

A Systematic Review on the Efficacy of Aloe Vera Mouthwash on Periodontal Health

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Abstract:

Background: As nowadays most of the microorganisms are drugresistant the periodontal health of individuals is affected. So as an alternative treatment modality, Aloe Vera, which has high medicinal properties, can be used for treating periodontal diseases.

Aim: To evaluate the efficacy of aloe Vera mouthwash in improving periodontal health.

Methodology: A literature review was performed using Pub Med, science direct, Medline, Cochrane, Scopus using keyword aloe Vera mouthwash and periodontal health. A total of 262 articles from various sources; 5 articles were related to research topics. The review is reported according to the PRISMA guideline.

Results and conclusion: In the available literature, aloe Vera mouthwash is equally effective and can be an alternative to the gold standard chlorhexidine in maintaining periodontal health.

Keywords: Aloe Vera mouthwash, Periodontal health

INTRODUCTION:

Nowadays use of antibiotics causes increase resistant to bacteria. In oral cavity, periodontal disease is most common. Periodontal diseases are initiated and sustained by microbial plaque that accumulates in the gingival crevicular region and causes inflammatory actions^[1]. Microorganism such as Streptococcus, Actinomyces, veillonella, Fusobacterium, Porphyromonas, etc. are responsible for initial plaque formation. These bacterias are mostly acidogenic in nature. So, plaque accumulation causes inflammation of gingiva. So, plaque control is the basis for prevention of oral diseases such as gingivitis, periodontitis, dental caries etc. For effective plaque control, several mechanical oral hygiene aids, as well as a number of anti-plaque agents, are used^[2]. Mechanical plaque control such as supragingival and subgingival scaling and root planing is the most effective process. Mouthwashes are generally considered as an addition to oral hygiene. chlorhexidine is a gold standard in preventing dental plaque^[3]. It is biguanide which causes the destruction of the inner cytoplasmic membrane of microorganisms. It is a broad-spectrum antibiotic act against microorganisms such as gram positive, gram negative, yeast, dermatophytes etc.

Aloe Vera is a medicinal plant. Aloe Vera (synonym: Aloe barbadensis Miller) belongs to the Liliaceae family. It contains about 360 species. Aloe Vera is a cactus-like plant that grows best in hot, dry climates^[4]. Aloe Vera is very complex. It is consisting of different ingredients including minerals (Sodium, potassium, calcium, magnesium, manganese, copper, zinc, chromium and iron), enzymes (eg. amylase, lipase, carboxypeptidase) sugars, anthraquinones their derivatives (Barbaloin, aloe-emodin-9-anthrone, Isobarbaloin, Anthrone-C-glycosides and chromones), lignin, saponins, sterols, amino acids and salicylic acid^[5,6]. A vast literature has mentioned its use worldwide like in Egypt, South Africa, India, China, Mexico and Japan for various ailments like burns, hair

loss, skin infections, hemorrhoids, sinusitis, and gastrointestinal (GI) pain. It is also a wound healer for bruises, X-ray burns, insect bites; and antihelminthics, somatics, anti-arthritis. Aloe vera has been used for various skin conditions, including radiodermatitis, frostbite, psoriasis and genital herpes infection. Its pharmacological actions include anti-inflammatory, antibacterial, antioxidant, antiviral and antifungal actions^[7]. It contains carboxypeptidase which inactivates bradykinin and prevents vasodilation and produces anti-inflammatory effect^[6]. It is also effective in controlling bacteria that causes plaque and cavity in the oral cavity.

As nowadays bacterias are becoming antibiotic resistant different types of medicinal plants are being used for their antimicrobial property. Considering the wide antimicrobial property of aloe vera in periodontal health, this study aimed to do a review on the efficacy of aloe Vera mouthwash on periodontal health.

MATERIALS AND METHOD:

Objective of the studies:

To evaluate the efficacy of aloe Vera mouthwash on improving periodontal health.

Study design:

A systematic review of randomized control trials done on the efficiency of aloe Vera mouthwash on periodontal health.

Search strategy:

The following electronic databases were used to find articles on aloe Vera mouthwash and plaque efficacy, PubMed, Medline, ScienceDirect, Scopus, Cochrane. Each database was searched to obtain the article using Mesh representation.

Inclusion criteria:

1. Original articles related to research.
2. Articles emphasizing on the efficacy of aloe Vera mouthwash on periodontal health.
3. Randomized control trial.

