http://dx.doi.org/ A Review Article

http://www.higieneanimal.ufc.br Veterinary Medicine

Medicinal Plants for Aphthous Ulcers: Therapeutic Effects and Evidence from Animal, Preclinical, and Clinical Studies: A Review

Plantas Medicinais para Úlceras Aftosas: Efeitos Terapêuticos e Evidências de Estudos Animais, Pré-Clínicos e Clínicos. Uma Revisão

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Abstract: Aphthous ulcers are common oral lesions that cause pain and discomfort. In traditional medicine, various medicinal plants have been employed to treat these ulcers due to their analgesic, anti-inflammatory, antimicrobial, and tissue-regenerative properties. These remedies typically have fewer side effects than conventional chemical drugs and may help prevent lesion recurrence. This review systematically analyzed Iranian traditional medicine texts alongside peer-reviewed scientific studies from domestic and international databases. Medicinal plants reported as effective for aphthous ulcers were identified, and their pharmacological properties including anti-inflammatory, antimicrobial, analgesic, and tissue-regenerative effects were examined. Prominent medicinal plants include *Rosmarinus officinalis*, *Citrus limon*, *Punica granatum*, *Aloe vera*, *Matricaria chamomilla*, *Camellia sinensis*, *Zingiber officinale*, *Glycyrrhiza glabra*, *Mentha* spp., *Salvia officinalis*, *Cichorium intybus*, *Vitis vinifera*, and others. The most frequently studied plant families were Lamiaceae, Asteraceae, Rosaceae, and Fabaceae, with fruits, leaves, and flowers being the most evaluated parts. These plants exhibit multiple pharmacological activities that promote healing, reduce inflammation, alleviate pain, and may help limit the recurrence of oral lesions. Medicinal plants provide promising complementary strategies for managing aphthous ulcers due to their low side-effect profiles and multiple therapeutic mechanisms. Integrating these plants with conventional treatments could improve clinical outcomes. Nevertheless, further well-designed clinical trials are required to confirm their efficacy and safety.

Keywords: Oral diseases, Aphthous ulcers, Traditional medicine, Medicinal plants, Anti-inflammatory, Healing, Complementary therapy

Resumo: As úlceras aftosas são lesões orais comuns que provocam dor e desconforto. Na medicina tradicional, diversas plantas medicinais têm sido empregadas no tratamento dessas lesões devido às suas propriedades analgésicas, anti-inflamatórias, antimicrobianas e regeneradoras de tecidos. Esses remédios geralmente apresentam menos efeitos colaterais em comparação aos fármacos químicos convencionais e podem auxiliar na prevenção da recorrência das lesões. Esta

revisão analisou sistematicamente textos da medicina tradicional iraniana juntamente com estudos científicos revisados por pares, de bases de dados nacionais e internacionais. Foram identificadas as plantas medicinais relatadas como eficazes para úlceras aftosas, e suas propriedades farmacológicas, incluindo efeitos anti-inflamatórios, antimicrobianos, analgésicos e regeneradores de tecidos, foram examinadas. Entre as plantas medicinais mais destacadas estão *Rosmarinus officinalis*, *Citrus limon*, *Punica granatum*, *Aloe vera*, *Matricaria chamomilla*, *Camellia sinensis*, *Zingiber officinale*, *Glycyrrhiza glabra*, espécies de *Mentha*, *Salvia officinalis*, *Cichorium intybus*, *Vitis vinifera*, entre outras. As famílias botânicas mais estudadas foram Lamiaceae, Asteraceae, Rosaceae e Fabaceae, sendo frutos, folhas e flores as partes mais avaliadas. Essas plantas apresentam múltiplas atividades farmacológicas que promovem a cicatrização, reduzem a inflamação, aliviam a dor e podem ajudar a limitar a recorrência das lesões orais. As plantas medicinais oferecem estratégias complementares promissoras para o manejo das úlceras aftosas devido ao baixo perfil de efeitos colaterais e aos múltiplos mecanismos terapêuticos. A integração dessas plantas com tratamentos convencionais pode aprimorar os desfechos clínicos. No entanto, são necessários ensaios clínicos bem delineados para confirmar sua eficácia e segurança.

