



# **Evaluation of Periodontitis Prevention by Using Traditional Medicinal Plants**

**Madhavi Pillalamarri <sup>a</sup>, Peddinti Harika <sup>a</sup>,  
Sravanthi Gojuvaka <sup>a</sup>, Samrin Saba <sup>a</sup>, Uma Devi Dasari <sup>a</sup>  
and Siddhartha Lolla <sup>a\*</sup>**

<sup>a</sup> Department of Pharmacology, Pulla Reddy Institute of Pharmacy, Jawaharlal Nehru Technological University, Dundigal, Hyderabad, Telangana-500043, India.

## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

## **Article Information**

DOI: 10.9734/IJTDH/2024/v45i51533

## **Open Peer Review History:**

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/115343>

**Review Article**

**Received: 28/01/2024**

**Accepted: 01/04/2024**

**Published: 03/04/2024**

## **ABSTRACT**

Periodontitis is a serious gum infection that damages gums and can destroy the jawbone. It is a disease of the tissue surrounding the tooth structure. It's usually brought on by bad brushing and flossing practices that let plaque sticky layer of bacteria accumulate and solidify on the teeth. The gums get swollen, red, and bleeding at first. In this perspective, the various mouth disinfection, etc. This study helps to examine the number of herbal plants to evaluate the periodontitis infection. As therapeutic and preventive measures, such as mechanical instrumentation, gingival irrigation, and oral hygiene. Lack of access to contemporary medical care is one of the primary causes of periodontitis in the global population. The present review aims to determine the pharmacological uses of a number of therapeutic herbs. Phytochemical constituents are mainly responsible for periodontitis is allicin; allin; musilage; albumin; alpha-glutamyn peptides; volatile acids; amino acids as methionine, lucine, cystine, vitamin C, demethoxycurcumin, curcuminoids, bisdemethoxycurcumin, volatile oils, tannins, flavonoids, cocumarins, phenylproponoids,

\*Corresponding author: Email: [siddu.pharmd@gmail.com](mailto:siddu.pharmd@gmail.com);

naphthalene, analogs, lipids, vitamins, phytosterols. The medicinal plants which are used for the periodontitis activity are *Curcuma longa*, *Aradiachta indica*, *Aloe barbadensis is miller*, *Syzygium aromaticum*, *Allium sativum* *Cinnamomum verum*, *piper cubeba* etc. due to their phytochemical constituents and biological active components which shows beneficial effects.

**Keywords:** Plaque; gingival irritation; phytochemicals; flossing habit.

## 1. INTRODUCTION

The gums and bone that surround and support the teeth are prone to infection and inflammation, which is the main cause of periodontal diseases. It is an inflammatory condition brought by oral cavity bacteria. The periodontium is destroyed by these bacteria when they combine to form complexes in the biofilms. According to most studies, 10% to 50% of people worldwide suffer from severe periodontitis. Periodontal diseases are a significant issue in Africa, where they can be as prevalent as 96% in certain nations. Certain regions of Cameroon have reported prevalence rates ranging from 30 to 98%. The primary objective of periodontal therapy is the eradication of subgingival microbes and bacterial plaque that are linked to periodontal disease. Professional scaling, surgery, and/or the use of systemic or local antimicrobial agents can all help achieve it [1]. These conditions are the most common oral health issues brought on by the dental plaque [2]. A complex microbial community with more than 108 bacteria per milligram is known as dental plaque. Up to 400 different bacterial species are thought to be present in plaque. Certain microorganisms found in Plaque have recently been linked to long-term periodontal disorders [3,4]. A clinical state of periodontal health is typically the consequence of a dynamic equilibrium between the host and periodontal microbiota, and is characterized by minimal inflammatory changes in the gingival margin tissues [5,6,7]. The development of intricate subgingival microbial biofilms and periodontal microbiota dysbiosis are the causes of this immune-inflammatory illness. *Porphyromonas gingivalis*, one of the primary pathogens responsible for the onset of periodontitis, induces proinflammatory cytokines, including IL-1, IL-8, IL-6, and TNF $\alpha$ . These cytokines permeate the gingival connective tissue, trigger a localized inflammatory response, and raise PMN (polymorphonucleocyte) counts and activity in tandem with cytokine production [8,9]. These PMNs also produce reactive oxygen species and set off an infection-related defense mechanism [10,11]. Additionally, it is essential for the inflammatory and catabolic processes that

