

## Aloe vera's therapeutic role in treating oral lesions: A review

Sumana Chithari Keshava \*

Senior lecturer, Department of Oral medicine & Radiology, Krishnadevaraya College of Dental Sciences, Bangalore, India.

World Journal of Biological and Pharmaceutical Research, 2024, 07(01), 001-007

Publication history: Received on 20 June 2024; revised on 22 August 2024; accepted on 25 August 2024

Article DOI: <https://doi.org/10.53346/wjbpr.2024.7.1.0032>

### Abstract

Aloe vera has been recognized for centuries as a medicinal plant renowned for its myriad health benefits, earning it the moniker of 'nature's miracle healer'. This tropical succulent thrives in warm, arid climates and resembles a cactus with its fleshy, spiky leaves. Among approximately 400 species of Aloe, Aloe barbadensis Miller (known as Aloe vera or "true aloe") stands out, predominantly found in Asia, Africa, and other tropical regions. This particular species is celebrated for its medicinal properties, including moisturizing, anti-inflammatory, antioxidant, anticancer, antibacterial, antiviral, and antifungal effects.

**Keywords:** Aloe vera; Magic herb; Dental uses; Anti-oxidant; Anti inflammatory

### 1. Introduction

Aloe Vera, a member of the botanical family Asphodelaceae, derives its name from the Arabic word "Alloeh," meaning "shining bitter substance," and "Vera," Latin for "true." Known also as Indian Aloe, Burn Aloe, True Aloe, and the "First aid plant," this versatile plant has over 300 species, with Aloe barbadensis renowned for its exceptional medicinal qualities. Native to dry regions of Africa, Asia, Europe, and America, Aloe Vera is prized for its myriad medicinal properties, primarily sourced from its leaves [1].

### 2. Aloe Vera plant

Aloe Vera presents itself with green to grayish colored foliage characterized by triangular, fleshy leaves arranged in a rosette atop a very short stem. These leaves measure approximately 30-50cm in length and 10cm in width at the base, featuring serrated edges. The whole leaf extract of Aloe Vera includes both its gel and inner parenchyma leaf pulp, along with bitter latex. Primarily valued for its dermatological advantages, Aloe Vera boasts numerous medicinal properties, with its leaves being the primary source utilized [2].

Aloe Vera is prized for its extensive medicinal properties, particularly its dermatological benefits, with its leaves being the primary part utilized for these purposes.

The main active constituents of Aloe Vera plant extract include hormones, anthraquinones, and their glycoside derivatives. Additionally, it contains phenylpyrone derivatives, flavonoids, phenylpropanoids, coumarins, phytosterols, naphthalene analogs, lipids, and vitamins [3].

Known for its dermatological benefits, the Aloe vera plant belongs to a family comprising over 300 species. Botanically named Aloe barbadensis miller, this tropical succulent is characterized by long, thick fleshy leaves with serrated edges that grow in a basal rosette. With proper care, it may produce yellow or spiky red flowers, though this flowering process

\*Corresponding author: Sumana Chithari Keshava

can take several years as young Aloe vera plants require time to mature and develop flower stalks. Despite this, Aloe vera remains a relatively fast-growing succulent, reaching maturity in 3-4 years compared to other plants.

## 2.1. Contents

Aloe vera contains a diverse array of active ingredients, including Enzymes like Alkaline phosphatase, Amylase, Bradykinase, Carboxy peptidase, Catalase, Cellulase, Lipase and Peroxidase, Vitamins like Vitamin A (Beta carotene), C, E, B12, Folic acid and Choline, Enzymes -Alkaline phosphatase, Amylase, Bradykinase, Carboxy peptidase, Catalase, Cellulase, Lipase and Peroxidase and also Monosaccharides (glucose and fructose) and Polysaccharides (glucomannans/ polymannose/Acemannan), Anthraquinones, Fatty acids, and aminoacids.

Many of the health benefits associated with Aloe vera have been attributed to the polysaccharides present in the gel part of the leaf. These componentsaid in promotion of wound healing, antifungal activity, hypoglycemic or antidiabetic effects anti-inflammatory, anticancer, immunomodulatory and gastroprotective properties[4].

---

## 3. Various available forms of Aloe Vera for oral application

Aloe vera "gel" and purified or filtered aloe vera "juice" are considered the safest forms of aloe, typically containing the highest concentrations of Acemannan, a gel-like substance found in aloe. These forms can be applied topically to the skin or consumed in small amounts as a liquid for potential therapeutic benefits [5].