Palavras-chave: Doenças orais, Úlceras aftosas, Medicina tradicional, Plantas medicinais, Anti-inflamatório, Cicatrização, Terapia complementar

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http://dx.doi.org/10.5935/1981-2965.20260003
Received on 09/1/2026 Accepted on 14/3/2026
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Introduction

Oral health is a fundamental component of public hygiene and overall quality of life, and the timely prevention of oral diseases such as dental caries and gingivitis can help prevent systemic complications and reduce associated healthcare costs (KAKUYI NEZHAD & GHAZNAVI, 2024; JAFARI HEYDARLOU & ALKHATIB, 2024; GHAZNAVI & LYSIUK, 2024; RAHIMI et al., 2023; GHAZNAVI ET AL., 2024; RAHIMI et al., 2023). Oral and dental diseases are among the most prevalent health issues worldwide, ranging from minor discomforts such as gingival inflammation and localized pain to more severe conditions, including extensive dental caries, tooth loss, and systemic infections (TAN et al., 2016). These disorders not only diminish patients' quality of life but also impose substantial economic burdens on healthcare systems (GERRITSEN et al.,

2010). Epidemiological studies indicate a high prevalence of oral and dental problems among both adults and adolescents, emphasizing the need for effective prevention and management strategies (MUHAMAD, 2016).

Aphthous ulcers are among the most common oral lesions (EDGAR et al., 2017). They are painful, recurrent, and non-contagious, typically presenting as small, round or oval ulcers with a white-to-yellow center and a red halo on the oral mucosa (CHAVAN et al., 2012). Patients often experience burning, tingling, or sharp pain at the lesion site prior to ulcer formation (AKINTOYE et al., 2014). While aphthous ulcers can occur across all age groups, they are particularly prevalent among adolescents, young adults, and women, with family history serving as a significant risk factor for susceptibility (SHIP et al., 2000).

The pathophysiology of aphthous ulcers is multifactorial, involving both local and systemic immune dysregulation. Activation of T lymphocytes and the subsequent release of pro-inflammatory cytokines, including IL-2, TNF-α, and IFN-γ, contribute to epithelial cell damage in the oral mucosa (KUMAR et al., 2014). Increased oxidative stress and reactive oxygen species further exacerbate inflammation and pain (NOOR et al., 2021).

Disruption of the epithelial barrier enhances mucosal permeability, facilitating local irritation and lesion progression (NOOR et al., 2021).

Although aphthous ulcers are not directly caused by infectious agents, alterations in the oral microbiome—such as increased populations of *Streptococcus sanguinis* and the presence of fungi like *Candida albicans*—may influence lesion severity and duration (ŚLEBIODA, 2014). These findings highlight the critical interplay between immune responses and oral microorganisms in ulcer pathogenesis (ŚLEBIODA et al., 2014).

Environmental and nutritional factors also contribute to ulcer formation. Local trauma (e.g., accidental biting or irritation from hard toothbrushes), deficiencies in vitamins and minerals such as B12, iron, and zinc, food sensitivities, and chronic stress increase susceptibility (FEMIANO et al., 2007). Preventive measures include maintaining oral hygiene, protecting the mucosa from injury, avoiding irritating foods, and managing stress (SHIP, 1996).

Mild aphthous ulcers typically heal spontaneously, whereas larger, painful, or

recurrent lesions may require intervention (BELENGUER-GUALLAR et al., 2014). Conventional therapies include chlorhexidine mouthwashes, topical lidocaine gels, and systemic corticosteroids (MIMURA et al., 2009).

However, long-term use of these agents can result in adverse effects such as mucosal dryness, local irritation, tooth discoloration, and gastrointestinal disturbances (MIMURA et al., 2009).

Traditional Iranian medicine, along with other ancient medical systems, has a long history of utilizing medicinal plants for oral and dental conditions (HAMEDI et al., 2016). Bioactive compounds in these plants, including flavonoids, tannins, and phenolic compounds—can modulate inflammatory pathways, reduce oxidative stress, and exert antimicrobial effects against oral bacteria and fungi (REZVANINEJAD et al., 2017).

