

Evaluation of *Lentinula edodes* (Shiitake Mushroom) Mouthwash in Patients with Gingivitis

Shubhashree Pillai*, Neema Shetty, Aditi Mathur, Ashish Bali, Prithish Chandra Pal and Mumtak Taki

Department of Periodontology and Implantology, Pacific Dental College and Hospital, Rajasthan, India

Abstract

Shiitake (*Lentinus edodes*) also known as oakwood mushroom, is the edible mushroom generally found in Asia and is well known for its antibacterial, anti-plaque and anti-inflammatory efficacy. Chlorhexidine mouthwash is considered as gold standard, but because of its various side effects, it is important to find an herbal alternative to it.

Aim: To evaluate the anti-inflammatory and anti-plaque efficacy of *Lentinula edodes* (Shiitake Mushroom) mouthwash in patients with gingivitis.

Methodology: 45 participants of both genders with age range of 17 to 60 years, with moderate to severe gingivitis, were randomly divided into 3 groups: GROUP 1-SRP+Shiitake mushroom mouthwash (n=15), GROUP 2-SRP+0.2% Chlorhexidine mouthwash (n=15), GROUP 3-Only SRP (n=15). The clinical outcomes evaluated were: PI (Turesky Gilmore Modification of Quigley Hein Plaque Index) and GI (Löe and Silness) at baseline, 15th and 30th day. Statistical analysis was done using dependent t-test and independent t-test.

Result: Intragroup comparison showed significant decrease in GI and PI from baseline in all the 3 groups but no statistical difference in intergroup comparison between the 3 groups was seen.

Conclusion: Shiitake mushroom mouthwash can be used as an herbal alternative to Chlorhexidin.

Keywords: Shiitake; Mushroom; Mouthwash; Gingivitis; Anti-Inflammatory

Introduction

For several years, dentists and dental hygienists have made oral hygiene care a priority. Mouthwash has been granted paramount importance in the current global pandemic, but people are still unaware of its importance. Mouthwashes or mouth rinses are basically a form of solution or a liquid which when used tends to reduce the microbial load in the oral cavity. Mouthwash also helps in reducing the risk of dental caries, various gingival and periodontal diseases, and infectious disease and also helps to reduce the bacteria that cause oral malodor.

The commercially available mouthwashes generally consist of derivatives of alcohol or phenol for example chlorhexidine gluconate, octenidine and triclosan mouthwashes. Dryness of the mouth, burning sensation, and loss of taste sensation are all potential side effects of these alcohol or phenolic-based mouthwashes. Also, it might lead to discoloration of the teeth and also in some cases parotid gland swelling [1]. To overcome these drawbacks of commercially available mouthwashes, various herbal alternatives have been popping out in the market. The biggest positives about natural mouthwashes are that it contains no alcohol; it is plant based and contains no artificial color.

Medicinal mushrooms, which have a variety of nutritional and medicinal properties, are well-known as traditional oriental therapies. Shiitake (*Lentinus edodes*) also known as oakwood mushroom is the edible mushroom generally found in Asia which is well known for its antibacterial, anti-plaque and anti-inflammatory efficacy. It has various other well-known therapeutic effects like anti-carcinogenic, anti-thrombotic, anti-oxidative, anti-fungal as well as anti-viral [2]. The present study compared the herbal mouthwash that is shiitake mushroom mouthwash to the commercially available mouthwash (0.2% Chlorhexidine gluconate) and also evaluated the anti-inflammatory and anti-plaque effectuality of Shiitake mushroom mouthwash.

Materials and Methods

Study design

This randomized controlled study was conducted on the 45 patients from the Outpatients Department of Department of Periodontology and Implantology, Pacific Dental College and Hospital, Udaipur. The patient with age ranges from 17-60 years and having moderate to severe gingivitis were included in the study. Patients who gave history of periodontitis, allergy to mushroom and pregnant and lactating women were prohibited to take part in the study. A total of 45 patients were divided randomly into 3 groups for evaluation using coin-toss method by the main investigator. In group 1, patients were given Shiitake mushroom mouthwash after scaling and root planning, for group 2, patients were prescribed 0.2% chlorhexidine gluconate mouthwash after scaling and root planning and in group 3 only scaling and root planing was carried out on the patients.



Figure 1: Commercially available dried Shiitake Mushroom.

