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Effectiveness of Tulsi on Gingivitis : A Systematic Review

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ABSTRACT

Background: In ancient times, Tulsi was used in the Ayurvedic technique. Tulsi is found to help provide therapeutic effects to an individual's health. The presence of various therapeutic effects of Tulsi, such as anti-inflammatory properties, makes Tulsi one of the most important medicinal herbs for use in the treatment of various diseases.

Aim:To assess the effectiveness of Tulsi as an agent in the treatment of gingivitis.

Methods: A literature search was performed using PMC, Sciencedirect, PubMed, Cochrane, Wiley, Prospero, Grey literature. To obtain the articles using MeSh representations, a literature search to collect relevant data was performed using "Tulsi" AND "Gingivitis". A total of 112 articles were screened, 15 were full-text articles assessed for eligibility, and 5 articles were finalized for the study.

Results: The Tulsi mouthwash was compared with other mouthwash, dentrifices and chlorhexidine in all the studies and Tulsi showed statistically significant results in comparison with the other mouthwash.

Conclusion: Tulsi was found to be effective in improving oral health and equally effective to other mouthwash and dentrifices.

Keywords: Tulsi, Gingivitis, Chlorhexidine

INTRODUCTION

In the current scenario, there are multiple dental-related issues that range from mild to severe and plaque-induced gingivitis is one such case that occurs in every individual at least once in their lifetime and affects an estimated majority of the population, and is characterized as the world's most predominant inflammatory periodontal disease and ranking just below dental caries in oral disease[1].

Ocimum sanctum, also known as Tulsi, belongs to the family Laminaceae[2]. Ocimum sanctum, produced mainly in India, is the largest source of medicinal plants in the whole world[3]. Naturally available herbs are helpful in providing therapeutic effects to the health of an individual, and in tulsi, eugenol is the constituent that gives the effect[4]. The demand for this plant is increasing every day for medicinal purposes. There are approximately 3,000 medicinal plants that are used for their therapeutic effect based on Ayurveda, Siddha and other traditional system and from which some are commercialized and used in present days[5]. Out of which, Ocimum sanctum is one of the most important for medicinal purposes. It is employed in the treatment of various diseases such as antimicrobial infection, antifungal, anticancer, arthritis, chronic fever, antifertility, eye disease, hepatoprotective, antispasmodic, and analgesic, antiemetic and cardioprotective[2]. Tulsi

has also been shown to help in reducing blood glucose levels, making it an effective treatment of diabetes[6].

As most people might know, gingivitis is defined as inflammation of the gums, which causes irritation, redness and swelling on the gums with no extension to the underlying tooth structures[7]. Plaque is the main cause of gingivitis which is a thin film of bacteria that constantly forms on the surface of your teeth[8]. Systemic diseases and drug-induced gingival inflammation can also be other causes of gingivitis [9].

The main goal in patients suffering from gingivitis is to control plaque build-up and soft tissue inflammation. In the current scenario, chlorhexidine is considered to be the gold standard in the prevention and treatment of gingivitis [10]. However, the negative side effects of chlorhexidine have been reported, such as oral mucosal erosion, discolouration of teeth, and bitter taste[11]. This allows alternative medications, and herbal medications are one such alternative that can be used as there has been a history of treating diseases with natural herbs since early days[4].

The leaves of Tulsi consists of 0.7% volatile oil comprising about 71% eugenol and 20% methyl eugenol[12]. The oil of Tulsi contains hydrocarbon caryophyllene, which is helpful in the treatment of gingivitis. Fresh leaves and stem of Tulsi extract yield phenolic compounds such as cirsilineol, circimaritin, isothymusin, apigenin and rosameric acid (most important in gingivitis), and appreciable quantities of eugenol[13].

The anti-inflammatory property of Tulsi is mainly due to the presence of Ursolic acid and Rosameric acid. Ursolic acid is a pentacyclic triterpenoid carboxylic acid which has the ability to suppress NF-κB (nuclear factor kappa B) activation as NF-κB, in coordination with NF-AT (nuclear factor of activated T cells) and AP-1(activator protein-1). Ursolic acid inhibits the activation, proliferation and cytokine secretion in T cells, B cells and macrophages[14].Rosemarie acid has many complex actions on inflammatory cascades, including inhibition of cytokine release from activated T cells and prevention of T-cell activation in the first place. Rosemarie acid limits the production of proinflammatory mediators while promoting anti-inflammatory mediators and helps in the inhibition of TNF-α and NF-κB activation[15].So, as a result of all the above mentioned anti-inflammatory properties of Tulsi and as an alternative for chlorhexidine, this review has been taken up to assess the effectiveness of tulsi on gingivitis.

MATERIALS AND METHODS:

Randomized controlled trials and clinical study with interventions were included in the study.

