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EFFICACY OF 2% CYMBOPOGON CITRATUS (LEMONGRASS) GEL AS AN ADJUNCT TO SCALING AND ROOT PLANING- A CLINICAL STUDY BASED ON PHYTOSCIENCE

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ABSTRACT

Objective: To evaluate the efficacy of locally delivered 2% lemongrass essential oil in gel form as an adjunct to scaling & root planing. **Materials & Methods**: A total of 100 sites were selected randomly from 50 subjects with moderate to severe chronic periodontitis in the age group of 20-60 years. 2% lemongrass essential oil used in indigenous preparation of gel and placed in moderate to deep periodontal pockets after scaling and root planing. **Results**: Statistically significant reduction in PD and gain in RAL and increased reduction of GI and PI in the experimental group than in the control group, though it was statistically nonsignificant seen in the experimental group as compared to the control group at 6 weeks and 3 months. **Conclusion**: 2% lemongrass essential oil gel appears to be an effective alternative agent that can be used for effective and safe local drug delivery as an adjunct to mechanical nonsurgical periodontal therapy.

KEYWORDS: Lemongrass essential oil, local drug delivery, periodontitis, phytoscience

INTRODUCTION

"Peri "means around and "odontal "refers to teeth. Periodontitis is an inflammatory response to biofilm bacteria characterized by periodontal pocket formation and alveolar bone resorption that could result in tooth loss. Pathogenic plaque micro-flora, host immune response, and environmental factors play a main etiologic role and cause both direct as well as host-mediated tissue injury. Elimination or modification of these factors is the basic aspect of treatment, which arrests or controls the disease process. Periodontal disease is infection of the structures around the teeth. In earliest stage of periodontal disease, the infection affects only the gums. But in more severe forms of the disease, all of the supporting tissues are involved. Bacteria are the major cause. Periodontal disease initiation and propagation is through an imbalance of the commensal oral micro biota i.e. dental plaque, which then interact with the immune defences of the host leading to inflammation and disease.[1]

The primary aim to treat periodontitis is, the elimination of specific periodontal pathogens with adjunct use of local and systematic antibiotics along with scaling and root planning. Mechanical means i.e. scaling and root planing is time consuming, difficult and sometimes less effective, so the locally delivered pharmacological agents, have been introduced to accomplish this goal. The main disadvantage of systemic administration of antibiotics is distribution of drug throughout the body, and it can also lead to sometimes toxicity problems. So to overcome this, local drug delivery system came in to light. (Slots & Rams, 1990; Goodson, 1994).[1] Mouth rinses, irrigation solutions and sustained release devices are some of these locally delivered agents.

Despite several chemical agents being commercially available and they can alter oral microbiota and have undesirable side effects such as diarrohoea, vomiting and staining of teeth, hence research for alternative agents continues and natural phytochemicals, that are isolated from plants used in traditional medicines are considered as better alternatives to that of synthetic chemicals. Let food be your medicine, and let medicine be your food – was adviced by Hippocrates over 2 millennium ago, it is still true that, you are what you eat.[2]

A recent study was conducted by World Health Organization, estimated that almost 70-80% of the population of the developing world has resorted to traditional practice for variety of ailments. There are many natural ways to treat periodontal disease, which includes some herbs that can help to eliminate inflammation and infection associated with periodontal disease.

Plants and natural products from time immemorial are used for their pharmacological applications viz, wound healing, antimicrobial, anti-inflammatory and anti-oxidant property.

Cymbopogon citratus, Staph (lemongrass) is a popular medicinal plant which is used to treat different ailments. It is commonly used in teas, cosmetics, preservative agent, and has antiseptic and antiemetic, analgesic and antipyretic properties. its chemical components are myrcene, citrenellal, geranyl acetate, nerol, geraniol, neral and traces of limonene and citral.

The purpose of this article is to present the advantage of 2% lemongrass as an adjunct to scaling and root planing to inhibit the growth of oral pathogens, reduce the development of dental plaque and to reduce the symptoms of oral disease.

An in vitro study by Khongkhunthian et al[3] showed the antimicrobial activity of lemongrass essential oil against periodontal pathogens, especially the reference strains Actinomyces naeslundii and Porphyromonas gingivalis, which were resistant to tetracycline hydrochloride.

In the present study an attempt was made to compare the efficacy of 2% lemongrass essential oil gel as locally delivered agent, adjunct to scaling root planing and SRP alone in the treatment of patients with chronic periodontitis with moderate to deep periodontal pocket.