### 3.1. Lichen Planus

Lichen planus is a chronic inflammatory disorder affecting the skin and oral mucosa. Due to its chronic nature, no definitive cure has been identified. However, applying Aloe vera topically three times daily has been shown to alleviate pain, improve oral lesions, and enhance the quality of life for patients with oral lichen planus [6].

Aloe vera juice and topical application of Aloe vera can effectively alleviate pain and burning associated with oral lichen planus, as well as pruritus related to skin lesions. While steroids have traditionally been the primary treatment for lichen planus, long-term steroid therapy is known to pose numerous systemic complications, making Aloe vera a favorable alternative due to its lower incidence of side effects. Furthermore, comparative studies have shown that topical Aloe vera may yield better outcomes than triamcinolone in treating lichen planus [7].

### 3.2. Anti fungal actions

Several studies have investigated the antimicrobial activity of Aloe vera against *Candida albicans*. Aloe vera leaf extracts have been found to inhibit the formation of germ tubes and consequently suppress the growth of *C. albicans* [8].

The purified Aloe protein has demonstrated strong anti-fungal activity against *Candida paraprilois*, *Candida krusei*, and *Candida albicans* [9].

### 3.3. Antiviral actions

A purified sample of Aloe emodin, derived from aloin, was studied for its effects on the infectivity of various viruses including herpes simplex virus type 1 and type 2, varicella-zoster virus, pseudorabies virus, influenza virus, adenovirus, and rhinovirus. The findings indicated that Aloe emodin effectively inactivated all tested viruses except adenovirus and rhinovirus. Electron microscopic analysis of herpes simplex virus treated with anthraquinones revealed partial disruption of the viral envelopes. These results suggest that anthraquinones possess direct virucidal effects against enveloped viruses [10].

### 3.4. Aphthous Stomatitis

Aloe vera oral gel has been shown to reduce pain scores and wound size in patients with recurrent aphthous stomatitis, and it also accelerates the healing period of aphthous ulcers [11].

The newly formulated Aloe and Myrrh-based gels have shown effectiveness in managing minor recurrent aphthous stomatitis topically. Aloe was found to be superior to Myrrh in reducing ulcer size, erythema, and exudation, while Myrrh provided greater pain relief [12].

Acemannan, a polysaccharide component found in Aloe vera, has been utilized for treating oral aphthous ulceration in patients who prefer to avoid steroid medications [13].

The US Food and Drug Administration has also recognized derivatives of Aloe vera as effective treatment alternatives for oral ulcers.

---

#### 4. Oral Submucous Fibrosis (OSMF)

Aloe vera gel has shown effectiveness as an adjuvant in the treatment of Oral Submucous Fibrosis (OSMF). When compared with an antioxidant (lycopene), Aloe vera resulted in better improvement in mouth opening and reduction of burning symptoms. The mouth opening was measured at 5.1mm in the Aloe vera treated group, 3.4mm in the antioxidant treated group, and 4.6mm in the antioxidant combined with steroid treated group. This suggests that Aloe vera may play a promising role in the treatment of OSMF, potentially reducing the necessity for surgical intervention in severe cases [14].

##### 4.1. Primary Teeth Pulpotomy

Aloe vera has been effectively utilized in pulpotomy procedures for primary teeth. Pulpotomy involves the removal of coronal pulp using a spoon excavator, followed by irrigation with saline and control of hemorrhage using wet cotton pellets. Applying Aloe vera gel to the remaining pulp stumps, followed by the application of non-eugenol cement and permanent restoration, has proven effective in relieving symptoms and preventing reinfection. Follow-up examinations at 30 and 60 days showed no evidence of abscess, tooth mobility, pain, or swelling, indicating successful treatment outcomes [15].

##### 4.2. Application on Alveolar Osteitis / dry socket

Aloe vera is a traditional medicine known for its wound-healing properties. Acemannan, a compound found in Aloe vera, has been shown to be effective in promoting bone regeneration [16].

The SaliCept Patch, which contains Acemannan Hydrogel derived from the clear inner gel of Aloe vera leaf, significantly reduces the incidence of alveolar osteitis compared to Gelfoam soaked with Clindamycin [17].