SEARCH STRATEGY:

Published results on Effectiveness of Tulsi on the treatment of gingivitis which includes original articles and research papers in databases such as:

PMC, Sciencedirect, PubMed, Cochrane, Wiley, Prospero, Grey literature. To obtain the articles using mesh representations, a literature search to collect relevant data was performed using MeSH terms “Tulsi” AND “Gingivitis”. After the search,112 articles were obtained, among which 5 were finalized for the study.

ELIGIBILITY CRITERIA

INCLUSION:

1. Comparative studies on the efficacy of Tulsi on Gingivitis
2. Studies published in English
3. Studies with randomized controlled trials
4. Full-text articles

EXCLUSION:

1. Articles published in other languages
2. Only abstracts available
3. Unrelated article

RESULTS:

The search yielded 112 articles, and 5 articles were independently assessed among these eligible articles. Tables were included, and Figure 1 shows Flow diagram of the reports identified, screened, assessed for eligibility, excluded and included for the review.

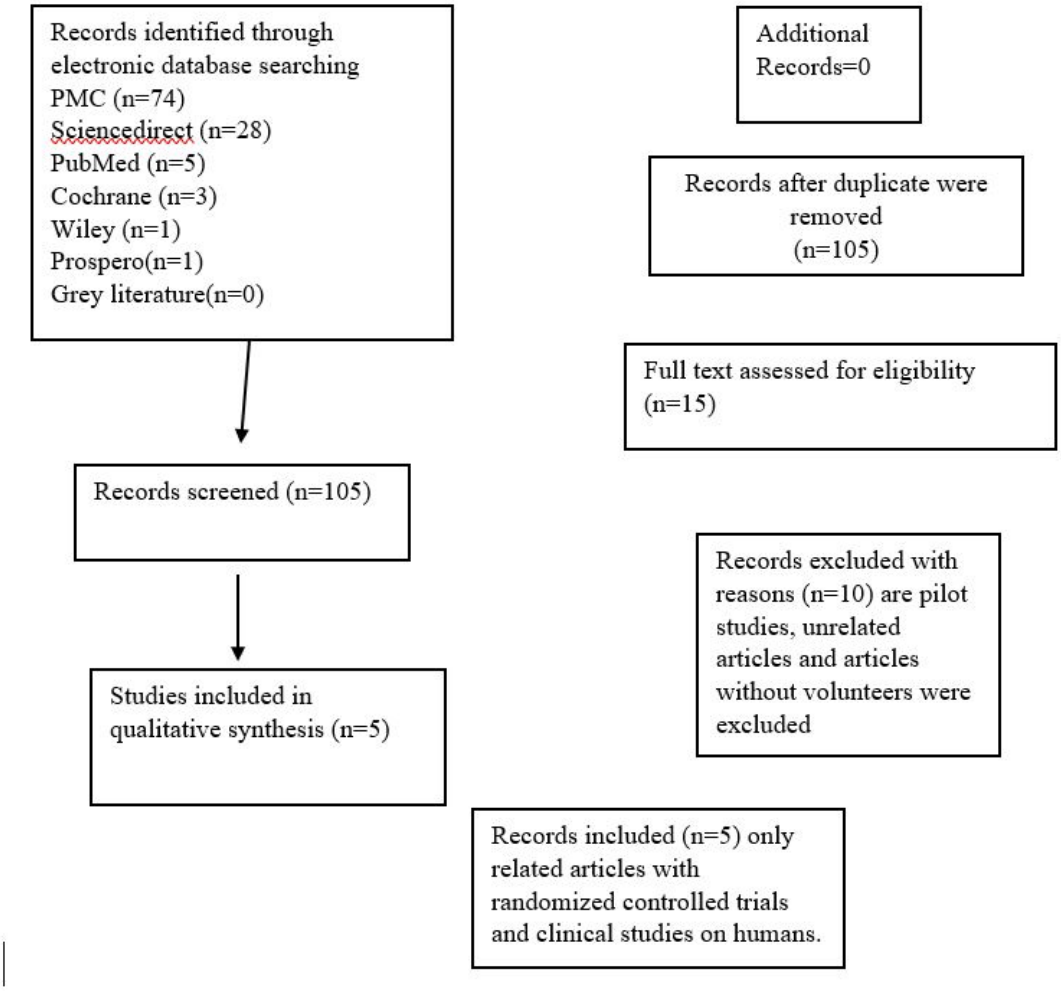

TABLE 1: CHARACTERISTIC OF INTERVENTION IN INCLUDED STUDY

AUTHOR NAME	YEAR	SAMPLE SIZE	PATIENT CHARACTERISTICS	DURATION	NUMBER (CASE/CONTROL)
Devanand Gupta et al. [16]	2014	108	Randomly selected group of volunteered undergraduate medical students of age 18-27	30 days	-Group I (n=36): Ocimum sanctum mouthwash -Group II (n=36): Chlorhexidine mouthwash -Group III (n=36): Normal saline mouthwash
Gautami S. Penmetsa et al [17]	2019	60	Patients with a minimum of 20 teeth and age ranging from 18-45 with mild and moderate gingivitis	30 days	-Group I (n=20): Ocimum sanctum mouthwash -Group II (n-20): Aloe vera mouthwash -Group III (n=20): Chlorhexidine mouthwash
Jijo Mon et al. [18]	2019	100	The study is done on children of age ranging from 10-12. Debris index-simplified (DI-S), calculus index-simplified (CI-S), oral hygiene index-simplified (OHI-S) scores, and *Streptococcus mutans* counts were recorded.	30 days	-Group I (n=25): Herbal water made from Ocimum sp. -Group II (n=25): Ozonated water -Group III (n=25): Water -Group IV (n=25): Chlorhexidine mouthwash
Bhuvaneshwari Gangadharamurthy	2020	84	The study was conducted on a group of selected school	21 days	--Group I (n=28): Tulsi dentifrices

Nadar et al. [19]			children aged 14-15 years		-Group II(n=28): Fluoridated dentifrices -Group III (n=28): Placebo dentifrices
Anupa Jankish et al. [20]	2021	60	Group of individuals with moderate to severe form of gingivitis who have been given oral prophylaxis	3 months	-Group I (n=20): 0.2% Chlorhexidine gel -Group II (n=20): Placebo gel -Group III (n=20): 0.2% Ocimum tenuiflorum gel

