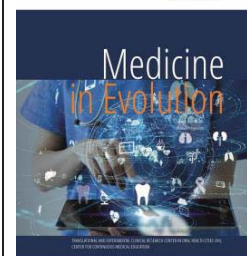


Applications of basil extracts on diseases of the oral cavity



Faur A.¹, Dinu S.C.², Todor L.³, Porumb A.³, Todor S.A.⁴, Cosoroabă R.M.⁵, Popovici R.A.⁵, Raica M.¹

¹*Victor Babes University of Medicine and Pharmacy, Faculty of Medicine, Department of Microscopic Morphology/Histology Angiogenesis Research Center Timisoara, Romania*

²*Department of Pediatric Dentistry, Faculty of Dental Medicine, "Victor Babeş" University of Medicine and Pharmacy, Timișoara, Romania*

³*Department of Dental Medicine, Faculty of Medicine and Pharmacy, University of Oradea, Romania*

⁴*Dentist doctor, private medical office, Oradea, Romania*

⁵*Department 1, Faculty of Dental Medicine, Victor Babes University of Medicine and Pharmacy, Timisoara, Romania*

Correspondence to:

Name: Liana Todor

Address: Department of Dental Medicine, Faculty of Medicine and Pharmacy, University of Oradea, Romania, December 1st Square no.10, 410068 Oradea, Bihor County, Romania

Phone: +40 723517100

E-mail address: liana.todor@gmail.com

Abstract

Nature offers us a great organic wealth, various types of plants growing in different parts of the world. Medicinal plants are cultivated or spontaneously grown plant species that, due to their chemical composition, have pharmaceutical properties, being used to alleviate various diseases. The holy basil, *Ocimum sanctum* Linn or Tulsi, has been used since ancient times to treat various ailments.

In this article we will talk about the use of Tulsi in oral diseases, , such as caries, gingivitis, periodontitis, oral cancer, oral candidiasis.

Keywords: *Ocimum sanctum* Linn, pharmaceutical properties, oral cavity

INTRODUCTION

Ocimum species representatives are very important for their therapeutic potential, being used against abdominal cramps, gastroenteritis, dysentery and diarrhea. The leaf extract has been used in the treatment of wounds, acne and vitiligo. Basil has traditionally been used to treat health problems such as anxiety, severe pain, stings, pyrexia, infectious diseases, myalgias, coughs, constipation, warts, helminths and kidney dysfunction [1-3]. It is also used as a deodorant, being considered an aphrodisiac [4].

The most important representatives of the Ocimum species are: Ocimum basilicum, Ocimum sanctum, Ocimum gratissimum, Ocimum canum, Ocimum kilimandscharicum, Ocimum americanum and Ocimum icranthum [5].

Ocimum sanctum Linn, also known as Holy Basil or Tulsi, has been used since ancient times in Europe and Asia, especially in India, as a medicinal plant. The name "Tulsi" in Sanskrit means "the only one". Tulsi is considered to be one of the most sacred and sacred plants documented in Ayurvedic medicine [6,7].

Aim and objectives

The purpose of this review is to present the use of Tulsi in oral diseases, such as caries, gingivitis, periodontitis, oral cancer, oral candidiasis.

THERAPEUTIC PROPERTIES OF BASIL IN THE ORAL CAVITY

Basil (Ocimum basilicum), the most cultivated plant in the world, contains active components that recommend it to be used as an antimicrobial and natural antioxidant [8].

Experiments have shown that Tulsi (Figure 1) has anti-inflammatory, antipyretic, analgesic, antidiabetic, anti-stress, hepatoprotective, hypolipidemic, immunomodulatory, chemopreventive, radiation protection and free radical scavenging properties.

In the oral cavity, basil has antibacterial properties on periodontal pathogens (Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis) [9,10]. The ethanolic extract of Ocimum sanctum has anti-caries properties due to its antimicrobial activity against Streptococcus mutans [11,12].