##### 4.3. In Root canal therapy of Primary Teeth

Aloe vera has demonstrated efficacy as a root canal obturative material for primary teeth. A study was conducted to assess the antimicrobial effectiveness of six different root canal filling materials: Aloe vera, sterile water with zinc oxide and eugenol (ZOE), zinc oxide eugenol with Aloe vera, calcium hydroxide with sterile water, calcium hydroxide with Aloe vera, calcium hydroxide with Iodoform (Metapex), and Vaseline (control). Aloe vera with sterile water exhibited the highest antimicrobial activity against most microorganisms, followed by ZOE with Aloe vera, calcium hydroxide with Aloe vera, ZOE alone, calcium hydroxide alone, and Metapex in descending order. Vaseline showed no inhibitory effects [18].

##### 4.4. As aAsA As a ingredient in Toothpastes and Mouthwashes

Aloe vera and Propolis (bee glue) dentifrice decreased the contamination of toothbrush bristles by *Streptococcus mutans* [19]. Toothpaste containing Aloe vera demonstrated notable improvements in gingival and plaque index scores, as well as microbiological counts, comparable to those achieved with toothpaste containing triclosan, when compared to a placebo dentifrice [20].

Aloe vera tooth gel and the toothpastes showed equal effectiveness against *Candida albicans*, *Streptococcus mutans*, *Lactobacillus acidophilus*, *Enterococcus faecalis*, *Prevotella intermedia*, and *Peptostreptococcus anaerobius*. However, Aloe vera tooth gel exhibited an enhanced antibacterial effect against *S. mitis* [21].

##### 4.5. Intra Canal Medicament

To ensure long-term success in root canal treatments, the elimination of microorganisms is crucial. Retaining microorganisms within the dentinal tubules is considered a potential source of persistent endodontic infection. In cases of persistent root canal infections and failed treatments, *Enterococcus faecalis* is often identified as the main organism. Herbal extracts, particularly Aloe vera, have gained attention in dentistry for their proven antibacterial properties, attributed to anthraquinones. Aloe vera has shown effectiveness against *E. faecalis* when used in root canal treatment [22].

#### **4.6. Disinfection of Irrigation Units**

Dental operatory waterlines are frequently contaminated with microorganisms, posing a potential source of infection. Proper disinfection of these pipelines is crucial. In a study where baseline water samples were obtained, dental unit waterlines were treated with three disinfectant solutions for comparison: Aloe vera, 10% hydrogen peroxide, and 5% sodium hypochlorite. Each disinfectant was applied at increasing concentrations, and their inhibitory effects were assessed. Significant reductions in mean CFU/ml were observed after one week of treatment with each disinfectant. Aloe vera solution demonstrated the highest effectiveness in reducing microbial colonies. The authors concluded that herbal disinfectants like Aloe vera could replace chemical-based disinfectants for treating microbial contamination in dental unit waterlines [23].

#### **4.7. Gingival Bleeding**

Aloe vera gel can serve as a local drug delivery system for treating periodontal pockets[24]. Subgingival administration of Aloe vera gel has been shown to improve periodontal and gingival conditions. Acemannan, a bioactive molecule found in Aloe vera, stimulates healing in both soft and hard tissues, making it a promising scaffold for periodontal tissue regeneration [25].

The gel is applied directly to the sites of periodontal surgeries, either with periodontal dressing or directly to the gum tissues. Aloe vera has also been evaluated as a mouthwash, serving as an adjunct to mechanical therapy for treating plaque-induced gingivitis [26].

##### **4.7.1. Denture Adhesive Formulations**

Acemannan was found to possess strong adhesive properties and demonstrated low cytotoxicity to gingival fibroblasts when used as a denture adhesive [27].

##### **4.7.2. Disinfection of GP (Gutta Percha) Cones**

To date, no chemical or herbal agent has proven effective for decontaminating GP cones. Dry and moist heat can cause cones to deform, and chemical agents pose risks of contamination. However, chair side decontamination prior to obturation remains essential. Various chemicals including chlorhexidine, ethyl alcohol, hydrogen peroxide, polyvinyl pyrrolidone iodine, and quaternary ammonium compounds have been attempted for GP decontamination. Electron beam sterilization has also been explored, but none of these methods have been fully effective.

The recommended approach for decontaminating GP points involves treating the cones with 1% sodium hypochlorite for 1 minute, or 0.5% sodium hypochlorite for 5 minutes. However, sodium hypochlorite may cause crystal deposition within the canals, potentially obstructing obturation. Aloe vera gel has been found effective in decontaminating GP cones within one minute [28].