Table 1 shows the characteristics of the included studies. Out of the 5 studies, Tulsi was compared with chlorhexidine in 4 of the studies and also with other materials such as Aloe vera, Fluoridated dentifrices, Ozonated water and placebo gel. The studies differ individually in sample size, age of the population and duration of intervention. All the studies were performed in different age groups

TABLE 2:OUTCOME DATA INCLUDED IN THE STUDY

AUTHOR NAME	**YEAR**	**EFFECT MEASURE**	**RESULT**
Devanand Gupta et al. [16]	2014	Scoring of supragingival plaque by Turesky modification of the Quigley–Hein plaque index and gingivitis by Gingival Index of Loe and Silness	-The study of 30 days shows a statistically significant result in plaque and gingivitis score in both *Ocimum sanctum* and Chlorhexidine group(P<0.05). -Thedifference in plaque and gingivitis between *Ocimum sanctum* and chlorhexidine was not statistically significant
Gautami S. Penmetsa et al [17]	2019	Plaque index (PI), gingival index (GI) and sulcus bleeding index (BI) scores were recorded.	-15th day:- Chlorhexidine does not show statistically significant result in GI and shows statistically significant result for BI in comparison to Ocimum sanctum and Aloe vera - All three groups remain more or so similar in PI with statistically significant result. -30th day:- All three groups show highly statistically significant results with P=0.00. -Ocimum sanctum and Aloe vera mouthwash are effective in gingivitis and plaque control with beneficial effects within 30 days.
Jijo Mon et al. [18]	2019	Debris index-simplified (DI-S), calculus index-simplified (CI-S), oral hygiene index-simplified (OHI-S) scores, and *Streptococcus mutans* counts were recorded at baseline(T_1) and data collected at 15^{th}(T_2) and 30^{th}(T_3) day.	-OW:-minimum DI-S score at T_2 and T_3 -HW:- minimum CI-S score at T_2 and T_3 -CHX:- minimum *S. mutans* count at T_2 and T_3 -OW:- maximum reduction in OHI-S score at T_2 -HW:- maximum reduction in OHI-S score at T_3
Bhuvaneshwari Gangadharamurthy Nadar et al. [19]	2020	Individuals with mean gingival index score of 1 using Loe-Silness Gingival Index, and individuals with mean plaque index score of 1.5Turesky modification of the Quigley-Hein Plaque Index were included.	-A 3 weeks study shows a statistically significant result in plaque and gingivitis index score for Tulsi and Fluoridated dentifrices group with P=0.001. -Tulsi and Fluoridated dentifrices show a clinical effect size of 0.39 and 0.59 for antiplaque and antigingivitis action, which can be considered as a moderate effect.
Anupa Jankish et al. [20]	2021	Modified sulcus bleeding index, gingival index (Loe ¨ and Silness) and Turesky – Gilmore Glickman modification of Quigley Hein Plaque Index recorded at baseline.	-PI and BI scores show significant results in Group I vs Group II and Group II vs Group III comparison. -PI and BI scores comparison between Group I & Group III does not show a significant result.