Exclusion criteria:

1. Studies that are not emphasizing on periodontal health
2. Studies that are not emphasizing on other products of aloe Vera other than mouthwash.
3. Review articles
4. Articles which doesn't have full text
5. In vitro studies.

Search engine:

1. Medline
2. PubMed
3. Cochrane library
4. Science direct
5. Scopus.

RESULT:

The search yielded 231 records, and 20 full text articles are independently assessed. Among these potentially eligible articles, 6 were included.

Figure 1 shows the flow diagram of the report that was identified, screened, assessed for eligibility excluded and included in the review. It shows that total 231 articles were

yielded by searching different databases. After removing duplicates and others a total of 5 full text articles fulfilling the inclusion criteria were included in the study

Table 1 shows the review of articles on the efficacy of aloe Vera mouthwash in periodontal health. It shows interventions in all 5 studies included. 100% aloe juice has been used, Nair, A.A. and Malaiappan, S.^[10], Karim, B. et al^[9] in 2014 and 2016 respectively. 99% aloe juice is used by Vangipuram, S., Jha, A. and Bhashyam, Mand^[5] in 2016 and 99.6% aloe juice is used by Chhina, S et al^[8], and all in 2018. All the above quantities have shown positive outcome. The results are discussed below.

Table 2 shows the review of articles on efficacy of aloe Vera mouthwash in periodontal health. It shows the results yielded in all the five studies. Studies by, Vangipuram, S., Jha, A. and Bhashyam, M^[5], Chhina, S et al^[8], Karim, B. et al^[9] and Nair, A.A. and Malaiappan, S.^[10] shows that Aloe Vera mouthwash shows mouthwash. But study by Yeturu, S.K., Acharya, S., Urala, A.S. and Pentapati, K.C.^[11] shows plaque reduction is higher in chlorhexidine group when compared to aloe Vera mouthwash.