MATERIALS AND METHODS

Sample collection

A total of 100 sites were selected randomly from 50 subjects with moderate to severe chronic periodontitis in the age group of 20-60 years (mean age 40.0± 5.4 years) who reported to the outpatient Department of Periodontics.

Exclusion criteria

The exclusion criteria for the patients were: (1) regular use of mouthwash/other chemical plaque control agents; (2) tobacco users in any form, alcohol use; (3) patients with systemic diseases like diabetes mellitus or with other diseases which compromise the immune system and are known to influence the periodontal disease; (4) patients having oral hard and soft tissue diseases except caries and periodontitis; (5) chronic use of antimicrobial, ant-inflammatory drugs and medication within 3 months prior to the study; (6) patients who had undergone periodontal therapy within 6 months prior to the study; and (7) pregnant females and lactating mothers.

Inclusion criteria

Systemically healthy subjects having at least four isolated periodontal pockets with a probing depth between 5 and 8 mm were included in the study.

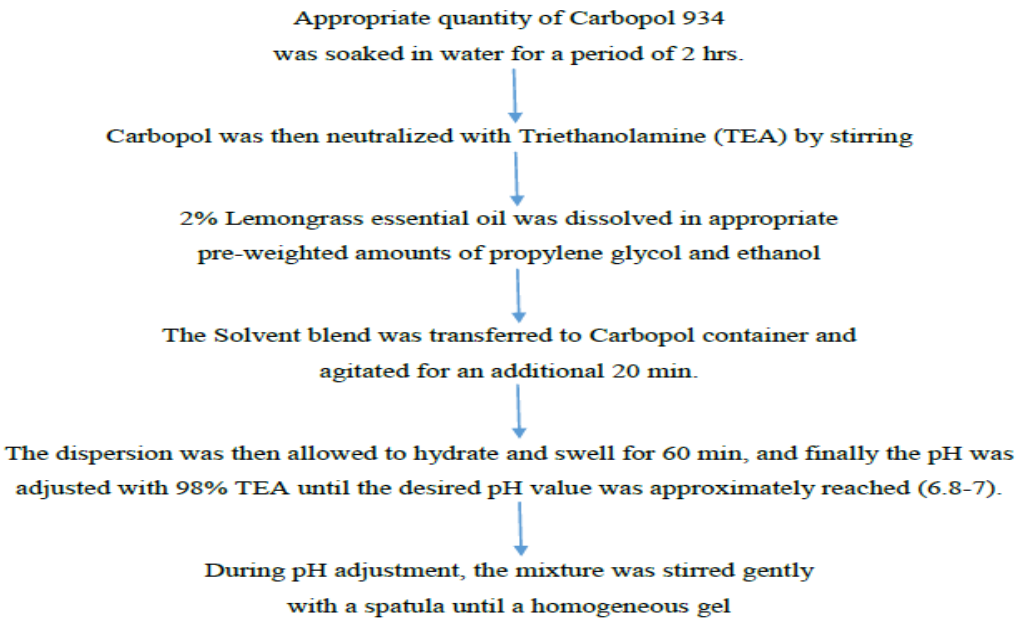
Informed consent

All potential participants were explained about the need and design of the study. Only those subjects who agreed to participate were enrolled in the study after obtaining their written informed consent. All potential participants were explained about the need and design of the study. Only those subjects who agreed to participate were enrolled in the study after obtaining their written informed consent

Study design

This was a randomized controlled clinical trial. After the initial oral examination of all the patients, the sites were selected and assigned randomly either to experimental or control group as follows: Group I experimental: 50 sites treated with SRP and 2% lemongrass essential oil gel Group II control: 50 sites treated with SRP alone Clinical parameters including gingival index (GI), probing depth (PD), and relative attachment level (RAL), plaque index (PI) were recorded at baseline (before SRP) and at 6 weeks and 3 months interval. A custom-made acrylic stent and a UNC probe was used to standardize the measurement of PD and RAL. RAL was calculated by measuring the distance from the stent (apical extent) to the base of the pocket.

Formulation of 2% lemongrass.[4]



Local drug delivery

The gel was administered by means of a syringe with a bent, blunt-end needle. The needle was carefully inserted into the periodontal pocket and the gel was applied in the test sites in a gentle probing manner, attempting to fill the full extent of the pocket. The gel was applied up to the gingival margin and the excess gel was removed with a sterile gauze. After placement of the gel *in situ*, patients were instructed to follow strict oral hygiene protocol but were discouraged from using any interdental cleaning aids for 1 week. They were also asked not to chew hard or sticky foods at the gel placement sites. Patients' oral hygiene status was reassessed at 1week interval. All patients were recalled for follow-up measurements at 6 weeks and 3 months intervals.