lead to the degradation of periodontal tissues [12]. Periodontal disease are considered as surgical and non surgical treatment. Only few drugs are available for the treatment of periodontitis. Traditional medicinal plants are used in treatment of periodontals are Garlic, Cinnamon, Turmeric, Neem, Alovera, Clove, Pepper etc [12].

## 2. PERIODONTITIS ACTIVITY OF VARIOUS MEDICINAL PLANTS

### 2.1 Garlic

It's scientific name is *Allium sativum*. It belongs to the family of amaryllidaceae. The chemical constituents of allium sativum are alliin; allin; mucilage; albumin; alpha-glutamyl peptides; volatile acids; amino acids as methionine, leucine, cystine, vitamin C. The pharmacological activity of garlic are anti viral, anti protozoal, anti microbial, anti cancer, anti oxidant, anti inflammatory, anti thrombotic, anti obesity, anti hypertensive, anti alzheimer's disease. Allium sativum is extracted by steam distillation. At 200C, conidial germination and mycelial growth of all three pathogens were effectively inhibited by garlic volatiles across the concentration range. Garlic inhibits and destroys bacteria, fungus and parasites as well as lowers blood pressure, cholesterol and sugar levels, preventing blood clotting and protecting the liver [13].

### 2.2 Cinnamon

The scientific name of cinnamon is *Cinnamomum verum*, *Cinnamomum aromaticum*, *Cinnamomum cassia*, *Cinnamomum zeylanicum*. It belongs to the family of lauraceae. It's chemical constituents are 0.5- 1% volatile oils, 1.2% tannin (phlobotannin) mucilage, calcium oxalate, starch and mannitol. Cinnamomol oil- eugenol, benzaldehyde, cumin aldehyde and other terpenes. The pharmacological activity are antioxidant, anti-inflammatory, antidiabetic, antimicrobial, anti cancer, lipid -lowering, cardiovascular disease -lowering compounds. Extracting volatile oil in cinnamon bark by utilizing an organic solvent. Extracting degraded

cinnamon bark powder after oil by utilizing a certain concentration of ethanol. It is also extracted by steam distillation. Cinnamon proved to have good potential for the invitro control of pathogens that are frequently isolated from the cows with endometritis. The results also indicated that cinnamon was able to inhibit formation significantly ( $p < 0.05$ ) [14,15,16]. Cinnamon have activities against neurological disorders, such as Parkinson's and Alzheimer's diseases [17].

### 2.3 Turmeric

The scientific name of turmeric is *Curcuma longa*. It belongs to the family of zingiberaceae. The chemical constituents are curcumin, demethoxycurcumin, curcuminoids, bisdemethoxycurcumin. The pharmacological activities are anti cancer, antidiabetic, anti oxidative, anti microbial, anti osteoarthritis, renoprotective, neuroprotective. It is extracted from steam distillation, hydro distillation and hexane. It's invitro method is used for microbiota modulation in patients with hypertension. Turmeric is used as an herbal medicine for rheumatoid arthritis, chronic anterior uveitis, conjunctivitis, skin cancer, small pox, chicken pox, wound healing, urinary tract infections and liver ailments [18].

### 2.4 Neem

The scientific name of neem is *Aradiachta indica*. It belong to the family of meliaceae. The chemical constituents are nimbin, nimbanene, himbolide, ascorbic acid, nimbandiol, aminoacid, hexalosanol, 7-desacetal, -7-benzoylazadiradione, nimbiol. The pharmacological activity are anti-bacteria, anti-fungal, anthemintic, anti-parasitic, anti-cancer, antidiarrheal, anti-microbial, anti-hiv, anti-pyretic, immune modulation. It is extracted from aqueous extraction. It's invitro method effect is invitro antibacterial activity against both staphylococcus aureus and LARSA with greatest cones of inhabitation noted at 100% concentration. Neem efficacious against skin diseases, septic sores and infected burns. The neem oil is used for the skin diseases such as scrofula, indolent ulcers and ringworms [1,19].