Table 2 shows the outcome data of plaque scores and gingival scores in the included studies. There was a decrease in the plaque and

gingival scores in the Tulsi group compared to the control from baseline till the end of the intervention period in all 5 studies with a significant P-value.

TABLE 3:BIAS ASSESSMENT INCLUDED IN THE STUDIES

Author name, (Year)	Random sequence generation	Allocation concealment	Blinding of outcome	Incomplete outcome data	Blinding of participants and personnel	Selective reporting
Devanand Gupta et al. (2014)	+	+	+	?	+	+
Gautami S. Penmetsa et al (2019)	+	+	+	+	+	+
Jijo Mon et al. (2019)	+	+	-	?	?	?
Bhuvaneshwari Gangadharamurthy Nadar et al. (2020)	+	+	-	+	?	?
Anupa Jankish et al. (2021)	+	+	?	-	+	+

+=low risk of bias, - =high risk of bias, ?=unclear risk of bias

DISCUSSION

The use of herbs as a medicinal plant has been observed since early ancient times. According to Ayurveda, there are numerous herbs that can be used as medicine. Tulsi was one such herb that gained popularity in recent years due to its various medicinal properties, and so it can be used in various diseases and also shows little to no adverse effects, unlike chemical drugs. The inflammatory properties of the Tulsi are taken up, particularly in these studies and assess its effectiveness in gingival inflammation. Gingivitis is mainly caused by plaque which contains microorganisms and food debris that remains on the tooth due to poor oral hygiene. So the main treatment choice for gingival inflammation is the removal of plaque and prevention, and to which the studies are assessing the Tulsi on its effectiveness.

In this systematic review, a total of 5 studies with randomized controlled trials were included, and the results of each study were observed. The results of the 5 studies mostly show positive results to its effectiveness on gingivitis with a reduction in plaque index and gingival index were statistically significant.

Devanand Gupta et al. reported a statistically significant result in the 30 days study on Plaque and Gingival index score for Ocimum sanctum and Chlorhexidine mouthwash group. This result shows the decrease in plaque and gingivitis during the 30 days study, which shows the effectiveness of Ocimum sanctum on plaque and gingivitis control compared to chlorhexidine, but the comparison is not able to produce any superior effect of Ocimum sanctum to chlorhexidine.

Gautami S. Penmetsa et al. study was done in 60 patients aged 18-45, which showed mild to moderate gingivitis condition. The study reported a statistically significant result in Plaque index(PI) scores for Chlorhexidine group, Ocimum sanctum group and Aloe vera group on the 15^{th} day. The Gingival index(GI) and Bleeding Index(BI) shows some variation within the groups on the 15^{th} day. On the 15^{th} day, a comparison was done and Chlorhexidine group evaluated the slightly better result compared to both Ocimum sanctum and Aloe vera group. Although the results were better in chlorhexidine, the results are statistically significant for BI but not significant for GI. By the 30^{th} day, all the three groups show statistically significant results in PI, GI and BI. So Ocimum sanctum is effective in plaque and gingivitis control with effects observed in 30 days.

Jijo Mon et al. study was done as a comparative evaluation between Ozonated water, Herbal water(made from Ocimum sp.) and Chlorhexidine mouthwash on DI-S, Ci-S and OHI-S. Herbal water is found to be the most effective on CI-S compared to others as CHX is more effective on OHI-S and Ozonated water on DI-S. This comparison shows the higher efficacy of Ocimum on calculus and thereby its effectiveness on gingivitis control.

Bhuvaneshwari Gangadharamurthy Nadar et al. study was done for 3 weeks(21 days) in 84 patients of 14-15 years age group. The results of the study were statistically significant in plaque and gingival index scores for Tulsi dentifrice and Fluoridated dentifrice group with P=0.001. The clinical effect size of the Tulsi and Fluoridated dentifrice shows the moderate effect as antigingivitis, and antiplaque control and so can be effective in their usage on gingivitis.

Anupa Jankish et al. shows a comparative evaluation between 0.2% Chlorhexidine gel, Placebo gel and Ocimum tenuiflorum gel. The study shows a significant decrease in plaque index and Bleeding index in Chlorhexidine gel and Ocimum tenuiflorum gel which is statistically significant in comparison between Chlorhexidine gel with Placebo gel and Placebo gel with Ocimum tenuiflorum.

There is conclusive evidence that Tulsi is effective in reducing gingival inflammation if it is used as a mouthwash and has equal effectiveness to that of other mouthwash, dentifrices and also to the gold standard chlorhexidine mouthwash.

CONCLUSION:-

The anti-inflammatory property of Tulsi is effective in reducing the inflammation of gingiva if used as a mouthwash. It can be used as an alternative to the gold standard chlorhexidine, without the adverse effect of teeth staining.

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