Figure 1: Acrylic stent for patient.

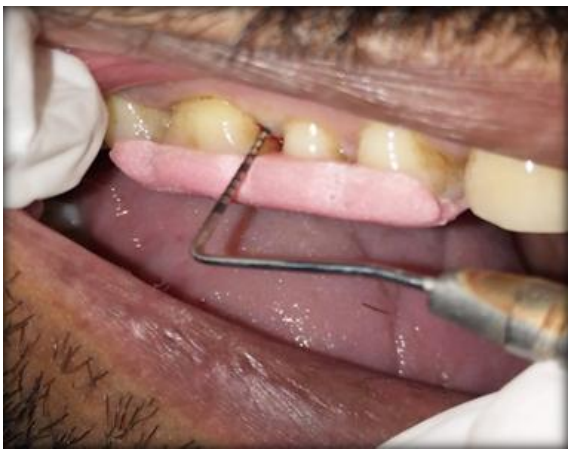


Figure 2: Measuring Pocket depth using UNC 15 Probe.

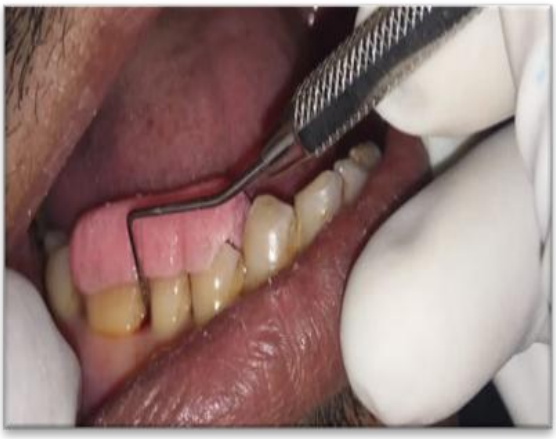


Figure 3: Measuring Pocket depth using UNC 15 Probe At Baseline.

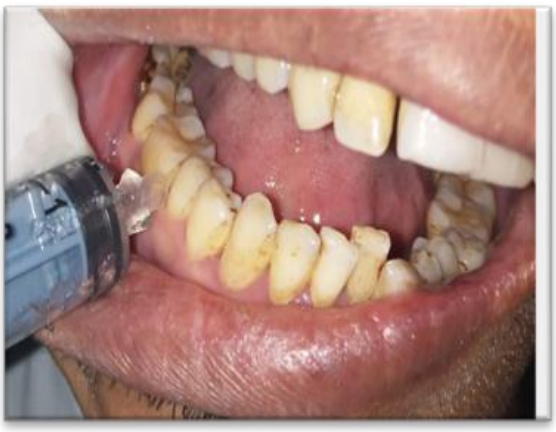


Figure 4: Gel insertion.

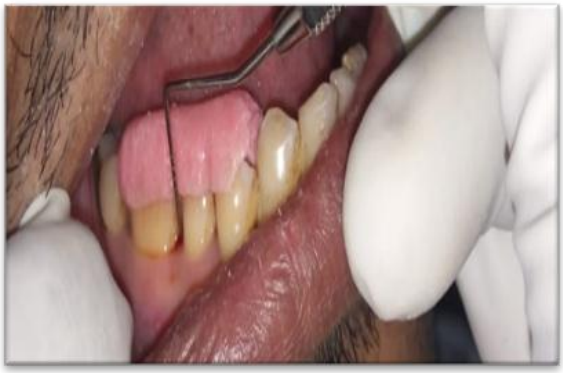


Figure 5: Measuring Pocket depth using UNC 15 Probe After 3 months.

STATISTICAL ANALYSIS

Statistical Analysis & Results

Statistical analysis of the data was performed by using Statistical Package for the Social Sciences (SPSS) software 16. Student's paired *t*-test was used to test the mean changes in scores at different time points within each study group. One-way analysis of variance (ANOVA) was used to compare the mean scores between different study groups. Tukey's "honestly significant difference" procedure was used to identify the significant groups, if the test of significance in one-way ANOVA was significant. $P < 0.05$ was considered as the level of significance in this study.