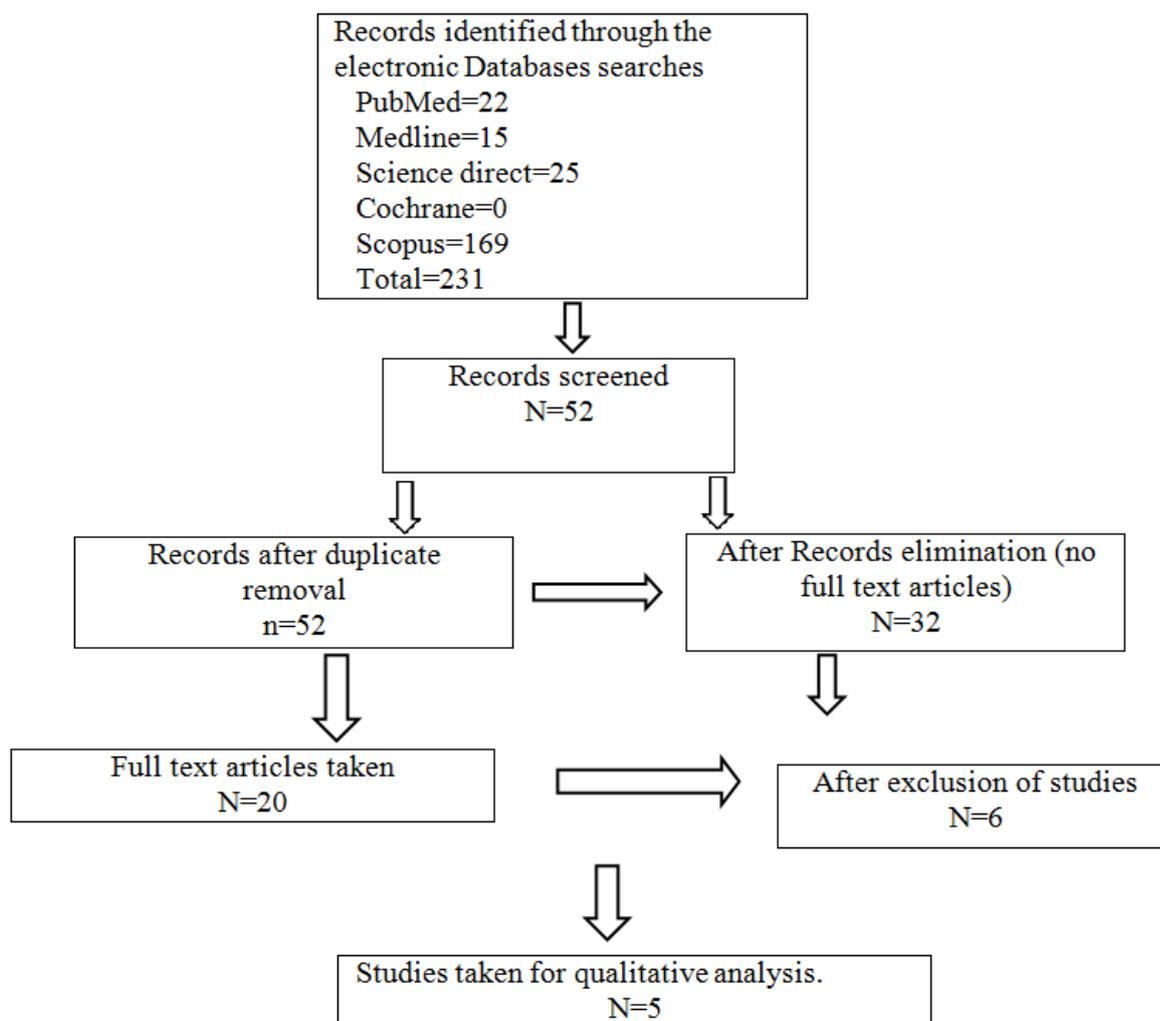


FIGURE 1: FLOW DIAGRAM SHOWING THE NUMBER OF STUDIES IDENTIFIED, SCREENED, ASSESSED FOR ELIGIBILITY, EXCLUDED AND INCLUDED IN SYSTEMATIC REVIEW

TABLE 1: CHARACTERISTICS OF INTERVENTIONS IN THE STUDY

AUTHOR NAME	YEAR	PATIENT SELECTION	PREPARATION	INTERVENTION
Vangipuram, S et al ^[5]	2016	390 Males-180 Females-210	Aloe Vera mouthwash consisted of 99% aloe juice, 0.2% preservative, 0.001% Spearmint flavor, and sweetened with sorbitol.	<ul style="list-style-type: none"> Aloe Vera mouthwash=130 Chlorhexidine mouthwash=130 Placebo=130
Chhina, S et al ^[8]	2018	90 Male-45 Female-45	Aloe Vera mouthwash containing 10 ml 99.6% (w/v) aloe Vera juice, 0.02% (w/v) citric acid crystal, 0.02% (w/v) sodium benzoate crystal (preservative), orange flavor.	<ul style="list-style-type: none"> Aloe Vera mouthwash=30 2% chlorhexidine gluconate mouthwash=30 Placebo=30
Karim, B. et al ^[9]	2014	345	100% concentration of aloe Vera juice	<ul style="list-style-type: none"> Aloe Vera mouthwash=115 Chlorhexidine mouthwash=115 Placebo=115
Nair, A.A et al ^[10]	2016	90	100% concentration of aloe Vera juice diluted with water	<ul style="list-style-type: none"> Group A:30 =aloe Vera mouthwash Group B:30=chlorhexidine mouth wash Group C:30=normal saline mouth wash
Yeturu, S.K et al ^[11]	2015	85	10ml twice daily for 1 minute for 15days	<ul style="list-style-type: none"> Aloe Vera mouthwash=30 Chlorine dioxide mouthwash=30 Chlorhexidine mouthwash=25