Preliminary clinical and laboratory studies indicate that topical application of medicinal plants can alleviate pain and inflammation while promoting wound healing (SHAVAKHI et al., 2022).

Nonetheless, limitations such as small sample sizes, variability in plant species and preparation methods, and the absence of large-scale controlled trials hinder their broader adoption in standardized treatments (HAMEDI et al., 2016).

Given the clinical significance of aphthous ulcers and the limitations of conventional therapies, this review aims to synthesize both traditional and contemporary evidence regarding medicinal plants effective against oral ulcers, examine their potential mechanisms of action, and provide directions for future research.

Methods

This study was conducted as a descriptive review aimed at identifying and compiling both traditional and scientific evidence on native Iranian medicinal plants with potential therapeutic effects for oral ulcers.

Phase 1: Traditional Sources

In the first phase, classical reference books and authoritative texts on Iranian traditional medicine were thoroughly examined to generate an initial list of relevant plant species (GHAFOURI, 2002; AGHILI KHORASANI, 2003, 2004; AVICENNA, 2005; HAFEZIAN et al., 2010; IBN BAITAR, 2011; MOZAFFARIAN, 2007; SHAMS ARDEKANI et al., 2015).

This phase focused on identifying plants historically used for the prevention or alleviation of oral ulcer lesions.

Emphasis on original texts and well-documented traditional sources allowed the recognition of species with long-standing clinical application.

Phase 2: Contemporary Scientific Literature

In the second phase, a systematic search of contemporary scientific literature was performed using international databases, including Web of Science, PubMed, Google Scholar, and ISC. The search aimed to gather empirical and laboratory-based evidence regarding the pharmacological effects, chemical constituents, and potential mechanisms of action of the plants identified in phase one. Search terms included both the scientific and common names of each plant, combined with keywords such as "aphthous ulcer," "oral ulcer," "herbal therapy," and "traditional medicine."

Inclusion Criteria

Studies published in English or Persian reporting the pharmacological effects of medicinal plants for the prevention or treatment of oral ulcers, as well as traditional medicine sources documenting plant use for oral ulcer lesions, were considered eligible.

Exclusion Criteria

Studies focusing solely on medicinal plants unrelated to oral ulcers, articles lacking full text or sufficient data for analysis, non-scientific sources or websites without academic credibility, and duplicate studies across databases were excluded.

Data Extraction and Organization

Following application of the inclusion and exclusion criteria, extracted data included the scientific and English names of plants, plant family, plant parts used, pharmacological effects, potential mechanisms of action, and ecological and phytochemical characteristics. This information was systematically organized into tables to provide a comprehensive reference for researchers and clinicians investigating medicinal plants effective against oral ulcers.

Results

Based on the available evidence, several key medicinal plants from the Iranian flora have been identified as effective for the prevention and treatment of oral ulcers. These include *Rosmarinus officinalis*, *Citrus limon*, *Punica granatum*, *Cocos nucifera*, *Aloe vera*, species of *Mentha*, *Cichorium intybus*, *Salvia officinalis*, *Malus domestica*, *Matricaria chamomilla*, *Camellia sinensis*, *Spinacia oleracea*, *Lens culinaris*, *Vitis vinifera*, *Zingiber officinale*, *Myrtus communis*, *Glycyrrhiza glabra*, *Syzygium aromaticum*, *Coriandrum sativum*, species of *Rosa*, *Musa* spp., *Ocimum basilicum*, *Allium*

cepa, *Solanum lycopersicum*, *Calendula officinalis*, *Citrus sinensis*, *Morus alba*, *Daucus carota*, *Rosa damascena*, *Corylus avellana*, *Melissa officinalis*, *Plantago major*, *Borago officinalis*, *Elettaria cardamomum*, and species of *Acacia*.

Owing to their anti-inflammatory, antiseptic, and tissue-regenerative properties, these plants play a significant role in alleviating pain, reducing inflammation, and promoting the faster healing of oral ulcer lesions. Detailed phytotherapeutic information for these species is summarized in Table 1.

