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Ocimum Sanctum: An Advent as a Local Drug Delivery Agent in the Management of Periodontal Disease

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Abstract:- A chronic inflammatory disease periodontitis, causes destruction of the connective tissues supporting the tooth, by various etiological agents, primarily the periodontal pathogens that dwells in the subgingival area. The use of antibiotics as local drug delivery agent, adjunct to scaling and root planning has been proven to be efficient in the management of periodontitis. A medicinal plant like tulsi has also been proven to have pharmacological properties which inhibits and controls the growth of periodontal pathogens. These findings are being utilized and more scientific research in its use as a local drug delivery agent is gaining momentum. Here we review the pharmacological properties and the role of Ocimum sanctum against periodontal pathogens.

Keywords:- *Ocimum sanctum, local drug delivery agent, periodontal pathogens.*

I. INTRODUCTION

Ocimum sanctum L. (also known as Ocimum tenuiflorum, Tulsi) with its copius healing characteristics has been used since time immemorial in Ayurveda of the many healing herbs, Tulsi, renowned as 'Queen of herbs', is considered to be one of the holiest and most cherished. [1]

In India, most commonly cultivated species is Ocimum sanctum Linn. There are two types of Ocimum sanctum Linn. The first type is green leaves type known as Sri tulsi (Fig.1) and second is purple leaves type known as Krishna Tulsi (Fig.2).

Other species of genus Ocimum which have high therapeutic potential and cultivated worldwide are Ocimum gratissium (Ram Tulsi), Ocimum canum (Dulal Tulsi), Ocimum basilicum (Ban Tulsi), Ocimum camphora Ocimum kilimandscharicum, Ocimum ammericanum, and Ocimum micranthum. [2]. Tulsi is considered to be an adaptogen, since it balances different processes in the body, and plays a role in adapting to stress. It is regarded in Ayurveda as a kind of 'elixir of life' due to its strong aroma and astringent taste.

Traditionally, O. sanctum L. is taken in many forms, as herbal tea, dried powder or fresh leaf. For centuries, the dried leaves of Tulsi have been mixed with stored grains to repel insects. [3]

Fig 1

Fig 2

The interplay between the pathogenic microorganisms and host immunoinflammatory mediators determines the progression of the periodontal disease. Ocimum sanctum has been proven to possess various properties that manages the interaction between the microorganisms and the host response.

II. HISTORY

The medicinal use of plants has been accounted since ancient time. The therapeutic use of plants dates back to 4000–5000 B.C. and the first to form medicines using natural herbs were the Chinese. [4]

Rigveda, which is written around 3500-1600 B.C. gives the record of the preparation of medicines using

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plants. [4] The foundation of ancient medical science, in India was formed by the records prepared by the ancient Ayurverdic physicians after studying the properties and therapeutic uses of various herbs [5]

Since the Vedic age, Holy basil is characterized to have variant use and is proved to be an eminent curative agent. In France it is the 'Herb royale', for the Italians it is a sign of love, and in India it is a sacred herb. It is known to be efficient in expelling worms in Africa, and in the Far East, the herb is used in treating cough. American colonists considered holy basil is the essential ingredients in a snuff used to ease headaches. [6,7]

III. PHARMACOLOGICAL PROPERTIES

A study done by Gupta SK et al (2002) revealed forty-five components and oils in Ocimum Sanctum. The chief being the rosmarinic acid (a strong antioxidant), 1,7 - dimethyl, 6-octadien-3-ol, linalool, methylchavicol, methylcinnamat, and eugenol. Its therapeutic effects are mostly due to eugenol, rhymol and camphor. [8]

The mucilage is composed of polysaccharides, xylose and sugars. An oil containing fatty acids and sitosterol is contained in the seeds. It is known to be a healing herb consisting of Vitamin A, and Vitamin C which stimulates up to 20% production of antibodies and antioxidants that promotes the prevention of cell damage. [8]

Several studies by the Indian researchers have proved the therapeutic potentials of Ocimum sanctum L by the presence of essential oils & eugenol. [9-10]. Eugenol is extracted from various parts of basil. It is a major constituent of essential oils and is a phenolic compound. On the basis of several pharmacological studies carried out with eugenol and steam distilled, petroleum ether and benzene extracts of different parts of Tulsi plant, its therapeutic potential has been established. [9-11]

Scientific researches have gained momentum to evaluate the pharmacological activities, therapeutical uses and toxicity of Ocimum sanctum against various diseases in the recent years.

