

EFFICACY OF PIPER BETEL-BASED MOUTHWASHES ON DENTAL PLAQUE AND GINGIVAL INFLAMMATION: A SYSTEMATIC REVIEW

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Abstract: *Plaque- induced gingivitis is a highly prevalent periodontal disease. It is caused by formation of microbial biofilm on the tooth surfaces, poor oral hygiene. Treatment of plaque induced gingivitis concentrates more on plaque control by various methods. The purpose of the study was to conduct a systematic review of efficacy of daily rinsing with piper betel extract mouthwashes in terms of Plaque Index (PI), and/ or Gingival Index (GI) as compared to other mouthwashes in plaque-induced gingivitis. an electronic search was carried out using the key words ‘herbal mouthwash’ ‘ piper betel’ ‘anti-gingivitis effect PubMed/Medline, ISI Web of Science and Google Scholar databases for relevant articles published from 2014-2019. The addressed focus question was: Is herbal mouthwash effective as an anti-plaque or anti gingivitis agent than other chemical mouthwashes? Following the removal of the duplicate results, the primary search resulted in 20 articles and twelve articles were excluded based on title and abstract. Hence, 9 articles were read completely for eligibility. After exclusion of 2 irrelevant studies, seven articles were included. Mostly RCT’s, all are human studies. Conclusion: Herbal mouthwashes like Piper Betel mouthwash can be used as an adjunct to various oral hygiene practices like tooth brushing, flossing. Its proven that they have effective anti-inflammatory, anti-plaque properties and hence can be used in supportive periodontal therapy. It does not contain alcohol, artificial preservatives, flavours or colours. Hence Piper Betel based mouthwashes can be considered an alternative to chemical mouthwashes in sustaining oral hygiene, especially because of the added advantages provided by herbal preparations.*

Key Words: *Herbal mouthwash, Plaque- induced gingivitis, Piper Betel*

1. INTRODUCTION:

Mouthwash is an aqueous solution which is most often used for control of plaque and is a medicated liquid which is held in the mouth and swished by the action of perioral musculature to eliminate the oral pathogens. Amid growing evidence of the connection between oral health and whole-body health, herbal medicines with their ‘naturally occurring’ active ingredients offer a gentle and enduring way for restoration of health by the foremost trustworthy and least harmful way. Herbal medicine is promotive and preventive in its approach. They are not reported with side-effects till date. They do not contain alcohol and/or sugar. The herbal extracts have anti- inflammatory effect. They have been used as an adjunct to other oral hygiene measures such as brushing and flossing.

Plaque-induced gingivitis is a highly prevalent periodontal disease that is frequently encountered in the daily dental practice. As we all know, it develops due to accumulation of microbial biofilms on the surface of teeth, and poor or inadequate oral hygiene is the chief predisposing factor. Treatment plan for plaque-induced gingivitis aims at prevention and control of plaque accumulation by a variety of methods that improve oral hygiene. These include mechanical elimination of dental plaque by tooth brushing, dental floss, tooth cleaning stick, oral irrigators, and professional scaling and polishing. Use of antimicrobial mouthwash in conjunction with mechanical oral hygiene methods is highly recommended. [8][9][10]

2. MATERIALS AND METHODS:

2.1 Focused Question:

According to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, a focused question was constructed based on the Participants, Interventions, Control, Outcomes (PICO) principle

The focused question was: Is Piper Betel herbal mouthwash effective as an anti-plaque or anti gingivitis agent on comparison with chemical mouthwashes?

2.2 Criteria for selection of studies:

Inclusion criteria:

(1)Original studies published in the English language, (2)Randomized Control trials, (3)Intervention: Efficacy of Piper Betel Herbal mouthwash as an anti-gingivitis and anti-plaque agent.

Exclusion criteria:

1) historic reviews, (2) letters to the editor, (3) case series and reports.