Table 1: Medicinal plants of Iranian flora used in prevention and treatment of oral aphthous ulcer

Persian Name	English Name	Scientific Name	Family	Plant Part Used
Rozmari	Rosemary	*Rosmarinus officinalis* L.	Lamiaceae	Leaf & Flower
Limo	Lemon	*Citrus limon* (L.) Osbeck	Rutaceae	Fruit
Anar	Pomegranate	*Punica granatum* L.	Lythraceae	Fruit
Nargil	Coconut	*Cocos nucifera* L.	Arecaceae	Fruit
Aloevera	Aloe Vera	*Aloe vera* (L.) Burm.f.	Asphodelaceae	Leaf Gel
Naena	Mint	*Mentha* spp.	Lamiaceae	Leaf
Kasni	Chicory	*Cichorium intybus* L.	Asteraceae	Leaf & Flower
Maryamgoli	Sage	*Salvia officinalis* L.	Lamiaceae	Leaf
Sib	Apple	*Malus domestica* Borkh.	Rosaceae	Fruit
Babouneh	Chamomile	*Matricaria chamomilla* L.	Asteraceae	Flower
Chayesiah	Black Tea	*Camellia sinensis* (L.) Kuntze	Theaceae	Leaf
Esfenaj	Spinach	*Spinacia Oleracea* L.	Amaranthaceae	Leaf
Adas	Lentil	*Lens culinaris* Medik.	Fabaceae	Seed

Angour	Grape	*Vitis vinifera* L.	Vitaceae	Fruit
Zanjabil	Ginger	*Zingiber officinale* Roscoe	Zingiberaceae	Rhizome
Mourd	Myrtle	*Myrtus communis* L.	Myrtaceae	Leaf & Fruit
Shirinbayan	Licorice	*Glycyrrhiza glabra* L.	Fabaceae	Root
Mikhak	Clove	*Syzygium aromaticum* (L.) Merr. & L.M. Perry	Myrtaceae	Flower Bud
Geshniz	Coriander	*Coriandrum sativum* L.	Apiaceae	Leaf & Seed
Golesorkh	Rose	*Rosa* spp.	Rosaceae	Flower
Mouz	Banana	*Musa* spp.	Musaceae	Fruit
Reyhan	Basil	*Ocimum basilicum* L.	Lamiaceae	Leaf
Piaz	Onion	*Allium cepa* L.	Amaryllidaceae	Bulb
Goje	Tomato	*Solanum Lycopersicon* L.	Solanaceae	Fruit
Golehamishebahar	Calendula	*Calendula officinalis* L.	Asteraceae	Flower
Portaghal	Orange	*Citrus sinensis* (L.) Osbeck	Rutaceae	Fruit
Shahtout	White Mulberry	*Morus alba* L.	Moraceae	Fruit
Havich	Carrot	*Daucus carota* L.	Apiaceae	Root
Goleroz	Damask Rose	*Rosa damascena* Mill.	Rosaceae	Flower
Fandogh	Hazelnut	*Corylus avellana* L.	Betulaceae	Fruit
Badranjbouyeh	Lemon Balm	*Melissa officinalis* L.	Lamiaceae	Leaf & Flower
Barhang	Plantain	*Plantago major* L.	Plantaginaceae	Leaf
Gavzaban	Borage	*Borago officinalis* L.	Boraginaceae	Leaf & Flower
Hel	Cardamom	*Elettaria cardamomum* (L.) Maton	Zingiberaceae	Seed Capsule

Aghaghia	Acacia	*Acacia* spp.	Fabaceae	Flower & Branch

Analysis of Table 1 revealed that the Lamiaceae family was the most frequently represented among the examined plant families. The families Asteraceae, Rosaceae, and Fabaceae were collectively ranked second in terms of frequency.

These findings underscore the prominence of these families in the reviewed literature and suggest a preference for species from these families in both traditional medicinal practices and contemporary research. In terms of plant parts, fruits, leaves, and flowers were the most utilized, reflecting their significance in traditional applications as well as pharmacological investigations.