Based on several experimental and clinical researches, the following pharmacological or therapeutical properties has been cited that plays an important role in the control of periodontal pathogens and hence the progression of the disease.

A. Antioxidant Activity

The antioxidant activity of Ocimum sanctum has been described by many researchers. The antioxidant properties of flavonoids and their relation to membrane protection have been observed. Antioxidant activity of the flavonoids (orientin and vicenin) in vivo was expressed in a significant reduction in the radiation induced lipid peroxidation in mouse liver. Ocimum sanctum extract has significant ability to scavenge highly reactive free radicals. The phenolic compounds, viz., cirsilineol, cirsimaritin, isothymusin, apigenin and rosmarinic acid, and appreciable quantities of eugenol (a major component of the volatile oil) from Ocimum sanctum extract of fresh leaves and stems possessed good antioxidant activity. [12]

The periodontal destruction is caused by the presence of free radicals along with the inflammatory mediators. Hence the anti-oxidant activity of Ocimum sanctum can prove to play a major role in controlling the disease.

B. Antimicrobial Activity

Aqueous extract of Ocimum sanctum showed growth inhibition for Klesbiella, E. coli, Proteus and Staphylococcus aureus; while alcoholic extract of Ocimum sanctum showed growth inhibition for Vibrio cholerae. The alcoholic extract of Ocimum sanctum was proven to be active against multidrug-resistant strains of S. aureus that are also resistant to common beta lactam antibiotics. [12] Its antimicrobial effect against specific periodontal pathogens has also been proven by several studies.

C. Immunomodulatory Activity

Modification in the humoral immune response in albino rats which could be attributed to such mechanisms as antibody production, release of mediators of hypersensitivity reactions and tissues responses to these mediators in the target organs was shown by using steam distilled extract from the fresh leaves of Ocimum sanctum. [13] Modulation of both humoral and cell-mediated immune responsiveness and GABAergic pathways that may mediate these immunomodulatory effects was produced by Ocimum sanctum seed oil. [14] This activity of Ocimum sanctum promises its efficiency in the management of periodontal disease.

D. Anti-Inflammatory Activity

In acute (carrageenan-induced pedal oedema) and chronic (croton oil induced granuloma and exudate formation) inflammations in rats, methanolic extract and aqueous suspension of Ocimum sanctum showed anti-inflammatory, analgesic and antipyretic effects. Linolenic acid and fixed oil have significant anti-inflammatory activity against arachidonic acid, leukotriene and PGE2 induced paw oedema in rats by virtue of their capacity to block both the cyclooxygenase and lipoxygenase pathways of arachidonic acid metabolism. [15]

E. Antistress Activity

The immunostimulant capacity of Ocimum sanctum may be responsible for the adaptogenic action of plant. Increase in the physical endurance of swimming mice is seen with the use of alcoholic extract of Ocimum sanctum whole plant. It also prevents stress induced ulcers and milk induced leucocytosis, respectively in rats and mice. Thus, the induction of non-specifically increased resistance against a variety of stress induced biological changes by Ocimum sanctum in animals is proven. [16] This activity can influence the pathogenesis of periodontal disease, where the role of stress is significant.

F. Anti-Diabetic and Glycemic Lowering Properties

The role of Ocimum sanctum in the management of diabetes mellitus is proving to be significant. Beneficial effects in the treatment of hyperglycaemia and hyperlipidaemia have been shown by presence of rich fiber content in the plant, especially the soluble fibers. The mechanism of action for its anti-diabetic activity is that the plant extract has the ability to stimulate adenylate cyclase or phosphatidylinositol, or it has direct effect on pancreatic beta cells which promotes the calcium entry followed by the release of stored insulin. [17] Thus, by having anti-diabetic property Ocimum sanctum can prevent periodontal disease, which is the sixth complication of diabetes melitus.