Under sterile conditions, some GP points were placed in thioglycolate broth and incubated for 24 hours. Concurrently, new GP cones were decontaminated for 1 minute in 90% Aloe vera gel. After removing the cones from the gel and cleaning them with sterile gauze, they were incubated in thioglycolate broth for 24 hours. Both sets of tubes were closely monitored for turbidity development. GP cones that were not decontaminated and placed directly in the broth showed turbidity. In contrast, cones decontaminated with Aloe vera and then incubated in the broth remained clear even after 24 hours, indicating the absence of microbial growth [29].

#### **4.8. Healing of wounds**

The polysaccharides found in the gel of Aloe vera leaves promote wound healing. Acemannan stimulates cell proliferation in gingival fibroblasts and enhances the expression of keratinocyte growth factor 1 (KGF-1), vascular endothelial growth factor (VEGF), and type 1 collagen. These findings underscore acemannan's significant role in oral wound healing. Aloe Vera-derived products, such as dressings and topical gels, have been found effective in healing both acute wounds (e.g., lacerations, surgical incisions, and burns) and chronic wounds (e.g., infected wounds, arterial and venous ulcers)[30].

#### **4.9. Burning Mouth Syndrome**

Burning mouth syndrome is a painful condition with multiple causes, often characterized by a burning sensation in the tongue, lips, palate, or throughout the mouth. Patients may also experience tingling, numbness, changes in taste, and dry or sore mouth, making the condition very distressing.

To evaluate the efficacy of Aloe vera in treating this syndrome, patients were divided into three groups:

- Group I used a tongue protector, a transparent, low-density polyethylene sheath covering the tongue from tip to posterior third, worn for 15 minutes three times a day.
- Group II used both the tongue protector and 0.5 ml of 70% Aloe vera three times a day.
- Group III used the tongue protector and 0.5 ml of placebo three times a day.

Treatment continued for 3 months. Overall, Group II showed greater clinical improvement, indicating that the combination of the tongue protector and Aloe vera is effective for treating patients with burning mouth syndrome [31].

#### 4.10. Head and Neck Cancer Patients undergone radiotherapy

Topical Aloe vera gel has demonstrated an inhibitory effect on cariogenic and periodontopathogenic microorganisms in patients who have undergone radiation therapy for head and neck cancer. This suggests that Aloe vera gel may play a preventive role in managing oral health in these patients [32].

Aloe vera mouthwash has the potential not only to prevent radiation-induced mucositis through its wound healing and anti-inflammatory mechanisms but also to alleviate oral candidiasis in patients undergoing head and neck radiotherapy, owing to its antifungal and immunomodulatory properties [33].

#### 4.11. Anticancer Agent

Standard cancer treatments are associated with significant side effects. Plant extracts are gaining popularity as alternatives to allopathic drugs in cancer treatment. Quinones, which are plant-derived secondary metabolites, exhibit anti-proliferative and anti-metastatic effects in various types of cancer, both in laboratory studies and animal models. The potential anticancer properties of plant-derived quinones, such as Aloe-emodin, found abundantly in Aloe vera, are currently being explored [34].

---

### 5. Contraindications

Like all pharmacological agents, Aloe vera is associated with potential side effects. Contact dermatitis and hypersensitivity reactions have been reported in some individuals following topical application of Aloe vera gel. It is advisable to avoid using Aloe vera during pregnancy or lactation except under medical supervision. Abdominal spasms and pain can occur even with a single dose, while overdose may lead to abdominal spasms, pain, and the development of thin, watery stools.

Due to these considerations, oral administration of Aloe vera is contraindicated in children under 10 years of age. In diabetic patients, increased hypoglycemia may occur if Aloe vera is used concurrently with oral antidiabetic medications or insulin [35].

Aloe vera gel for systemic application is not recommended in combination with antidiabetic, diuretic, or laxative drugs, as well as sevoflurane or digoxin [36].

---

### 6. Conclusion

Aloe vera may play a promising role in various branches of dentistry in the future. Future research should focus on determining its optimal method of preparation, concentration, timing of application, and effects on the oral cavity. Additionally, it is crucial to study and evaluate the potential long-term side effects of Aloe vera.