*Corresponding author: Shubhashree Pillai, Department of Periodontology and Implantology, Pacific Dental College and Hospital, Rajasthan, India, Tel: (+91) 9769254177; E-mail: pillai.shubhashree06@gmail.com

Received: July 23, 2021; Accepted: August 06, 2021; Published: August 13, 2021

Citation: Pillai S, Shetty N, Mathur A, Bali A, Pal PC, et al. (2021) Evaluation of *Lentinula edodes* (Shiitake Mushroom) Mouthwash in Patients with Gingivitis. J Oral Hyg Health 9: 289.

Copyright: © 2021 Pillai S, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Preparation of mouthwash

For the preparation of Shiitake mushroom mouth rinse following materials were utilized:

- Commercially available dried shiitake mushroom (50 g) (granulate form) (Figure 1).
- 100 ml distilled water
- Ethyl alcohol (100 ml) (99% pure)
- Reagent bottle
- Filter paper and stand
- Water bath

A process called maceration was done to prepare a dual-step extract of Shiitake, i.e., aqueous and ethyl alcohol extract. Pure ethyl alcohol (100 ml) and distilled water (100 ml) were poured into reagent bottles separately. Mushroom powder which was then divided into two parts was added to two bottles individually and this was kept for 24 hours after maceration. Subsequently, this solution was sieved using the filter paper. Finally, the mouthwash was prepared by heating the filtrate at temperature of 70°C-80°C (Figure 2) [3].



Figure 2: Prepared Shiitake mushroom mouthwash.

Verbal information about the study and written consent forms were handed to the patients with the various information's about the study. Patients were instructed to use the mouthwash twice daily, by swishing in the mouth for a time period of 30 seconds, for 14 days. The patients were also instructed to use the mouthwash directly without diluting it. Patients were also given various oral hygiene instructions for maintenance.

The clinical parameters to be recorded were Turesky modification of the Quigley-Hein Plaque Index and Gingival Index of Løe and Sillness [4,5]. All the clinical parameters were recorded at baseline (prior to scaling and root planing), 15th day and 1 month interval (Figure 3). Gingival Index scores were given prior to Plaque Index as the dye that was used to evaluate the plaque index could mask the color of the gingiva.

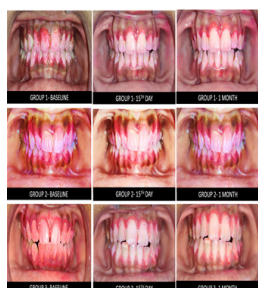


Figure 3: Clinical photographs showing recording of the plaque scores using Turesky modification of the Quigley-Hein plaque index of the patients at baseline and at 15th day and 1 month recall.

Statistical analysis

The results were analyzed using SPSS software version 17.0. Intra-group statistical analysis was done using Dependent sample t-test and Inter-group comparison was done using Independent t-test (Figures 4-7). For comparison of all the three different groups' one-way ANOVA test was used.

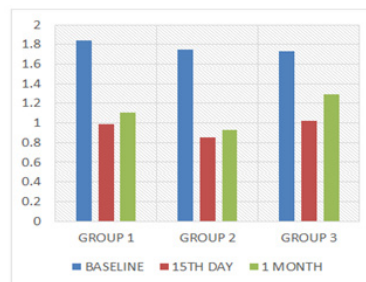


Figure 4: Intragroup comparison gingival index.

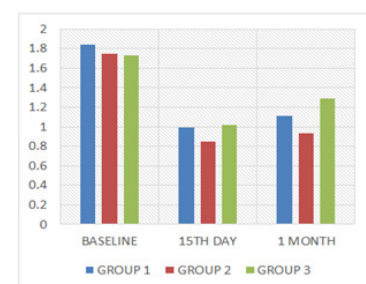


Figure 5: Intergroup comparison of gingival index.

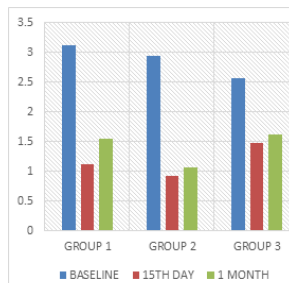


Figure 6: Intragroup comparison of plaque index.

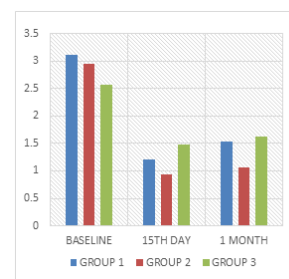


Figure 7: Intergroup comparison of plaque index.