### 2.5 Aloe vera

The scientific name of aloe vera is *Aloebarbadensis millar*. It belongs to the family of Liliaceae. The chemical components are flavonoids, cocumarins, phenylproponoids,

naphthalene, analogs, lipids, vitamins, phytosterols. The aloe vera has many pharmacological activities like anti-oxidants, anti-inflammatory, Immunoregulatory activities. It is extracted from ethanol. Its invitro method effect is antimicrobial activity by aloe vera juice. Aloe vera is traditionally used to treat skin injuries and digestive problems [12].

### 2.6 Clove

The scientific name of clove is *Syzygium aromaticum*. It belong to the family of myrtaceae. The chemical constituents are volatile oils, phenol chiefly eugenol, acetyl eugenol, humulenol, alpha and beta caryophyllene, tannins other substances mainly methyl furfural and dimethyl furfural. Other pharmacological activities of clove are anti microbial, anti oxidant, anti inflammatory, analgesic, anticancer and anaesthetic effect. The extraction of clove involves hydro and steam distillation. Clove helps in lower your risk of developing heart disease, diabetics and certain cancers [20].

### 2.7 Pepper

The scientific name of piper is *Piper nigrum*. It belongs to the family of piperaceae. It consists of alkaloids (piperine, piperidine), volatile oil, pungent resin, starch, piper volatile oils contains caryophyllene and phellandrene. The pharmacological activities involves antihypertensive and anti-platelets, antioxidants, antitumor, antiasthmatics, antipyretic, analgesic, anti-inflammatory, anti-diarrheal, antispasmodic, anxiolytic, antidepressant hepatoprotective, immune-modulatory, antibacterial, antifungal, anti-thyroids. To extract the volatile oil from black peppers, a combination process of water steam distillation and ether extraction is used, along with salting, drying with a drying agent, and solvent recovery under low pressure. Pepper used to improve cholesterol levels, blood sugar control, brain and gut health [21].

## 3. DISCUSSION

From mild gingivitis to advanced loss of connective tissue attachment and supporting bone, periodontal disease is an infectious process. Suppression or elimination of the subgingival periodontopathogens is necessary for the effective treatment of periodontitis. As probing depth increases, the effectiveness of conventional homecare and non-surgical mechanical procedures in controlling the pathogenic flora declines [22,23]. Therefore, when used as a supplement to mechanical

**Table 1. Other pharmacological activities of medicinal plants**

<b>Plant Name</b>	<b>Family</b>	<b>Other Pharmacological Activities</b>	<b>Chemical Constituents</b>
<i>Allium sativum</i>	Amaryllidaceae	Antibacterial activity, Vasodilator, Relaxant	Allicin; allin; musilage; albumin; alpha glutamyn peptides; volatile acids; amino acids as methionine, lucine, cystine, vitamin C
<i>Cinnamomum verum</i>	Lauraceae	Antibacterial activity, Vasodilator, Relaxant	0.5- 1% volatile oils, 1.2% tannin (phlobotannin) mucilage, calcium oxalate, starch and mannitol. Cinnamol oil- eugenol, benzaldehyde, cumin aldehyde and other terpenes.
<i>Curcuma longa</i>	Zingiberaceae	Anticancer, Antidiabetic, Antibacterial activity, Vasodilator, Relaxant, Cardioprotective	Curcumin difer uloylmethane, demethoxycurcumin, curcuminoids, bisdemethoxycurcumin.
<i>Aradiachta indica</i>	Neliaceae	Immunomodulatory, Antiinflammatory, Antimalarial, Antiviral, Antioxidant, Anti Anticarcinogenic	Nimbin, nimbanene, himbolide, ascorbic acid, nimbandiol, aminoacid, hexalosanol, 7- desacetal -7- benzoylazadiradione, nimbiol.
<i>Aloebarbadensis millar</i>	Liliaceae	Antifungal, Antiinflammatory, Anticancer, Immunomodulatory	Flavonoids, cocumarins, phenylproponoids, naphthalene, analogs, lipids, vitamins, phytosterols.
<i>Syzygium aromaticum</i>	Myrtaceae	Antimicrobial, Antioxidant, Analgesic, Antioxidant	Volatile oils, phenol chiefly eugenol, acetyl eugenol, humulen, alpha and beta caryophyllene, tannins other substances mainly methyl furfural and dimethyl furfural.
<i>Piper nigrum</i>	Piperaceae	Antihypertensive, Antiplatelets, Antitumor, Antispasmodic, Antifungal	Alkaloids (piperine, piperidine), volatile oil, pungent resin, starch, piper volatile oils contains caryophyllene and phellandrene.