Table 2 provides a summary of the bioactive compounds and potential mechanisms of action of medicinal plants shown to be effective against oral ulcers.

Table 2: Common Iranian medicinal plants and their mechanisms of action in prevention and treatment of oral aphthous ulcer

Scientific Name	Active Compounds	Mechanism of Action in Oral Aphthous Ulcers	Image
Rosmarinus officinalis L.	Rosmarinic acid, Carnosic acid, Eugenol, Flavonoids	Anti-inflammatory and antimicrobial, pain reduction, promotes wound healing	

Citrus limon (L.) Osbeck	Vitamin C, Limonene, Flavonoids	Antioxidant, anti-inflammatory, enhances tissue repair, inhibits bacterial growth	
Punica granatum L.	Polyphenols, Tannins, Anthocyanins	Inhibits bacterial and fungal growth, reduces inflammation and ulcer pain	
Cocos nucifera L.	Lauric acid, Polyphenols	Antimicrobial, moisturizing, soothing, anti-inflammatory	
Aloe vera (L.) Burm.f.	Aloin, Aloemarin, Enzymes, Vitamins	Anti-inflammatory, accelerates wound healing, reduces pain	

Mentha spp.	Menthol, Flavonoids	Pain relief, antimicrobial, anti-inflammatory	
Cichorium intybus L.	Inulin, Flavonoids	Anti-inflammatory, promotes oral tissue repair	
Salvia officinalis L.	Tannins, Flavonoids, Rosmarinic acid	Antimicrobial and anti-inflammatory, reduce ulcer pain, enhances healing	
Malus domestica Borkh.	Vitamin C, Flavonoids, Pectin	Reduces inflammation, antioxidant, supports mucosal repair	
Matricaria chamomilla L.	Apigenin, Flavonoids, Essential oils	Anti-inflammatory, antimicrobial, pain relief	

Camellia sinensis (L.) Kuntze	Catechins, Theophylline, Polyphenols	Anti-inflammatory, antimicrobial, pain reduction, accelerates healing	
Spinacia Oleracea L.	Vitamin C, Flavonoids, Carotenoids	Antioxidant, reduces inflammation, promotes mucosal repair	
Lens culinaris Medik.	Proteins, Flavonoids, Tannins	Anti-inflammatory, supports tissue repair, antioxidant	
Vitis vinifera L.	Resveratrol, Flavonoids, Tannins	Anti-inflammatory, antimicrobial, pain relief, prevents secondary infections	

Zingiber officinale Roscoe	Gingerols, Shogaols, Zingerone	Anti-inflammatory, analgesic, promotes wound healing	
Myrtus communis L.	Flavonoids, Myrtol, Essential oils	Antimicrobial, anti-inflammatory, reduces pain, accelerates healing	
Glycyrrhiza glabra L.	Glycyrrhizin, Flavonoids	Anti-inflammatory pain relief promotes oral wound healing	
Syzygium aromaticum (L.) Merr. & L.M. Perry	Eugenol, Stigmasterol, Flavonoids	Analgesic, anti-inflammatory, antimicrobial, supports healing	

Coriandrum sativum L.	Coriander aldehyde, Flavonoids	Antimicrobial, anti-inflammatory, reduces ulcer pain	
Rosa spp.	Flavonoids, Tannins, Essential oils	Anti-inflammatory, antimicrobial, stimulates mucosal repair, reduces pain	
Musa spp.	Potassium, Vitamins, Polyphenols	Moisturizing, anti-inflammatory, reduces irritation and pain	
Ocimum basilicum L.	Eugenol, Flavonoids	Anti-inflammatory, antimicrobial, reduces ulcer pain	

Allium cepa L.	Allyl propyl disulfide, Flavonoids	Anti-inflammatory, antimicrobial, pain relief, promotes repair	
Solanum lycopersicum L.	Lycopene, Vitamin C, Flavonoids	Anti-inflammatory, antioxidant, reduces irritation and pain	
Calendula officinalis L.	Flavonoids, Carotenoids, Triterpenes	Anti-inflammatory, accelerating wound healing, reduces pain	
Citrus sinensis (L.) Osbeck	Vitamin C, Flavonoids, Limonene	Anti-inflammatory, antimicrobial, promotes tissue repair, reduces pain	