Tulsi extracts also have antiviral [13] and antifungal properties against oral pathogenic fungi (Candida) [14,15].

Preclinical studies have shown that Tulsi and some of its phytochemicals (eugenol, rosmarinic acid, apigenin, myrethenal, luteolin, β -sitosterol, carnosic acid) prevented chemically induced oral, lung, skin and liver cancer by increasing antioxidant activity, induction of apoptosis, alteration of gene expression and inhibition of angiogenesis and metastasis [16].



Figure 1. Tulsi Plant – Holy Basil

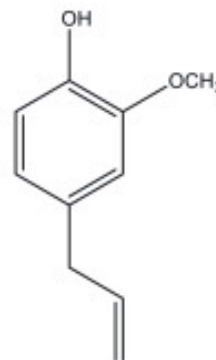


Figure 2. Eugenol

Tulsi leaf ethanolic extract is used for its anti-invasive effect on cancer cells [17]. The active phenolic compounds identified in it, rosmarinic acid, caffeic acid and apigenin, could be used as alternative therapeutic agents in malignant tumors [18].

Eugenol (1-hydroxy-2-methoxy-4-allylbenzene) (Figure 2), the active ingredient in *Ocimum sanctum*, is thought to be responsible for the therapeutic effects of Tulsi [19].

DISCUSSIONS

Many studies have been performed to evaluate the antimicrobial activity of *Ocimum sanctum* (tulsi) extract on bacteria that frequently colonize the subgingival area (*A. actinomycetemcomitans*, *P. gingivalis*), and those in dental caries (*Streptococcus mutans*). Ethanol extract of Tulsi prepared by the cold extraction method and diluted with an inert solvent, dimethylformamide, was used.

Jayanti et al. concluded that an 8% concentration of *O. sanctum* extract showed maximum antimicrobial activity against *A. actinomycetemcomitans* and *P. gingivalis* [10]. Mallikarjun et al. concluded that at 5% and 10% concentrations, Tulsi extracts showed antimicrobial activity against *A. actinomycetemcomitans*, similar to doxycycline. *P. gingivalis* and *P. intermedia* were resistant to Tulsi extract [20]. Eswar et al. observed that the antimicrobial potential against *A. actinomycetemcomitans* of *Ocimum sanctum* Linn extract was maximal at a concentration of 6% [21].

Dr. Devang Bharkat Kumar Khambholja incorporated Tulsi extract into the Guided Tissue Regeneration Membrane (GTR) to inhibit the growth of bacteria (*Streptococcus* sp. and *Rhodococcus* sp.) [22].

Agarwal et al. observed that Tulsi ethanolic extract had the highest zone of inhibition over *S. mutans* at a concentration of 4% [11].

Kochikar Pai et al used the ethanolic extract of *Ocimum sanctum* prepared by the hot extraction method, diluted with an inert solvent, dimethyl sulfoxide. The maximum activity against microorganisms responsible for dental caries (*S. mutans* and *S. sanguis*) was observed with the 10% extract [12].

There are studies comparing and evaluating the anti-karyogenic properties of different plant extracts against different karyogenic microorganisms. Thus *Glycyrrhiza glabra* (licorice) followed in descending order by *Ocimum sanctum* (Tulsi), *Terminalia chebula* (Harad), *Tinospora cordifolia* (Guduchi) have a strong antibacterial efficacy against *Streptococcus mutans* and *Lactobacillus acidophilus* [23].

Numerous studies have shown that several species of *Ocimum sanctum* (OS) extract have therapeutic properties and, in some cases, antitumor properties. The antiproliferative

effects of OS extract have been studied in cases of breast cancer, oral cancer and human fibrosarcoma [18].

Various researchers have studied the cytotoxic and anti-proliferative effects of extracts of two types of Tulsi on cancer cells (Rama Tulsi with open leaves and Krishna Tulsi with dark leaves). Aqueous and dry extracts have shown an important cytotoxicity on the studied cell lines, being effective as anti-proliferative agents that cause apoptosis in the cell line of oral cancer [24,25].