debridement, antimicrobial agents try to directly lower the pocket micro flora. There is a great deal of interest in creating novel antimicrobial molecules to combat periodontal infections because of the restricted access to medical care and pharmaceutical facilities in developing nations, coupled with the rise in bacterial resistance to antibiotics [24][25] Furthermore, a wide range of bioactive compounds with potent pharmacological actions and no unfavorable side effects are present in most plants [26] Herbal formulations, or therapy based on conventional herbs, are essential for naturally reducing the difficulties of periodontitis. Moreover, traditional medicine is required to treat periodontitis in developing countries, particularly to lessen the financial burden that the general public has while using regular dose forms [27,28]. Antibacterial, antifungal, and antiproteolytic properties of garlic are well established. The current investigation evaluated garlic's efficacy, specifically in relation to potential periodontal pathogens. Garlic has a strong inhibitory effect against periodontal pathogens, according to the current study [29,30]. Cinnamon is known to have antibacterial effect of cinnamon essential oil and extracts against cariogenic bacteria and approximately a dozen studies focused on the antifungal effect. Pure cinnamon compounds show different antimicrobial properties [18]. This study on the antibacterial activity of curcumin is valuable in light of the emerging natural antibacterial agents against strains that are resistant to drugs. This study's primary goal was to assess curcumin's antibacterial properties against periodontopathic bacteria [19]. Neem has been considered to have an astringent, antiseptic, insecticidal, antiulcer properties. *Azadirachta indica* or neem has been used widely in the Indian subcontinent for decades of years as a remarkable tool for maintaining healthy periodontium. It is considered as a useful alternative for maintaining healthy periodontium because of its chemopreventive action [20]. Alovera is also used to cure the Periodontal disease. Alovera is known to have antioxidants, anti-inflammatory activity [5]. For centuries, people have used *Syzygium aromaticum*, or clove, as a flavoring and fragrance in their food. Eugenol was the most abundant of the 21 components made from clove leaf essential oil in this work. Eugenol, which ranges in content from 45% to 90% of cloves, is primarily found in the leaves and buds of cloves [21]. Pepper has a well-documented anti-inflammatory effect. Piperine's antibacterial and anti-inflammatory properties may be responsible for these effects. According to

reports, piperine inhibits the production of nitric oxide and tumor necrosis factor- $\alpha$ , two substances known to be involved in the pathophysiology of inflammation in periodontal disease [13].

- Vitamin C is the main constituent which is present in the above mentioned plants. Vitamin C aids in both the treatment and prevention of periodontal disease [27,31,32].

#### 4. CONCLUSION

The majority of herbal plants that we utilize on a daily basis for their excellent therapy for the management of periodontitis. Effective treatment of periodontitis requires the removal/elimination of subgingival periodontal pathogenic bacteria. In order to replace the surgical method with a non-surgical method process and conventional home care methods in controlling pathogens. The medicinal plants which are selected for periodontitis activity are *Curcuma longa*, *Aradiachta indica*, *Aloebarbadensis melle*, *Syzygium aromaticum*, *piper cubeba*, *Cinnamomum verum*, *Allium sativum* because of their significant therapeutic effects. Hence, these selected herbal plants have high chances to raise the possibility in order to prevent and treat periodontitis.