Results

The present study mainly focuses on comparison between the efficiency of shiitake mushroom mouthwash over Chlorhexidine gluconate mouthwash against the gingival inflammation and dental plaque. In this

study, for gingival index, all the three groups on inter group comparison for gingival index at baseline gave no statistically significant difference ($p=0.312$), but on 15th day and 1 month re-evaluation all the three groups gave a highly statistically significant difference ($p<0.001$) between the groups. On intra-group comparison for the gingival index at baseline, 15th day and 1 month, all the groups gave a statistically significant decrease ($p<0.001$) in the gingival index scores as given in Table 1. For the plaque index, on inter-group as well as on intra-group comparison at baseline, 15th day and 1 month, there was a statistically significant decrease in the plaque score values ($p<0.001$) as given in Table 1.

In Table 2, when group 1 was compared to group 2, the p-values of 0.20, 0.025 and 0.005 at baseline, 15th day and 1 month respectively showed that there was no statistically significant difference between these two groups. When the anti-plaque efficacy of the two mouthwashes were evaluated, it was found that the p-value at baseline was found to be 0.196 which was not statistically significant but on 15th day and 1 month it was found to be <0.001 and <0.001 which was highly statistically significant. These results showed that better antiplaque efficacy was seen in the Chlorhexidine group than the Shiitake mushroom mouthwash group

	Gingival Index				Plaque Index			
	Baseline (Mean±SD)	15 TH Day (Mean ±SD)	1 Month (Mean ±SD)	P-Value	Baseline (Mean ±SD)	15 TH Day (Mean ±SD)	1 Month (Mean ±SD)	P-Value
Group 1 (N=15)	1.84±0.21	0.99±0.20	1.11±0.21	<0.001	3.12±0.32	1.21±0.26	1.54±0.33	<0.001
Group 2 (N=15)	1.75±0.15	0.85±0.14	0.93±0.10	<0.001	2.94±0.45	0.93±0.07	1.07±0.09	<0.001
Group 3 (N=15)	1.73±0.25	1.02±0.13	1.29±0.13	<0.001	2.57±0.24	1.48±0.20	1.62±0.16	<0.001
P value	0.312	<0.001	<0.001		<0.001	<0.001	<0.001	

Table 1: IntraGroup and InterGroup comparison of GI and PI between Group 1, 2 and 3.

		Gingival Index		Plaque Index	
		Mean Difference	P-value	Mean Difference	P-value
Group 1 vs. Group 2	Baseline	0.087	0.2	0.189	0.196
	15 th Day	0.147	0.025	0.28	<0.001
	1 Month	0.182	0.005	0.469	<0.001
Group 2 vs. Group 3	Baseline	0.019	0.801	0.363	0.01
	15 th Day	0.169	0.002	0.544	<0.001
	1 Month	0.364	<0.001	0.553	<0.001
Group 1 vs. Group 3	Baseline	0.106	0.219	0.552	<0.001
	15 th Day	0.022	0.724	0.264	0.004
	1 Month	0.182	0.008	0.084	0.384

Table 2: InterGroup comparison of GI And PI between Group (1,2), Group (2,3) and Group (1,3).

Discussion

In this present study assessment of shiitake mushroom mouthwash and chlorhexidine mouthwash against gingival inflammation and dental plaque was done. To understand the mechanism of action of shiitake mushroom mouthwash it is important we understand the two main components of the mushroom that is Lentinan and Carvacrol. Chihara et al. [6] stated that LENTINAN appears to be a potent host defense potentiator which improves homeostasis of the host against cancer or infection. It was also stated that Lentinan induces formation of anti-tumor effector cells, such as killer T cells, NK cells, and cytotoxic macrophages.

The Shiitake mushroom mouthwash group showed an arithmetically significant decrease in the Gingival index and Plaque index at the 15th day and 1 month follow up when compared to the baseline. These results are in accordance with the study done by Solmaz et al. [7] and Akira et al. [8] has stated about the anti-microbial and anti-biofilm efficacy of shiitake mushroom extract. Solmaz et al. [7] explained the importance of the component named carvacrol present in *Lentinula edodes* oil extract which is an aromatic monoterpene which has showed the property to deteriorate the outer membrane of gram-negative bacteria. Another study done by Zuara et al. [9] shows that Shiitake extract fractions have an inhibitory effect on the dental plaque.

Shiitake mushroom mouthwash showed a substantial reduction in gingival inflammation on the 15th day as well as 1 month recall in the current report. This is in accordance with a study done by Ciric et al. [10] in which it was stated that shiitake mushroom extract decreased the disease-causing taxa without effecting the healthy taxa. It was stated to have an anti-

inflammatory property.