The presence of a large number of phytoconstituents in Tulsi (eugenol, rosmarinic acid, apigenin, myrethenal, luteolin, β -sitosterol, carnosic acid) could explain its beneficial effects, including in the prevention and treatment of cancer [16,26]. Tulsi has chemopreventive and radiation-protective properties. The aqueous extract of *Ocimum sanctum* and its flavonoids, orintin and vicenin, protect mice against γ -radiation-induced diseases and mortality and selectively protect normal tissues from the tumoricidal effects of radiation. Other phytoconstituents: eugenol, rosmarinic acid, apigenin and carnosic acid, prevent radiation-induced DNA damage [16].

Uma Devi et al. showed that two water-soluble flavonoids, Orientin (Ot) and Vicenin (Vc), extracted from the leaves of *Ocimum sanctum* Linn provide remarkable protection against radiation [27].

The alkaloids present in *Ocimum Sanctum*, Flavanoids, Glycosides, Linolols, Eugenol, Cineol can be used as astringent, edema reliever, pain reliever and hemostatic for the treatment of oral submucosal fibrosis (OSMF). Srivastava et al. showed in a study that an adhesive made of 1 g of tulsi and 1 g of turmeric mixed with glycerin, applied topically 3-4 times a day, led to a statistically significant improvement in both the burning sensation and the opening of the mouth in patients with OSMF [28].

Candida albicans has recently shown resistance to many synthetic drugs, which has led to the need for new antifungal drugs with fewer side effects. Many studies have suggested that some plant species have promising antifungal compounds. *Ocimum sanctum* essential oil and its two components eugenol and linalool, have a strong antifungal activity by releasing secondary metabolites against *Candida albicans* and *Candida tropicalis*. Ethanolic extracts and ethyl acetate from Tulsi leaves obtained by the cold extraction method were used, and the antifungal activity was compared with that of fluconazole [29]. *Ocimum sanctum* essential oil is promising as an antifungal agent in combination treatments for candidiasis [30-33].

Aqueous extracts and oils from *Ocimum sanctum* have been compared, as an anti-candida activity, with those of other medicinal plants, with Tulsi essential oil proving to be the most effective [34]. Other researchers have synthesized silver nanoparticles using aqueous leaf extract of *Ocimum sanctum* (Tulsi) as a reducing agent, and found antimicrobial activity in *Candida albicans* as well [35].

Researchers are studying the use of Tulsi by incorporation into toothpaste or mouthwash, by studying the effects of declining periodontal indices, which are comparable to those of chlorhexidine [36 - 38].

A study by Gupta et al. showed a significant reduction in plaque, inflammation and gingival bleeding when a mouthwash of *Ocimum sanctum* was used for 15 to 30 days, which was as effective as chlorhexidine [39].

CONCLUSIONS

Ocimum sanctum extract, in concentrations between 5-10%, is recommended as an adjunct to mechanical therapy in the prevention and treatment of periodontal diseases, as well as for inhibiting the growth of bacteria responsible for carious lesions.

Tested Tulsi extracts show promising antibacterial activity and low cytotoxicity. Additional tests should be performed to eradicate the biofilm and examine the activity against other dental pathogens and the oral microbiome to confirm the potential of these extracts as antibacterial agents.

The Tulsi plant, widely grown in India, can be used for its anticancer properties for treating oral cancer. Not only will this be cost effective, but it will have fewer or no side effects.

Mouthwash with *Ocimum sanctum* proves to be effective due to its ability to lower periodontal indexes, being much more cost-effective than chlorhexidine and easily accessible.

Synthetic drugs have many side effects, so more attention has been paid to natural remedies, which are safe and effective. Today, the main focus is on herbal remedies, which has led to the screening of many plants for their potential antimicrobial activity. The same can be used clinically as an alternative to the drugs used in dentistry, for the treatment of diseases of the oral cavity.

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