The mean PD in the control group at baseline was 5.22±0.67 mm, after 6 weeks was 4.24±0.62 mm and 4.10±0.61 mm after 3 months. Mean reduction in PD in the control group from baseline to 1 month was0.98±0.65 and 3 months was 1.12±0.61 which was statistically significant. [Table 1]

In the test site the mean PD was 5.72±0.61 mm at baseline and 3.60±0.49 mm and 2.92±0.27 mm after 6 weeks and 3 months respectively. Mean reduction from basline to 1 month was 2.12±0.56 and at 3 months was 2.8±0.45which was statistically significant.

The mean RAL was 9.80 ± 0.72 mm at baseline, 8.78 ± 0.70 mm after 6 weeks, and 8.64 ± 0.74 mm after 3 months. Mean difference in RAL in the control group between baseline and 1month values was 1.02±0.71 mm and between baseline and 3 months values was1.16±0.72 mm, which was statistically significant. In the experimental group, the mean RAL was 9.94 ± 0.89 mm at baseline and 7.84 ± 0.71 mm and 6.80 ± 0.60 mm after 6 weeks and 3 months, respectively. Mean RAL gain was 2.1±0.81 and 3.14±0.74mm at 6 weeks and 3 months,

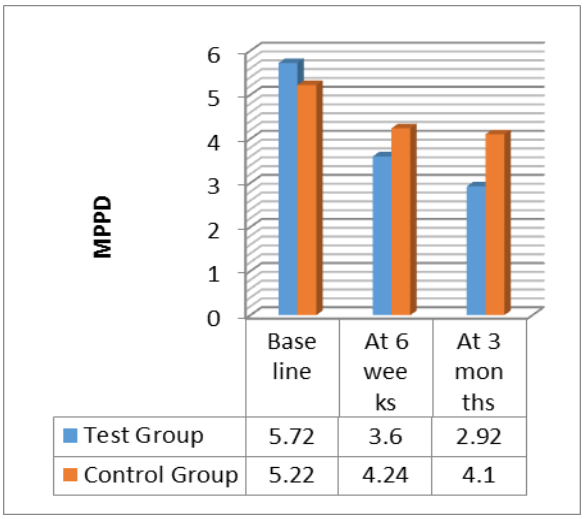
respectively, which was statistically significant. There was statistically significant RAL gain in the experimental group than in the control group at 3 months (Table 2).

Table 1: Intra Group Comparison of Mean Pocket Probing Depth At Baseline.

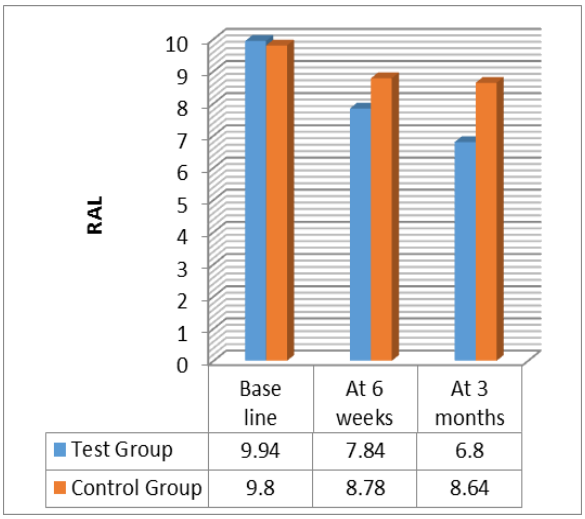
Group Statistics						
	GROUP	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**P value**
BMPPD	Test Group	50	5.72	.671	.095	.000
	Control Group	50	5.22	.648	.092	.000
SMPPD	Test Group	50	3.60	.495	.070	.000
	Control Group	50	4.24	.625	.088	.000
TMPPD	Test Group	50	2.92	.274	.039	.000
	Control Group	50	4.10	.614	.087	.000

Table 2: Intra Group Comparison of Relative Attachment Level At Baseline.

Group Statistics						
	GROUP	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**P value**
BRAL	Test Group	50	9.94	.890	.126	.391
	Control Group	50	9.80	.728	.103	
SRAL	Test Group	50	7.84	.710	.100	.000
	Control Group	50	8.78	.708	.100	
TRAL	Test Group	50	6.80	.606	.086	
	Control Group	50	8.64	.749	.106	.000



Graph 1: Intra group comparison of Mean Pocket Probing Depth.



Graph 2: Intra group comparison of Relative Attachment Level.