2.3 Search Methodology:

An electronic search was carried out using the key words Herbal mouthwash, plaque- induced gingivitis, Piper Betel via PubMed/Medline, ISI Web of Science and Google Scholar databases for relevant articles published from 2014 to 2019. The titles and abstracts found were read independently by two authors. The references in the potentially relevant articles

were read by both the authors to find additional studies which the authors checked agreement via discussion.

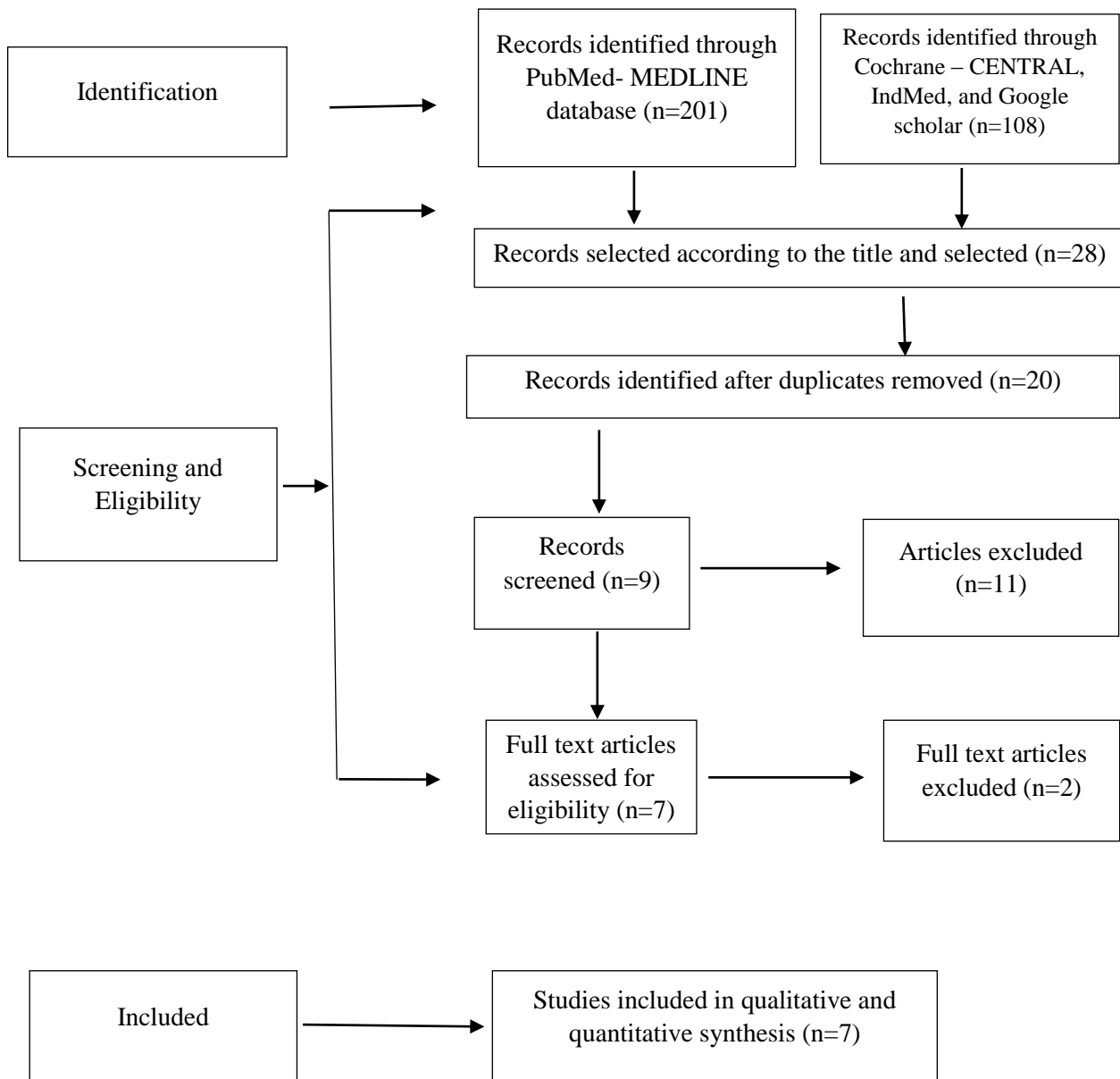


Table 1: Characteristics features of Human studies

Author, year, country	Study Design	Age Group (years)	Population (Sample Size)	Duration (days)	Intervention	Outcome