---

### References

- [1] Surjushe A, Vasani R, Sable DG. Aloe vera: A short review. *Indian J Dermatol.* 2008;53:163–6.
- [2] C. Bharthi A handbook of common medicinal plants used in Ayurveda, 2019; 22-23
- [3] Kahramanoğlu, İbrahim, Chuying Chen, Jinyin Chen, and Chunpeng Wan. "Chemical Constituents, Antimicrobial Activity, and Food Preservative Characteristics of Aloe vera Gel" *Agronomy*, 2019;12: 831.
- [4] Mangaiyarkarasi SP, Manigandan T, Elumalai M, Cholan PK, Kaur RP. Benefits of Aloe vera in dentistry. *J Pharm Bioallied Sci.* 2015 Apr;7(Suppl 1)

- [5] Chandra, V. C., Nur'aeny, n., & Wahyuni, i. S. Anti-inflammatory potential of Aloe vera in oral mucositis therapy: Systematic review. *International journal of applied pharmaceutics*, 2022; 14: 22–27.
- [6] Radwan-OczkoM. Topical Application of Drugs Used in Treatment of Oral Lichen Planus Lesions. *Adv Clin Exp Med*. 2013;22:893-898.
- [7] Patil BA, Bhaskar HP, PolJS, SodhiA, MadhuAV. Aloevera as cure for lichen planus. *N Y State Dent J*. 2013;79:65-8.
- [8] BernardesI, Felipe Rodrigues MP, Bacelli GK, Munin E, AlvesL P, CostaMS. Aloevera extract reduces both growth and germtube formation by *Candida albicans*. *Mycoses*. 2012; 55:257-61.
- [9] DasS, MishraB, GillK, AshrafMS, SinghAK, SinhaM, et al. Isolation and characterization of novel protein with anti-fungal and anti-inflammatory properties from Aloe vera leaf gel. *Int J Biol Macromol*. 2011;48:38-43.
- [10] SydiskisRJ, OwenDG, LohrJL, RoslerKH, BlomsterRN. Inactivation of enveloped viruses by anthraquinones extracted from plants. *Antimicrob Agents Chemother*. 1991;35:2463-6.
- [11] GarnickJJ, SinghB, Winkley G. Effectiveness of a medicament containing silicon dioxide, aloe, and all antoinon aphthous stomatitis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 1998;86:550-6.
- [12] Mansour G, OudaS, ShakerA. Clinical efficacy of new Aloe vera- and myrrh-based oral muco adhesive gels in the management of minor recurrent aphthous stomatitis: a randomized, double-blind, vehicle-controlled study. *J Oral Pathol Med*. 2013;25. doi: 10.1111/jop.12130.
- [13] BhalangK, ThunyakitpisalP, RungsirisateanN. Acemannan, a polysaccharide extracted from Aloe vera, is effective in the treatment of oral aphthous ulceration. *J Altern Complement Med*. 2013;19:429-34.
- [14] SudarshanR, AnnigeriRG, Sree VijayabalaG. Aloe vera in the treatment for Oral Submucous Fibrosis-a preliminary study. *J Oral Pathol Med*. 2012;41:755-61
- [15] GuptaN, BhatM, DeviP, Girish. Aloe vera: A Nature's Gift to Children. *Int J Clin Pediatr Dent*. 2010;3:87-92
- [16] Boonyagul S, Banlunara W, Sangvanich P, Thunyakitpisal P. Effect of acemannan, an extracted polysaccharide from Aloe vera, on BMSCs proliferation, differentiation, extracellular matrix synthesis, mineralization, and bone formation in a tooth extraction model. *Odontology*. [Epub ahead of print]. 2013;12.
- [17] Poor MR, Hall JE, Poor AS. Reduction in the incidence of alveolar osteitis in patients treated with the SaliCept patch, containing Acemannan hydrogel. *J Oral Maxillofac Surg*. 2002; 60:374-9.
- [18] Kriplani R, Thosar N, Baliga MS, Kulkarni P, Shah N, Yeluri R. Comparative evaluation of antimicrobial efficacy of various root canal filling materials along with Aloe vera used in primary teeth: a microbiological study. *J Clin Pediatr Dent*. 2013;37:257-62.
- [19] BertoliniPF, BiondiFilhoO, PomilioA, PinheiroSL, CarvalhoMS. Antimicrobial capacity of Aloe vera and Propolis dentifrice against *Streptococcus mutans* strains in toothbrushes: an in vitro study. *J Appl Oral Sci*. 2012;20:32-7
- [20] PradeepAR, AgarwalE, NaikSB. Clinical and microbiologic effects of commercially available dentifrice containing Aloe vera: A randomized controlled clinical trial. *J Periodontol*. 2012; 83:797-804.
- [21] George D, Bhat SS, Antony B. Comparative evaluation of the antimicrobial efficacy of Aloe vera tooth gel and two popular commercial toothpastes: an in vitro study. *Gen Dent*. 2009;57:238-41.
- [22] BhardwajA, BallalS, VelmuruganN. Comparative evaluation of the antimicrobial activity of natural extracts of *Morinda citrifolia*, papain and Aloe vera (all in gel formulation), 2% chlorhexidine gel and calcium hydroxide, against *Enterococcus faecalis*: An in vitro study. *J Cons Dent*. 2012;15:293-297.
- [23] PareekS, NagarajaA, SharmaP, AtriM, WaliaS, NaiduS, Yousuf A. Disinfection of dental unit waterline using Aloe vera: in vitro study. *Int J Dent*. 2013;618962. doi: 10.1155/2013/618962. Epub 2013 Sep 8.
- [24] BhatG, KudvaP, DodwadV. Aloe vera: Nature's soothing healer to periodontal disease. *J Indian Soc Periodontol*. 2011;15:205–20
- [25] ChantarawatitP, SangvanichP, BanlunaraW, SoontornvipartK, ThunyakitpisalP. Acemannan sponges stimulate alveolar bone, cementum and periodontal ligament regeneration in a canine class II furcation defect model. *J Periodontol Res*. 2013; 28. [Epub ahead of print] doi: 10.1111/jre.12090.
- [26] AjmeraN, ChatterjeeA, GoyalV. Aloe vera: It's effect on gingivitis. *J Ind Soc Periodontol*. 2013;17:435-8.
- [27] TelloCG, FordP, IacopinoAM. In vitro evaluation of complex carbohydrate denture adhesive formulations. *Quint Int*. 1998;9:585-93.