Morus alba L.	Anthocyanins, Flavonoids	Anti-inflammatory, antioxidant, supports mucosal healing	
Daucus carota L.	Beta-carotene, Vitamin A, Flavonoids	Antioxidant, reduces inflammation, promotes tissue repair	
Rosa damascene Mill.	Flavonoids, Tannins, Essential oils	Anti-inflammatory, antimicrobial, supports tissue repair, reduces pain	
Corylus avellana L.	Vitamin E, Fatty acids	Moisturizing, anti-inflammatory, promotes mucosal repair	

Melissa officinalis L.	Flavonoids, Rosmarinic acid, Essential oils	Anti-inflammatory, antimicrobial, pain relief, accelerates healing	
Plantago major L.	Polysaccharides, Flavonoids	Anti-inflammatory, moisturizing, promotes wound repair	
Borago officinalis L.	Gamma-linolenic acid, Flavonoids	Anti-inflammatory, antimicrobial, pain relief, promotes repair	
Elettaria cardamomum (L.) Maton	Eugenol, Menthol, Flavonoids	Anti-inflammatory, antimicrobial, reduces ulcer pain	

Acacia spp.	Tannins, Flavonoids	Anti-inflammatory, antimicrobial, promotes faster wound healing	

Based on the analysis of Table 2, medicinal plants effective against aphthous ulcers exhibit a diverse range of therapeutic mechanisms, with the most prominent being anti-inflammatory, antimicrobial, analgesic, and tissue-regenerative effects. Anti-inflammatory activity was observed in nearly all reviewed species, highlighting its central role in reducing inflammation and alleviating ulcer symptoms.

Many of these plants also possess antimicrobial properties, enabling them to inhibit the growth of bacteria and fungi implicated in oral infections, thereby complementing their analgesic and discomfort-relieving effects. Additionally, their ability to stimulate tissue and mucosal repair represents a key therapeutic feature, promoting faster healing of oral ulcer lesions. Some species further demonstrate antioxidant activity, protecting oral tissues from oxidative damage and enhancing their anti-inflammatory effects. A limited number of plants also exhibit moisturizing and soothing properties on the oral mucosa, contributing to the relief of local discomfort. Modern pharmacological studies have validated the traditional therapeutic effects of *Rosmarinus officinalis* L., *Citrus limon* (L.) Osbeck, *Cocos nucifera* L., *Aloe vera* (L.) Burm.f., *Salvia officinalis* L., *Matricaria chamomilla* L., *Camellia sinensis* (L.) Kuntze, *Spinacia oleracea* L., *Zingiber officinale* Roscoe, *Myrtus communis* L., *Glycyrrhiza glabra* L., *Calendula officinalis* L., *Rosa damascena* Mill., *Plantago major* L., and *Elettaria cardamomum* (L.) Maton, as confirmed by contemporary scientific evidence. The corresponding results are summarized in Table 3.

Table 3: Effects of Selected Medicinal Plants on Oral Lesions and Dental Health: Evidence from Animal, Preclinical and Clinical Studies

Scientific Name	**Model Type**	**Summary of Therapeutic Effects (Evidence from Animal, Preclinical, and Clinical Studies)**	**Ref.**
Rosmarinus officinalis L.	Human – Clinical	Rosemary extract exhibits strong antimicrobial activity, significantly reducing human oral biofilms and demonstrating potential as an adjunctive therapy for the prevention of dental caries and periodontitis.	Günther et al., 2022
Citrus limon (L.) Osbeck	Human – Clinical	A honey–lemon spray (Mucotin) showed efficacy comparable to topical triamcinolone in alleviating pain and lesions in recurrent aphthous stomatitis, supporting its use as a safe first-line herbal therapy.	Shirzaiy et al., 2023
Cocos nucifera L.	Laboratory / Preclinical	Coconut shell alcohol extract inhibited the growth of cariogenic and periodontal pathogens, as well as *Candida* species, in a concentration-dependent manner, highlighting its potential for promoting oral health.	Jose et al., 2014
Aloe vera (L.) Burm.f.	Human – Clinical	Topical Aloe vera gel significantly reduced pain, inflammation, and lesion size in mild oral aphthae, thereby accelerating the wound healing process.	Babaee et al., 2012
Salvia officinalis L.	Human – Clinical	A mouthwash containing sage and curcumin reduced pain and accelerated the healing of recurrent aphthous lesions, offering a natural and effective therapeutic option.	Raheem, 2021