Shivanand Aspalli, 2019, India	RCT	20-45	100	21	Scaling alone	Piper Betel Herbal mouthwash is effective in treatment of plaque induced gingivitis and used effectively as an adjunct to mechanical therapy with lesser side- effects.
					Scaling and use of herbal mouthwash	
Syed Saima, 2019, India	RCT	20-45	100	21	Group A Scaling Alone	Piper Betel Herbal mouthwash was effective in treatment of plaque induced gingivitis in group B than group A.
					Group B Scaling along with herbal mouthwash	
Jaiganesh Ramamurth,201 8, India	RCT	NA	30	15	Chlorhexidin e Gluconate	Piper Betel Herbal mouthwash and chlorhexidin e were equally
					Herbal Mouthwash	

						effective in treatment of gingivitis.
Rahul Gupta, 2017, India	RCT (crossover)	8-16	72	NA	Herbal Mouthwash	Chlorhexidine is effective in reducing dental plaque than other mouth washes.
					Chlorhexidine	
					10% Terminalia chebula	
Sanjeet Gill, 2017, India	Clinical study (crossover)	18-25	30	NA	Group A (hiora & listerine)	Piper Betel Herbal mouthwash was found to be a potent plaque inhibitor compared to those of Listerine mouthwash.
					Group B (hiora & listerine)	
Manjiri Abhay Deshmukh,2017 , India	RCT	18-21	45	14	Herbal Mouthwash	Piper Betel Herbal and probiotic mouthwash can prove to be effective alternative to chlorhexidine with minimal side
					0.2% chlorhexidine	
					Probiotic	

						effects.
Nagesh Bhatt,2014, India.	Double- blinded RCT	18-24	66	30	Herbal mouthwash	The efficacy of Piper Betel herbal mouthwash was equally effective in reducing plaque and gingivitis s compaed to chlorhexidin e mouthash and may be considered as a good alternative.
					0.2% chlorhexidin e	
					0.05% saline	

Table 2: Mean changes and clinical parameters reports by selected studies.

Author, country	year,	Duratio n	Intervention	Interva l	PI	GI	BI
Shivanand Aspalli,		21	Scaling alone	Day 0	1.698±0.37	1.798±0.34	N

2019, India.					3	A
			Day 21	1.132±0.35	0.896±0.311	N A
		Scaling and use of herbal mouthwash	Day 0	1.643±0.41	1.84±0.28	N A
			Day 21	0.66±0.216	0.724±0.24	N A
Jaiganesh Ramamurth,2018, India	15	Chlorhexidine Gluconate	Baseline	2.1167	1.3567	N A
			After 15 days	1.5333	1.1673	N A
		Herbal Mouthwash	Baseline	1.8833	1.4213	N A
			After 15 days	1.6167	1.3053	N A
Rahul Gupta, 2017, India	15	Herbal Mouthwash	<u>Phase 1</u>	1.12±0.34	NA	N A
			Baseline			
			After 10 days	0.76±0.36	NA	N A
			<u>Phase 2</u>	0.54±0.20	NA	N A
			Baseline			
			After 10 days	0.41±0.18	NA	N A
			<u>Phase 3</u>	0.48±0.09	NA	N A
		Baseline				
After 10 days	0.27±0.05	NA	N A			
		Chlorhexidine	<u>Phase 1</u>	0.50±0.17	NA	N A
			Baseline			