In the control group, the mean GI was 1.96 ± 0.32 mm at baseline, 1.43 ± 0.33 mm after 6 weeks, and 1.29 ± 0.28 mm after 3 months. The mean difference in GI in the control group between baseline and 6 weeks values was statistically nonsignificant (0.53 ± 0.30 mm), and at 3 months, it was0.67±0.30 mm, which was statistically significant. In the experimental

group, the mean GI was 1.97 ± 0.33 mm at baseline and 1.05 ± 0.31 mm and 1.02 ± 0.29 mm after 6 weeks and 3 months, respectively. Mean reduction in GI was and 0.92±0.32mm at 6 weeks and 0.95±0.30 at 3 months, respectively. At 3 months, the mean GI reduction was statistically significant. There was statistically significant reduction in GI in the experimental group and control group from baseline, and after 3 months, it was not statistically significant. Although there was statistically significant reduction in GI in the experimental group than in the control group, it was not statistically significant(Table 3).

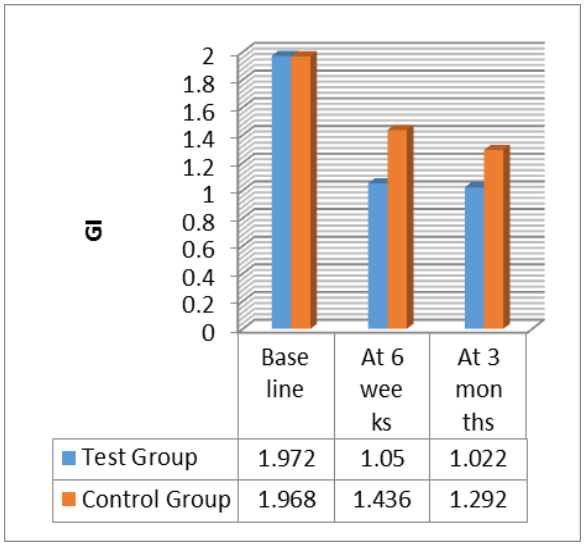
Table 3: Intra Group Comparison of Gingival Index At Baseline.

Group Statistics						
	GROUP	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**P value**
BGI	Test Group	50	1.972	.3338	.0472	
	Control Group	50	1.968	.3298	.0466	.952
SGI	Test Group	50	1.050	.3112	.0440	
	Control Group	50	1.436	.3397	.0480	.000
TGI	Test Group	50	1.022	.2902	.0410	
	Control Group	50	1.292	.2842	.0402	.000

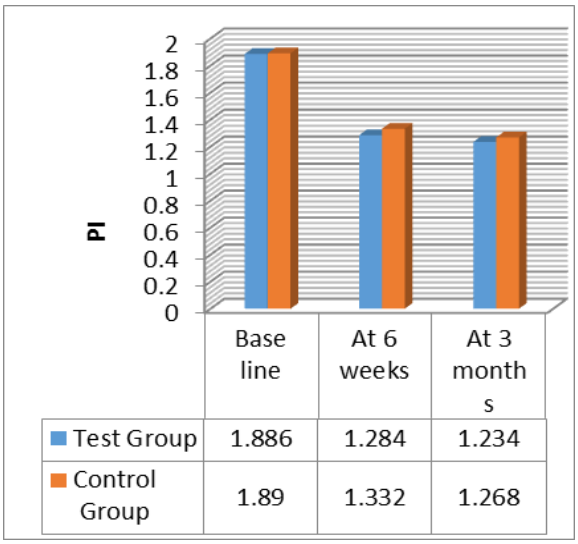
Table 4: Intra Group Comparison Of Plaque Index At Baseline.

Group Statistics						
	GROUP	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**P value**
BPI	Test Group	50	1.886	.2942	.0416	
	Control Group	50	1.890	.2859	.0404	.945
SPI	Test Group	50	1.284	.2765	.0391	
	Control Group	50	1.332	.2759	.0390	.387
TPI	Test Group	50	1.234	.2300	.0325	
	Control Group	50	1.268	.2094	.0296	.441

In the control group, the mean PI was 1.89 ± 0.28 mm at baseline, 1.33 ± 0.27 mm after 6 weeks, and 1.26 ± 0.2 mm after 3 months. The mean difference in GI in the control group between baseline and 6 weeks values was statistically nonsignificant (0.56 ± 0.26 mm), and at 3 months, it was0.63±0.30 mm, which was statistically nonsignificant. In the experimental group, the mean PI was 1.88 ± 0.33 mm at baseline and 1.28 ± 0.31 mm and 1.23 ± 0.29 mm after 6 weeks and 3 months, respectively. Mean reduction in PI was 0.92±0.32mm at 6 weeks and 0.65±0.30 at 3 months, respectively. At 3 months, the mean PI reduction was statistically significant. There was statistically nonsignificant reduction in PI in the experimental group and control group from baseline, and after 3 months. (Table 4).