Chlorhexidine remains the Gold standard as it has been commonly used in dental practice as antiseptic agent since 1970 [11] due to its long-lasting antibacterial activity but it has shown adverse effects on long term use. Because of these adverse effects, there is a constant surge in field of dentistry to find newer alternatives for it. In this study Shiitake mushroom mouthwash gave equally efficacious results when compared to the chlorhexidine mouthwash in reducing the gingival inflammation. According to, Solmaz et al. [7] and Signoretto et al. [12], Shiitake mushroom oil extract have an inhibitory effect on gram-negative periodontal pathogens like *A. Actinomycetemcomitans*. Another study done by Huang et al. [13] and Kitzberger et al. [14] gave us an insight about the anti-oxidant effect of Shiitake extract. Thus, further research into the Shiitake mushrooms anti-oxidant properties and possible action against periodontal pathogens is required. There was a study which evaluated anti-gingivitis effect of shiitake mushroom essential oil but there is no study that evaluated the anti-plaque and anti-inflammatory efficacy of the shiitake mushroom mouthrinse on patients with moderate to severe gingivitis.

Conclusion

It can be concluded that the comparison of the Shiitake mushroom mouthwash with Chlorhexidine mouthwash has provided us with a valuable insight of action of different mouthwashes on dental plaque. Chlorhexidine mouthwash is considered as a gold standard in treatment of cases with moderate to severe gingivitis; however, Shiitake mushroom mouthwash has also shown the potential anti-inflammatory and anti-plaque efficacy. The results implicit that the action of Shiitake mushroom

mouthwash should be explored further for its favorable effects on oral hygiene by carrying out the microbiological examination for its action on particular micro-organisms.

Acknowledgements

NIL

References

1. Flötra L, Gjermo P, Rølla G, Waerhaug J (1971) Side effects of chlorhexidine mouth washes. Scand J Dent Res 79:119-25.
2. Finimundy T, Dillon A, Henriques J, Ely M (2014) A review on general nutritional compounds and pharmacological properties of the *Lentinula edodes* Mushroom. J Food Nutr Sci 5:1095- 1105.
3. Sharma S, and Prakash S (2019) To detect the minimum inhibitory concentration and time-kill curve of shiitake mushroom on periodontal pathogens: An *in vitro* study. J Indian Soc Periodontol 23:216-219.
4. Turesky S, Gilmore ND, Glickman I (1970) Reduced plaque formation by the chloromethyl analogue of vitamin C. J Periodontol 41:41-43.
5. Loe H (1967) The gingival index, the plaque index and the retention index systems. J Periodontol 38:610-616.
6. Chihara G, Hamuro J, Maeda Y, Arai Y, Fukuoka F (1970) Fractionation and purification of the polysaccharides with marked antitumor activity, especially lentinan, from *Lentinus edodes* (Berk.) Sing. (an edible mushroom). Cancer Res 30:2776-2781.
7. Solmaz G, Ozen F, Ekinci Y, Bird PS, Korachi M (2013) Inhibitory and disruptive effects of shiitake mushroom (*Lentinula edodes*) essential oil extract on oral biofilms. Jundishapur J of Microbiol 6:12-15.
8. Akira Y, Sayaka K, Yoshihisa Y, Yuichi S, Yuko N, et al. (2009) The inhibitory effects of mushroom extracts on sucrose-dependent oral biofilm formation. Appl Microbiol Biotechnol 86:615-623.
9. Zaura E, Buijs M J, Hoogenkamp M A, Ciric L, Papetti A, et al. (2011). The effects of fractions from shiitake mushroom on composition and cariogenicity of dental plaque microorganisms in an *in vitro* caries model. J of Biomed and Biotechnol.
10. Ciric L, Tymon A, Zaura E, Lingström P, Stauder M, et al. (2011) *In vitro* assessment of Shiitake mushroom (*Lentinula edodes*) extract for its antigingivitis activity. J Biomed Biotechnol.
11. Mathur S, Mathur T, Srivastava R, Khatri R (2011). Chlorhexidine: The gold standard in chemical plaque control. Natl J Physiol Pharm Pharmacol 1: 45-50.
12. Signoreto C, Marchi A, Bertoncelli A, Burlacchini G, Tessarolo F, et al (2011). Effects of mushroom and chicory extracts on the physiology and shape of *Prevotella intermedia*, a Period onto pathogenic bacterium. J Biomed Biotechnol.
13. Huang W, Kim J S, Chung H Y (2011) Antioxidant activity and total phenolic content in shiitake mycelial exudates. Natural product communications 6:845-850.
14. Kitzberger CSG, Smânia Jr A, Pedrosa RC, Ferreira SRS (2007). Antioxidant and antimicrobial activities of shiitake (*Lentinula edodes*) extracts obtained by organic solvents and supercritical fluids. J Food Engineer. 80:631-638.