans* and non-albicans. *Future Microbiol*. 2015;10:917–27.
  37. Vaghela JH, Shah JH, Patel JH, Purohit BM. Comparison of safety and analgesic efficacy of diclofenac sodium with etodolac after surgical extraction of third molars: A randomized, double-blind, double-dummy, parallel-group study. *J Dent Anesth Pain Med*. 2020;20:19–27.
  38. Piecuch JF. What strategies are helpful in the operative management of third molars? *J Oral Maxillofac Surg*. 2012;70: S25-32.
  39. Li HY, Hu J, Zhao S, Yuan Z-Y, Wan HJ, Lei F, et al. Comparative study of the effect of baicalin and its natural analogs on neurons with oxygen and glucose deprivation involving innate immune reaction of TLR2/TNF $\alpha$ . *J Biomed Biotechnol*. 2012;2012:267890.
  40. Moghaddam E, Teoh B-T, Sam S-S, Lani R, Hassandarvish P, Chik Z, et al. Baicalin, a metabolite of baicalein with antiviral activity against dengue virus. *Scientific Reports*. 2014;4:5452.
  41. Chen J, Li Z, Chen AY, Ye X, Luo H, Rankin GO, et al. Inhibitory effect of baicalin and baicalein on ovarian cancer cells. *Int J Mol Sci*. 2013;14:6012–25.
  42. Lee W, Ku SK, Bae JS. Anti-inflammatory effects of baicalin, baicalein, and wogonin *in vitro* and *in vivo*. *Inflammation*. 2015;38: 110–25.
  43. Chi YS, Lim H, Park H, Kim HP. Effects of wogonin, a plant flavone from *Scutellaria radix*, on skin inflammation: *In vivo* regulation of inflammation-associated gene expression. *Biochem Pharmacol*. 2003;66: 1271–8.

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