			After 10 days	1.23±0.44	NA	N A
			<u>Phase 2</u> Baseline	1.23±0.44	NA	N A
			After 10 days	0.57±0.32	NA	N A
			<u>Phase 3</u> Baseline	0.76±0.29	NA	N A
			After 10 days	0.44±0.19	NA	N A
		10% Terminaal chebula	<u>Phase 1</u> Baseline	0.88±0.35	NA	N A
			After 10 days	0.52±0.20	NA	N A
			<u>Phase 2</u> Baseline	0.49±0.15	NA	N A
			After 10 days	0.30±0.06	NA	N A
			<u>Phase 3</u> Baseline	0.99±0.46	NA	N A
			After 10 days	0.65±0.35	NA	N A
Sanjeet Gill, 2017, India	NA		Group A	Hiora	1.22±0.28	NA
		Listerin		1.26±0.34	NA	N A
		Group B	Hiora	1.12±0.08	NA	N A

			Listerine	1.11±0.28	NA	NA		
Manjiri Abhay Deshmukh, 2017, India	14	Herbal Mouthwash	Day 0	0	0.15±0.05	NA		
			Day 7	0.05±0.02	0.05±0.02	NA		
			Day 14	0.04±0.01	0.03±0.01	NA		
		0.2% chlorhexidine	Day 0	0	0.19±0.09	NA		
			Day 7	0.06±0.03	0.06±0.3	NA		
			Day 14	0.04±0.07	0.04±0.02	NA		
		Probiotic	Day 0	0	0.18±0.11	NA		
			Day 7	0.07±0.02	0.07±0.02	NA		
			Day 14	0.04±0.06	0.04±0.09	NA		
		Nagesh Bhatt, 2014, India.	30	Herbal mouthwash	Baseline	1.5±0.32	0.62±0.52	NA
					After 1 month	1.23	0.68	NA
				0.2% chlorhexidine	Baseline	1.22±0.25	0.77±0.43	NA
After 1 month	1.07				0.42	NA		
0.05% saline	Baseline			1.34±0.48	0.91±0.84	NA		
	After 1 month			3.0	2.4	NA		

3. RESULTS:

3.1 Search Results:

Following the removal of the duplicate search results, the primary search resulted in 20 articles in total. Two articles were excluded based on title and abstract. Hence, remaining eight articles were read completely for eligibility. After exclusion of another two irrelevant studies, seven studies ([Shivanand Aspalli 2019](#), [Syed Saima 2019](#), [Jaiganesh Ramamurthy 2018](#), [Rahul Gupta 2017](#), [Sanjeet Gill 2017](#), [Manjiri Abhay Deshmukh 2017](#), [Nagesh Bhatt 2014](#)) were included in the study.