Graph 3: Intra group comparison of Gingival Index At Baseline.



Graph 4: Intra group comparison of Plaque Index.

DISCUSSION

2% lemongrass oil in gel form used as locally delivered agent, combined with SRP shows additional benefits in pocket depth reduction and RAL gain compared to SRP alone many locally delivered agents are commercially available, but the need for safe, effective and economical agents has led to the use of various natural extracts.[5]

Various herbal plants and their products such as neem, tulsi, propolis, turmeric, green tea, in the form of gel and mouthwash, have shown significant benefits over the chemical ones in the treatment of periodontal diseases.[6,7] Statistically significant reduction in PD and gain in RAL were seen in the experimental group as compared to the control group at 6 weeks and 3 months. Also, there was increased reduction of GI in the experimental group than in the control group, though it was statistically nonsignificant.

Overall, the improved clinical resolution of inflammation and destruction seen in the experimental group can be explained by the effectiveness of lemongrass essential oil gel as an anti-inflammatory and antimicrobial agent against periodontal pathogens, which might have prevented microbial recolonization of periodontal pockets. Increased tissue healing response seen in the experimental group can also be explained by the antioxidant activity of lemongrass essential oil gel components, which prevents further periodontal tissue destruction.

Results of the present study is directly similar to those of previous studies, where lemongrass essential oil in the form of gel is used for treating patients with chronic periodontitis.[8]

Susanto *et al.* (2010)[9] determined the salivary glutathione level of moderate gingivitis patients after they gargled with different concentrations like 0.5%, 1%, 2%, or 4% of lemongrass essential oil. Glutathione, also known as sulfhydryl glutathione (GSH), is one of the nonenzymatic antioxidants in the body found in every cell and plays an important role in protection against oxidative stress. Gargling with different concentrations of lemongrass essential oil increased the salivary GSH levels in moderate gingivitis patients, especially 2% and 4% lemongrass essential oil showed the same potency as hexetidine 0.1%. It was concluded that 2% lemongrass essential oil solution can accelerate the gingivitis healing process better than at other concentrations.

Anand *et al.* (2011) studied the efficacy of lemongrass oil mouthwash and evaluated its antioxidant property by estimating salivary and gingival crevicular fluid GCF superoxide dismutase levels before and after its administration. Lemongrass oil mouthwash was used along with nonsurgical treatment in various concentrations (0.1%, 0.25%, and 0.5%). Superoxide dismutase levels increased when compared with the initial values in all the groups, with reduction in gingivitis. It was implied that the lemongrass oil mouthwash may have an additive effect on the treatment outcome, when it is used along with scaling.[10]

Citral can subside oxidative stress through GSH's antioxidant system induction because of its steroisomer; neral and geranial.[11] It can also act via terminating the chain reaction of lipid metabolism by donating hydrogen to free radical.[12]

Flavonoid; a chemical component of lemongrass oil has many biological activities; viz., antioxidant, anti-inflammatory, antimicrobial, antimutagenic and anti tumour.[13] So its activity can evade oxidation reaction along with reducing hydroxyl radical, peroxyl radical and superoxide.[14]

Citral is not only an active component of lemongrass oil but also helps in formation of Vitamin A and C; which are secondary antioxidants to scavenge free radicals and also prevents damage by stopping chain reaction.[14]

According to Kukkamalla et al[15] lemongrass oil mouthwash used in concentration 0.25% 0.5% showed reduction in plaque, better than that of chlorhexidine.

Further research with large sample size and long term follow up at multiple intervals will make for an interesting study that could shed more light on role of lemongrass gel as an adjunct to scaling and root planning. But this study has its own limitations as the effects of 2% lemongrass essential oil gel on subgingival microbiota and its antioxidant activity were not assessed.

CONCLUSION

Lemongrass isolation and characterization of phytochemical extracts from this plant offers new choice of therapy as an adjunct to mechanical instrumentation, in the treatment of chronic periodontitis with moderate to deep periodontitis, and it can be used at a concentration of 2% as local drug delivery agent as an adjunct to scaling and root planing. The conclusions from this study suggests that herbal medicine i.e. lemongrass could prove to be potential effective competitor to modern medication as an adjunct to scaling and root planning. But more evidence of clinical trials are required to further establish herbal medication as a reliable treatment modality in periodontal therapy.

Conflict of interest: None.

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