IV. IN PERIODONTAL THERAPY

Recognition of the pharmacological property of Ocimum sanctum has led to its research in the management of periodontal disease. Only few clinical studies have been reported that showed its activity against the periodontal pathogens.

Ocimum sanctum is used to control plaque and gingivitis in the form of mouthwash. A study conducted by D Gupta (2014) proved that the efficacy of ocimum sanctum mouthrinse in the reduction of plaque and gingivitis was equal to that of chlorhexidine over a period of 15 and 30 days. [18] Thus, by proving the antiplaque effect of Ocimum sanctum, it can further help to prevent the cascade of gingival disease to periodontal disease.

Massage with tulsi powder have reported to be highly effective in many gingival and periodontal diseases. The tulsi extract has high antimicrobial activity against streptococcus mutans. The streptococcus mutans has been reported to be key microorganism causing dental caries. In an in vitro study, it was found that 4% concentration of tulsi extract has highest antimicrobial activity. [2]

An in vitro - in vivo study, to evaluate the efficacy of holy basil as antibacterial agent and antiplaque agent by M Hosamane (2014) proved holy basil to be effective against Prevotella intermedia and Fusobacterium nucleatum strains and also to be an effective antiplaque agent. [19]

Similar in vitro studies were done to evaluate the antimicrobial effect on specific microorganisms. An in vitro study done by Mallikarjun S et al (2016) concluded that Ocimum sanctum revealed to be an effective antimicrobial against A. actinomycetemcomitans, and hence can be used effectively as an adjunct together with the standard management of periodontal conditions. [20]

Periodontal disease is best managed by having a control on the host immunoinflammatory mediators. In 2011, Mondal S et.al. conducted a double blinded randomized control trial that showed significantly increased levels of Interferon gamma, Interleukin 4 and T-helper cells in the study group as compared to the control group, after a period of 4 weeks. Thus, it was shown that Ocimum sanctum has pro-immunomodulatory effects on the body. [21]

Efficacy of Ocimum sanctum in various forms was studied. Its local application in the form of aqueous extract and gel form was researched upon. Rajesh Ramesh Hosadurga et al (2015) conducted a study for the evaluation of its anti-inflammatory activity; to assess duration of the action and the efficacy of 2% tulsi (*O. sanctum*) gel in the treatment of experimental periodontitis in Wistar Albino rat model and concluded that 2% tulsi (*O. sanctum*) gel was effective in the treatment of experimental periodontitis. [22]

Another study conducted by Gaur J et al (2015) in 30 chronic periodontitis patients, showed that the intra-pocket irrigation of Ocimum sanctum proved to have equal efficacy in reducing periodontal indices as chlorhexidine. Reduction in all clinical parameters were observed over a period of four weeks in both the test and the control groups which was significant. [23]

However, further research assessing the toxicity, durability, and other assessments followed by clinical trials is necessary to explore the potential of Ocimum sanctum as local drug delivery agent in combating periodontal conditions.

V. CONCLUSION

Ocimum sanctum can be a promising herb in treatment of many oral disorders due to its anti-inflammatory, antibacterial, antioxidant and immunomodulatory properties. Its application in the form of local drug delivery agent can improve its effectiveness due to its high gingival crevicular fluid concentration. However more research and studies are needed to establish it as treatment modality.

REFERENCES

[1]. Pattanayak P, Behera P, Das D, Panda SK. Ocimum sanctum Linn. A reservoir plant for therapeutic applications: An overview. Pharmacogn Rev. 2010;4(7):95-105.
[2]. Chaurasia A. Tulsi-A Promising herb in dentistry. Journal of Oral Medicine, Oral Surg.Oral Pathol.Oral Radiol. 2015;1(1):21-3.
[3]. Biswas NP, Biswas AK. Evaluation of some leaf dusts as grain protectant against rice weevil Sitophilus oryzae (Linn.). Environ Ecol 2005;23(3):485-8.
[4]. Prakash P, Gupta N. Therapeutic uses of Ocimum sanctum Linn (Tulsi) with a note on eugenol and its pharmacological actions: a short review. Indian J Physiol Pharmacol 2005;49(2):125-31.
[5]. Sirkar NN. Pharmacological basis of Ayurvedic therapeutics. In: Cultivation and utilization of medicinal plants. Editors: Atal CK and Kapoor BM (Published by PID CSIR) 1989.
[6]. Williamson EM, Okpako DT, Evans FJ. Selection, preparation and pharmacological evaluation of plant material. John Wiley & Sons; 1996.
[7]. Siddiqui HH. Safety of herbal drugs-an overview. Drugs News & Views 1993; 1(2): 7–10.