3.2 Human studies:

All the studies were randomized control trials (RCT) ([Shivanand Aspalli 2019](#), [Syed Saima 2019](#), [Jaiganesh Ramamurthy 2018](#), [Rahul Gupta 2017](#), [Sanjeet Gill 2017](#), [Manjiri Abhay Deshmukh 2017](#), [Nagesh Bhatt 2014](#)). The sample ranged from 30-100. The age of the patients ranged from 8-45 years ([Shivanand Aspalli 2019](#), [Syed Saima 2019](#), [Jaiganesh Ramamurthy 2018](#), [Rahul Gupta 2017](#), [Sanjeet Gill 2017](#), [Manjiri Abhay Deshmukh 2017](#), [Nagesh Bhatt 2014](#)). In all the studies Piper Betel herbal mouthwash is used in comparison to other chemical mouthwashes. In **first study** ([Shivanand Aspalli 2019](#)) Group A patients were treated by scaling alone without the use of herbal mouthwash, Group B patients were treated by scaling along with Piper Betel herbal mouthwash. In **second study** ([Syed Saima 2019](#)) Group A patients were treated by scaling alone without the use of herbal mouthwash, Group B patients were treated by scaling along with the usage of Piper Betel herbal mouthwash. In **third study** ([Jaiganesh Ramamurthy 2018](#)) Group A patients were asked to use 10ml of chlorhexidine gluconate mouthwash twice daily in the interval of 12h for 15 days and instruction was given not to rinse their mouth for 30mins, Group B patients were prescribed to use 10ml of Piper Betel herbal mouthwash twice daily in the interval of 12h for 15 days, and instruction was given not to rinse their mouth for 30mins. In **fourth study** ([Rahul Gupta 2017](#)) the total sample was divided into three groups of 24 subjects in each group for use of three different mouthwashes during the three different phases of crossover study. In **fifth study** ([Sanjeet Gill 2017](#)) Group A was given Listerine mouthwash first and then Piper Betel herbal mouthwash, Group B was given Piper Betel herbal mouthwash first and then Listerine mouthwash with a washout period of 15 days between the use of two mouthwash. In **sixth study** ([Manjiri Abhay Deshmukh 2017](#)) Group A rinsed with 15ml of Piper Betel Herbal

mouthwash for 60 seconds twice daily for 30 mins after brushing for 14 days and then spit it, Group B rinsed with 10 ml hexidine mouthwash for 60 seconds twice daily 30 mins after toothbrushing for 14 days and then spit it, Group C rinsed with Darolac (probiotic) sachets dissolved in 20 ml of water for 60 seconds twice daily 30 minutes after toothbrushing for 14 days and then swallowed it. In **seventh study** (Nagesh Bhatt 2014) Group A, Group B, Group C rinsed 10 ml Piper Betel herbal mouthwash, chlorhexidine mouthwash and normal saline respectively for 1 min carried out twice a day after toothbrushing for a period of 4 weeks.

3.3 Assessment of parameters:

(Shivanand Aspalli 2019, Syed Saima 2019, Jaiganesh Ramamurthy 2018, Rahul Gupta 2017, Sanjeet Gill 2017, Manjiri Abhay Deshmukh 2017, Nagesh Bhatt 2014). In the **first study** (Shivanand Aspalli 2019), clinical parameters like Plaque Index (PI), Gingival Index (GI), Gingival Bleeding Index (BI) are assessed on day 0 and day 21. In the **second study** (Syed Saima 2019), clinical parameters like Plaque Index (PI), Gingival Index (GI), Gingival Bleeding Index (BI) are assessed on day 0 and day 21. In the **third study** (Jaiganesh Ramamurthy 2018), clinical parameters Plaque Index (PI), Gingival Index (GI) are assessed on day 0 and day 15. In the **fourth study** (Rahul Gupta 2017), clinical parameter Modified Plaque Index (PI) are assessed every 10 days in three phases. In the **fifth day** (Sanjeet Gill 2017), Plaque Score (PI) was recorded every day for 10 days. In the **sixth day** (Manjiri Abhay Deshmukh 2017), the clinical parameters OHI-S, Plaque Index (PI), and Gingival Index (GI) are recorded on baseline, 7th day and 14th day. In the **seventh day** (Nagesh Bhatt 2014), clinical parameters Plaque Index (PI) and Gingival Index (GI) were recorded at baseline and after 1 month.

3.4 Outcome of studies:

(Shivanand Aspalli 2019, Syed Saima 2019, Jaiganesh Ramamurthy 2018, Rahul Gupta 2017, Sanjeet Gill 2017, Manjiri Abhay Deshmukh 2017, Nagesh Bhatt 2014). In this study (Shivanand Aspalli 2019) there was a significant greater reduction in plaque, gingival and bleeding index scores from baseline in group B compared with the group A. In the study (Syed Saima 2019) there is significant reduction in plaque scores, gingival scores, bleeding index scores in both group A and group B after scaling. But a greater reduction in plaque scores, gingival scores and bleeding index scores were seen in group B compared with group A. In the study (Jaiganesh Ramamurthy 2018) the mean values of GI and PI were found to be significantly lower than the pre-operative mean values. At the end of 15 days, almost