#### CONSENT AND ETHICAL APPROVAL

It is not applicable.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

#### REFERENCES

1. Elavarasu S, Abinaya P, Elanchezhian S, Vennila K, Naziya KB. Evaluation of anti plaque microbial activity of *Azadirachta indica* (neem oil) in vitro: A pilot study. *Journal of pharmacy & bioallied sciences*. 2012 Aug;4(Suppl 2):S394.
2. Al-Zahrani MS, Borawski EA, Bissada NF. Increased physical activity reduces prevalence of periodontitis. *Journal of dentistry*. 2005 Oct 1;33(9):703-10.
3. Timmerman MF, Van der Weijden GA. Risk factors for periodontitis. *International journal of dental hygiene*. 2006 Feb;4(1):2-7.21. Van Dyke TE, Dave S. Risk factors for periodontitis. *Journal of the*

- International Academy of Periodontology. 2005 Jan;7(1):3.
4. Köll-Klais P, Mändar R, Leibur E, Marcotte H, Hammarström L, Mikelsaar M. Oral lactobacilli in chronic periodontitis and periodontal health: species composition and antimicrobial activity. *Oral microbiology and immunology*. 2005 Dec;20(6):354-61.
  5. Nikniaz S, Vaziri F, Mansouri R. Impact of resveratrol supplementation on clinical parameters and inflammatory markers in patients with chronic periodontitis: a randomized clinical trial. *BMC Oral Health*. 2023 Mar 27;23(1):177.
  6. MS, Mombelli A. Early-onset periodontitis. *Annals of Periodontology*. 1999 Dec;4(1):39-52.
  7. Fine DH, Mandel ID. Indicators of periodontal disease activity: an evaluation. *Journal of clinical periodontology*. 1986 May;13(5):533-46.
  8. Toczewska J, Konopka T. Activity of enzymatic antioxidants in periodontitis: A systematic overview of the literature. *Dental and medical problems*. 2019 Oct 1;56(4):419-26.
  9. Lee W, Aitken S, Sodek J, McCulloch CA. Evidence of a direct relationship between neutrophil collagenase activity and periodontal tissue destruction in vivo: role of active enzyme in human periodontitis. *Journal of periodontal research*. 1995 Jan;30(1):23-33.34. Sanders AE, Slade GD, Fitzsimmons TR, Bartold PM. Physical activity, inflammatory biomarkers in gingival crevicular fluid and periodontitis. *Journal of clinical periodontology*. 2009 May;36(5):388-95.
  10. Kwon T, Lamster IB, Levin L. Current concepts in the management of periodontitis. *International dental journal*. 2021 Dec 1;71(6):462-76.
  11. Bizzarro S, Van Der Velden U, Ten Heggeler JM, Leivadaros E, Hoek FJ, Gerdes VE, Bakker SJ, Gans RO, Ten Cate H, Loos BG. Periodontitis is characterized by elevated PAI-1 activity. *Journal of clinical periodontology*. 2007 Jul;34(7):574-80.
  12. Dodwad V, Arora K. Effects of Aloe vera gel, Aloe vera irrigation in treatment of chronic periodontitis-A clinico-microbiological study. *KDJ*. 2011 Jan;34(1):48-51.7. Yanakiev S. Effects of cinnamon (*Cinnamomum* spp.) in dentistry: A review. *Molecules*. 2020 Sep 12;25(18):4184.
  13. Toczewska J, Konopka T. Activity of enzymatic antioxidants in periodontitis: A systematic overview of the literature. *Dental and medical problems*. 2019 Oct 1;56(4):419-26.
  14. Preshaw PM, Bissett SM. Periodontitis and diabetes. *British dental journal*. 2019 Oct;227(7):577-84.
  15. Tonetti MS, D'Aiuto F, Nibali L, Donald A, Storry C, Parkar M, Suvan J, Hingorani AD, Vallance P, Deanfield J. Treatment of periodontitis and endothelial function. *New England Journal of Medicine*. 2007 Mar 1;356(9):911-20.
  16. Rodríguez-Lozano B, González-Febles J, Garnier-Rodríguez JL, Dadlani S, Bustabad-Reyes S, Sanz M, Sánchez-Alonso F, Sánchez-Piedra C, González-Dávila E, Díaz-González F. Association between severity of periodontitis and clinical activity in rheumatoid arthritis patients: a case-control study. *Arthritis research & therapy*. 2019 Dec;21:1-2.
  17. Bomdyal RS, Shah MU, Doshi YS, Shah VA, Khirade SP. Antibacterial activity of curcumin (turmeric) against periopathogens-An in vitro evaluation. *Journal of Advanced Clinical and Research Insights*. 2017 Nov 1;4(6):175-80.
  18. Paul S, Rithesh K, Savita S. Neem: A herbal remedy for periodontitis. *Glob. J. Res. Anal*. 2017;6(6):2431-2.
  19. Zhang Y, Wang Y, Zhu X, Cao P, Wei S, Lu Y. Antibacterial and antibiofilm activities of eugenol from essential oil of *Syzygium aromaticum* (L.) Merr. & LM Perry (clove) leaf against periodontal pathogen *Porphyromonas gingivalis*. *Microbial pathogenesis*. 2017 Dec 1;113:396-402.
  20. Gopalakrishna PK, Jayaramu RA, Boregowda SS, Eshwar S, Suresh NV, Abu Lila AS, Moin A, Alotaibi HF, Obaidullah AJ, Khafagy ES. Piperine-Loaded In Situ Gel: Formulation, In Vitro Characterization, and Clinical Evaluation against Periodontitis. *Gels*. 2023 Jul 14;9(7):577.
  21. Shetty S, Thomas B, Shetty V, Bhandary R, Shetty RM. An in-vitro evaluation of the efficacy of garlic extract as an antimicrobial agent on periodontal pathogens: A microbiological study. *Ayu*. 2013 Oct;34(4):445.