[8]. Gupta SK, Prakash J, Srivastava S. Validation of claim of Tulsi, Ocimum sanctum Linn as a medicinal plant. Indian J Experimental Biology 2002; 40(7): 765– 73.
[9]. Sen P. Therapeutic potentials of Tulsi : from experience to facts. Drugs News & Views 1993; 1(2): 15–21.
[10]. Ocimum sanctum. The Indian home remedy. In: Current Medical Scene, March-April 1992 (Edited and published by S. Rajeshwari, Cipla Ltd., Bombay Central, Bombay).
[11]. Khanna N, Bhatia J. Action of Ocimum sanctum (Tulsi) in mice: possible mechanism involved. J Ethnopharmacol 2003; 88(2–3): 293-6.
[12]. Pandey G, Madhuri S. Pharmacological activities of Ocimum sanctum (tulsi): a review. Int J Pharm Sci Rev Res.2010;5(1):61-6.
[13]. Mediratta PK, Dewan V, Bhattacharya SK, Gupta VS, Maiti S, Sen P. Effect of Ocimum sanctum Linn. on humoral immune responses. Indian J Med Res.1998; 87:384-6.
[14]. Mukherjee R, Das PK, Ram GC. Immunotherapeutic potential of Ocimum sanctum Linn. bovine subclinical mastitis. Rev Vet Sci. 2005;79(1): 37-43.
[15]. Singh S, Majumdar DK. Evaluation of antiinflammatory activity of fatty acids of Ocimum sanctum fixed oil. Indian J Exp Biol. 1997; 35(4):380-3.
[16]. Bhargava KP, Singh N. Antistress activity of Ocimum sanctum Linn. Indian J Med Res. 1981; 73: 443-51.
[17]. Perakath V, Lakshmanan R. Tulsi-The matchless medicinal herb. J Dent Med Sci. 2014;13(2):51-5.
[18]. Gupta D, Bhaskar DJ, Gupta RK, Karim B, Jain A, Singh R, Karim W. A randomized controlled clinical trial of Ocimum sanctum and chlorhexidine mouthwash on dental plaque and gingival inflammation. J Ayurveda Integr Med. 2014 ;5(2):109-16.
[19]. Hosamane M, Acharya AB, Vij C, Trivedi D, Setty SB, Thakur SL. Evaluation of holy basil mouthwash as an adjunctive plaque control agent in a four day plaque regrowth model. J Clin Exp Dent. 2014;6(5): e491-6.
[20]. Mallikarjun S, Rao A, Rajesh G, Shenoy R, Pai M. Antimicrobial efficacy of Tulsi leaf (Ocimum sanctum) extract on periodontal pathogens: An in vitro study. J. Indian Soc. Periodontol. 2016 ;20(2):145-50.
[21]. Mondal S, Varma S, Bamola VD, Naik SN, Mirdha BR, Padhi MM, Mehta N, Mahapatra SC. Double-blinded randomized controlled trial for immunomodulatory effects of Tulsi (Ocimum sanctum Linn.) leaf extract on healthy volunteers. J Ethnopharmacol. 2011;136(3):452-6.
[22]. Hosadurga RR, Rao SN, Edavanputhalath R, Jose J, Rompicharla NC, Shakil M, Raju S. Evaluation of the efficacy of 2% Ocimum sanctum gel in the treatment of experimental periodontitis. Int J Pharma Investig. 2015;5(1):35-42.
[23]. Gaur J, Chandra J, Chaudhry S, Vaish S, Dodwad V. Assessment of 4% ocimum sanctum and 0.2% chlorhexidine irrigation as an adjunct to scaling & root planing in management of chronic periodontitis-a randomized controlled trial. J Dent Specialities. 2015;3(2):217-9.