comparable reduction in amount of plaque and gingivitis was found in group A and group B. In the study ([Rahul Gupta 2017](#)) the a significant redction in plaque scores from baseline to phase 1, 2 and 3 in both chlorhexidine and piper Betel mouthwash.. In the study ([Sanjeet Gill 2017](#)) between the two groups the plaque scores in phase 1 and phase 2 comparable results in plaque reduction. The study ([Manjiri Abhay Deshmukh 2017](#)) shows comparison of mean values of variable between three groups. ANOVA test showed that there was no significant difference d=in the effect of the three mouthwashes on plaque accumulation, gingival health, and oral hygiene status except the mean values of GI between groups A, B and C at day seven ($p < 0.05$). In the study ([Nagesh Bhatt 2014](#)) there was a significant difference reduction in the plaque and gingival indices from baseline values. But there is no stastically significant difference between the mouthwashes compared.

4. DISCUSSION:

([Shivanand Aspalli 2019](#), [Syed Saima 2019](#), [Jaiganesh Ramamurthy 2018](#), [Rahul Gupta 2017](#), [Sanjeet Gill 2017](#), [Manjiri Abhay Deshmukh 2017](#), [Nagesh Bhatt 2014](#)). In study ([Shivanand Aspalli 2019](#)) showed results that the ingredients in the Piper Betel herbal oral rinse were effective in controlling plaque and gingivitis. In study ([Syed Saima 2019](#)) showed that the Piper Betel herbal mouthwash was effective in plaque and gingivitis. In study ([Jaiganesh Ramamurthy 2018](#)) showed that Piper Betel herbal mouthwash and Chlorhexidine mouthwashes were equally effective in the treatment of gingivitis. In study ([Rahul Gupta 2017](#)) showed that chlorhexidine was more effective in reducing dental plaque compared to other mouthwashes. In the study ([Sanjeet Gill 2017](#)) concluded that Piper Betel herbal mouthwash was found to be potent plaque inhibitor, yielding results comparable to those of Listerine mouthwash. In the study ([Manjiri Abhay Deshmukh 2017](#)) showed that Piper Betel herbal mouthwash and probiotic mouthwashes can prove to be effective alternative to chlorhexidine with minimal side effects. In the study ([Nagesh Bhatt 2014](#)) showed that the efficacy of Piper Betel herbal mouthwash was equally effective in reducing plaque and gingivitis as compared to chlorhexidine mouthwash and may be considered as a good alternative.

5. LIMITATIONS:

Although the major databases were used for the literature search, articles might have missed because they might not be listed in these sources. The present review includes articles published in English language, which may have excluded potentially valuable evidence. Most

of the studies didn't provide any information on sample size calculation. The patients are likely to change their behaviour because of their participation in a research project. Initial prophylaxis may have contributed partly to the general reduction of all clinical parameters and hence it cannot be solely concluded that the product investigated is beneficial in reducing plaque and gingivitis. Varied indices were used for dental plaque and gingivitis and the duration for evaluation was not uniform for included studies ^[11].

6. CONCLUSION:

Herbal mouthwash is a potent inhibitor of plaque and gingivitis. It has minimal side effects and does not contain alcohol, artificial preservatives, flavours or colours and it does not stain the teeth. Though chlorhexidine is considered the gold standard, it has various side effects like brown staining of teeth, burning sensation of the mouth due to alcohol content, dryness of mouth on long term use. All these give way for the herbal mouthwash an effective alternative to chemical mouthwashes by overcoming the side effects. Hence Piper betel herbal mouthwashes can be considered an alternative to chemical mouthwashes in maintain oral hygiene, due to the added advantages of such herbal preparations.

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