22. Listgarten MA. Pathogenesis of periodontitis. Journal of clinical periodontology. 1986 May;13(5):418-25.
23. Borrell LN, Papapanou PN. Analytical epidemiology of periodontitis. Journal of clinical periodontology. 2005 Oct;32:132-58.
24. Walker CB, Pappas JD, Tyler KZ, Cohen S, Gordon JM. Antibiotic susceptibilities of periodontal bacteria: In vitro susceptibilities to eight antimicrobial agents. Journal of periodontology. 1985 Nov;56:67-74.
25. Slots J. Periodontitis: facts, fallacies and the future. Periodontology 2000. 2017 Oct;75(1):7- 23.
26. Madhavi P, Swathika K, Akhil K, Kumar PN, Anusri J, Ahmed F, Sarkar R. Evaluation of anti-inflammatory activity using plants brassica oleracea VAR. CAPITA, *Brassica oleracea* VAR. Italica; 2023.
27. Fageeh HN, Fageeh HI, Prabhu A, Bhandi S, Khan S, Patil S. Efficacy of vitamin C supplementation as an adjunct in the non-surgical management of periodontitis: a systematic review. Systematic Reviews. 2021 Dec;10(1):1-0.
28. Merchant AT, Pitiphat W, Rimm EB, Joshipura K. Increased physical activity decreases periodontitis risk in men. European journal of epidemiology. 2003 Sep;18:891-8.
29. Flemmig TF. Periodontitis. Annals of periodontology. 1999 Dec;4(1):32-7.
30. Bienvenue DN, Bong DA, Brian NZ, Staphane Ja HG. In Vitro Evaluation of the Efficacy of an Aqueous Extract of Allium Sativum as an Antibacterial Agent on Three Major Periodontal Pathogen. J Oral Dent Health Res. 2021;3(1):1-5.
31. Kjeldsen M, Holmstrup P, Bendtzen K. Marginal periodontitis and cytokines: a review of the literature. Journal of periodontology. 1993 Nov;64(11): 1013-22.
32. Kjeldsen M, Holmstrup P, Bendtzen K. Marginal periodontitis and cytokines: a review of the literature. Journal of periodontology. 1993 Nov;64(11): 1013-22.

© Copyright (2024): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*

*The peer review history for this paper can be accessed here:  
<https://www.sdiarticle5.com/review-history/115343>*