- [28] PangNS, JungIY, BaeKS, BaekSH, LeeWC, Kum KY. Effects of short-term chemical disinfection of gutta-percha cones, identification of affected microbes and alterations in surface texture and physical properties. *J Endod.* 2007;33(5):594-8.
- [29] AthibanPP, BorthakurBJ, GanesanS, SwathikaB. Evaluation of antimicrobial efficacy of Aloe vera and its effectiveness in decontaminating gutta-percha cones. *J Conserv Dent.* 2012;15:246-8.
- [30] Khan AW, Kotta S, Ansari SH, Sharma RK, Kumar A, Ali J. Formulation development, optimization and evaluation of Aloe vera gel for wound healing. *Pharmacogn Mag.* 2013; 9:S6-S10.
- [31] López-JornetP, Camacho-AlonsoF, Molino-Pagan D. Prospective, randomized, double-blind, clinical evaluation of Aloe vera *Barbadensis*, applied in combination with a tongue protector to treat burning mouth syndrome. *J Oral Pathol Med.* 2013;42:295-301.
- [32] BidraAS, TarrandJJ, RobertsDB, RolstonKV, ChambersMS. Antimicrobial efficacy of oral topical agents on microorganisms associated with radiated head and neck cancer patients: an in vitro study. *Quint Int.* 2011;42:307-33)
- [33] AhmadiA. Potential prevention: Aloe vera mouthwash may reduce radiation-induced oral mucositis in head and neck cancer patients. *Chin J Integr Med.* 2012; 18:635-40.
- [34] Tayal, Erika, Divesh Sardana, K. R. Indu Shekar, Bhavna G. Saraf, and Neha Sheoran. 2014. "Current Perspectives on Use of Aloe Vera in Dentistry". *European Journal of Medicinal Plants* 4 (12):1408-19
- [35] World Health Organization (WHO), ed WHO monographs on selected medicinal plants. Geneva, Switzerland: World Health Organization. Organization WH, ed. WHO monographs on selected medicinal plants. 1999;1(1 ed.): 1.
- [36] BrinkerF. Herb Contraindications and Drug Interactions. 2nd ed: Eclectic Medical Publications; 1998.

---

### Authors short Biography



**Dr Sumana Chithari Keshava**, MDS, has done more than 20 national and international publications, currently working as a Senior lecturer in Department of Oral Medicine and Radiology, Krishnadevaraya College of Dental Sciences and Hospital, Bangalore