Matricaria chamomilla L.	Human – Clinical	Chamomile extract alleviated pain in mild oral aphthae and improved patient satisfaction, although triamcinolone was more effective in achieving complete lesion resolution.	Tadbir et al., 2015
Camellia sinensis (L.) Kuntze	Animal (Rat) – Preclinical	Treatment reduced wound size, increased epithelial thickness, and decreased inflammation, thereby accelerating oral wound healing.	Hashemipour et al., 2017
Spinacia Oleracea L.	Human – Clinical	Mouthwashes containing spinach and bitter melon extracts exhibited antimicrobial effects comparable to 0.2% chlorhexidine, suggesting a viable herbal alternative for caries prevention.	Kadam et al., 2023
Zingiber officinale Roscoe	Human – Clinical	A ginger-containing bio adhesive reduced pain in recurrent aphthous stomatitis, although it did not significantly affect lesion size or healing time.	Haghpanah et al., 2015
Myrtus communis L.	Human – Clinical	Consistent with traditional Iranian medicine, *Myrtus communis* possesses analgesic, anti-inflammatory, and wound-healing properties, demonstrating efficacy in mild aphthous ulcers.	Mahboubi, 2016
Glycyrrhiza glabra L.	Human – Clinical	A licorice root-based oral adhesive reduced pain and markedly decreased lesion size by day eight, thereby accelerating the healing process.	Martin et al., 2008
Calendula officinalis L.	Human – Clinical	A 25% calendula mouthwash rapidly reduced lesion size, pain, and erythema, while improving salivary antioxidant markers,	Ahmed, 2026

		serving as a safe and effective alternative to corticosteroids.	
Rosa damascene Mill.	Human – Clinical	A rose extract mouthwash decreased pain, lesion size, and number in recurrent aphthous stomatitis more effectively than placebo, supporting its use as an adjunctive herbal therapy.	Hoseinpour et al., 2011
Plantago major L.	Animal (Mouse) – Preclinical	A 5% standardized *Plantago major* nanoemulsion may enhance epithelialization of oral lesions, although it did not significantly accelerate healing in mouse models.	Jahanimoghadam et al., 2024
Elettaria cardamomum (L.) Maton	Human – Clinical	Cardamom mouthwash demonstrated limited antimicrobial activity, whereas chlorhexidine exhibited the highest efficacy, and green tea showed moderate potential.	Deolikar et al., 2024

Discussion

Aphthous ulcers and fungal infections caused by *Candida albicans*, particularly among immunocompromised patients and individuals with chronic oral conditions, represent common oral health challenges.

The rising resistance of microorganisms to conventional chemical drugs, along with associated adverse effects, has drawn increasing attention to medicinal plants and natural compounds as alternative or adjunctive therapies. Evidence suggests that herbal mouthwashes, gels, and creams can serve as effective substitutes or complements to conventional pharmaceuticals while minimizing side effects.

Clinical studies have demonstrated that the herbal mouthwash Persica significantly alleviates pain and accelerates healing of ulcerative lesions, providing a viable alternative to chemical drugs with known adverse effects (TAHDOUST AKRAD et al., 2003). Similarly, gels containing *Eucalyptus* and natural honey, with strong antibacterial activity, have been

shown to promote faster recovery of ulcerative lesions and act as effective natural remedies (AMARLOO, 2021).

The mouthwash Protect, containing *Thymus vulgaris* (Shirazi thyme) extract, also exhibited anti-inflammatory, antimicrobial, and tissue-regenerative activities, facilitating oral wound healing and achieving high satisfaction among patients and clinicians (MIRZAEI et al., 2025).

Multiple studies indicate that native Iranian and regional plants exert significant anti-*Candida* effects and can be used as adjunct or alternative therapies to reduce *Candida albicans* proliferation and alleviate oral thrush symptoms (GHAZNAVI et al., 2024).

Notable examples include Persica, *Echinacea*, *Matricaria*, Cinnamol, *Cuminum cyminum*, Lemon balm, *Camellia sinensis*, *Zingiber zerumbet*, *Crocus sativus*, *Valeriana*, *Thymus*, and *Allium sativum*. Aqueous and ethanolic extracts of plants such as *Jatropha curcas*, *Eucalyptus globulus*, *Vernonia amygdalina*, and *Zanthoxylum zanthoxyloides* demonstrated significant antifungal activity against *Candida* species, highlighting their potential as natural oral antifungal agents (EBABHI et al., 2019).

Extracts of saffron, clove, black cumin, and miswak similarly inhibited *Candida* growth, offering potential complementary therapies for oral infections (MOHAMMED & FADHIL, 2025).

The extract of *Rosmarinus officinalis* L., rich in phenolic and flavonoid compounds, inhibited *Candida* biofilm formation, exhibiting effects comparable to nystatin (MECCATTI et al., 2021).

Methanolic extracts of *Matricaria chamomilla* flowers inhibited strains resistant to conventional antifungals (ABDULLAH et al., 2022). The rhizome extract of *Zingiber zerumbet*, with antifungal and anti-inflammatory properties, has been formulated as a thermosensitive hydrogel, providing prolonged stability and ease of application (HUANBUTTA et al., 2024).

Other studies reported significant antifungal activity for *Syzygium aromaticum* and *Punica granatum*, with *S. aromaticum* outperforming nystatin in some cases (MANSOURIAN et al., 2014). Conversely, extracts of *Ocimum sanctum* leaves and eugenol showed limited efficacy compared to standard drugs (SASMITO et al., 2022). Beetroot and onion extracts also demonstrated satisfactory anti-*Candida* activity and acted synergistically with conventional antifungal agents (AHMED,

2023).

In clinical applications, *Calendula officinalis* vaginal cream proved effective against vaginal candidiasis, exhibiting longer-lasting effects than clotrimazole (SAFFARI et al., 2017). Extracts of *Morus alba* and its active compound Kuwanon G demonstrated strong antibacterial effects against pathogens responsible for dental caries and periodontal diseases (PARK et al., 2003).

Extracts of *Glycyrrhiza glabra*, *Ficus religiosa*, and *Plantago major* exhibited notable anti-*Candida* activity, though further studies are required to determine optimal dosages and clinical protocols (Sharma et al., 2016). Extracts of *Borago officinalis* and *Camellia sinensis* showed broad antifungal effects against various *Candida* and *Aspergillus* species, representing promising natural sources of bioactive compounds (EIDI et al., 2014).

Furthermore, extracts of *Elettaria cardamomum* strongly inhibited pathogenic *Candida* species and biofilm formation, with acetonic extracts completely preventing biofilm development (VIJAYALAKSHMI et al., 2016).

Conclusion

Overall, the evidence indicates that diverse medicinal plants exhibit significant anti-inflammatory, antimicrobial, and anti-*Candida* effects on oral lesions and fungal infections.

Herbal mouthwashes, gels, and creams containing these extracts, either as standalone therapies or as adjuncts to conventional treatments, can reduce side effects and enhance patient satisfaction. Future research should focus on determining optimal dosages, effective concentrations, and clinical efficacy to facilitate the development of standardized and effective herbal therapies.

Statements and Declarations

Funding support

The authors did not receive support from any organization for the submitted work

Competing interests

The authors have no competing interests to declare that are relevant to the content of this article.

Ethics approval

This study was performed in line with the principles of the Declaration of Helsinki.

Consent to participate

Informed consent was obtained from all individual participants included in the study.

Acknowledgments

The authors would like to express their gratitude to the clinical research development unit of Imam Khomeini Hospital, Urmia

University of Medical Sciences, for English editing.

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