TABLE 2: CHARACTERISTICS OF THE OUTCOME AND RESULTS

AUTHOR NAME	YEAR	PRIMARY OUTCOME	RESULT	P-VALUE
Vangipuram, S., Jha, A. and Bhashyam, M ^[5]	2016	Both aloe Vera and chlorhexidine mouthwash shows Significant reduction in plaque and gingival index but a decrease in score of aloe Vera mouthwash and chlorhexidine mouthwash shows no significant difference. But aloe Vera mouthwash and placebo and chlorhexidine mouthwash and placebo show a significant difference.	Aloe vera mouthwash and chlorhexidine mouthwash shows equal effectiveness.	<0.05
Chhina, S et al ^[8]	2018	The aloe Vera mouthwash(test) and the chlorhexidine gluconate mouthwash(control)shows no significant difference and plaque score. Whereas the placebo group and chlorhexidine group show a significant difference in plaque score.	Aloe Vera mouthwash has an efficacy which is comparable to chlorhexidine gluconate mouthwash.	0.05
Karim, B. et al ^[9]	2014	There was a statistically significant decrease in the plaque and gingivitis in both the Aloe vera and chlorhexidine groups. There was a progressive decrease in the plaque and gingivitis score at 5% level of significance. Chlorhexidine group showed maximum decrease as compared to Aloe vera group but the difference was not statistically significant. But chlorhexidine mouth wash and placebo and aloe vera mouthwash and placebo shows a significant difference	Aloe vera mouthwash is equally efficient as chlorhexidine mouthwash	0.05
Nair, A.A. and Malaiappan, S. ^[10]	2016	The highest percentage of reduction in plaque score and gingival score was found in chlorhexidine mouthwash group followed by Aloe Vera and then placebo group shows the least reduction.	Aloe Vera mouthwash is a suitable and economic alternative for chlorhexidine mouthwash.	0.007
Yeturu, S.K et al ^[11]	2015	There was a significant reduction in plaque and gingival score in all three groups when compared to the base line.	A significantly higher reduction of plaque and gingival score in chlorhexidine when compared with Aloe Vera.	<0.005

TABLE 3: ASSESSMENT OF RISK OF BIAS IN THE INCLUDED STUDIES

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data addressed (attrition bias)	Selective reporting (reporting bias)	Diagnosis reliability (misclassification bias)	Baseline balance (selection bias)
Vangipuram, S. et al ^[5]	-	-	+	+	+	-	?	+
Chhina, S et al ^[8]	+	-	-	+	+	-	+	+
Karim, B. et al ^[9]	+	-	+	+	+	-	?	+
Nair, A.A. et al ^[10]	-	-	?	?	+	+	-	-
Yeturu, S.K. et al ^[11]	+	-	+	-	+	-	+	-

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

DISCUSSION:

Periodontal health can be maintained by proper brushing, flossing, regular scaling and with use of mouthwash. Mouthwashes are medicated solution which is kept in oral cavity and swished to eliminate microorganisms.^[12] The gold standard mouthwash used in everyday life is chlorhexidine. As it has a wide microbial spectrum is causes the effective reduction of plaque in oral cavity. There are other synthetic mouthwashes along with chlorhexidine.

Recently commercially available mouthwashes have side effects like toxicity, tooth staining, hypersensitivity reaction .so medicinal plant like aloe Vera which contains phytochemicals can be used as alternative to the synthetic mouthwash to avoid such adverse effect.^[7] has two types of action in relation to oral cavity. It has antimicrobial properties as it contains lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenols and sulfur which causes destruction and prevention of bacteria, viruses and fungal organisms. Another one is the anti-inflammatory property. It causes inhibition of the cyclooxygenase pathway and also causes the reduction in prostaglandin E2 production from arachidonic acids which causes decrease in inflammation.^[13]

Vangipuram, S., Jha, A. and Bhashyam, M^[5] conducted a study which is triple blinded randomized control study. The experiment was done to compare the efficacy of aloe Vera and chlorhexidine mouthwash on periodontal health. In this study 390 dental students are taken in which 210 are female and 180 are male. The average age of participants was 23. All participants used toothbrush and tooth paste as the main method for oral hygiene maintenance, while only 105 used other methods such as dental floss or mouth wash in past. The study was conducted for 30 days .participants are divided in the into 3 groups with 130 participants in each group. Group 1 was given aloe Vera mouthwash, group 2 was given chlorhexidine and group 3 was placebo and were instructed to use 10ml twice a day for 30 days. The composition of aloe Vera juice given to study participants is 99% aloe juice, 0.2% preservative, 0.001% Spearmint flavor, and sweetened with sorbitol. The placebo solution

and the control were taste matched, with identical consistency. The plaque index and gingival index were taken for each participant at baseline, and after 15 days and 30 days. There was no significant difference in the baseline for Aloe Vera and chlorhexidine mouthwash. But there was a highly significant difference in both plaque and gingival index for Aloe Vera and chlorhexidine mouthwash in 15 days and 30 days. But there is no significant difference in the gingival and plaque score between Aloe Vera and chlorhexidine mouthwash. But the difference in score between placebo and chlorhexidine and placebo and aloe Vera mouthwash was significant. hence aloe Vera mouthwash and chlorhexidine mouthwash is equally effective. Aloe Vera is an effective antibacterial agent which is significant in preventing organisms which can affect periodontal health.^[14]

In Chhina, S et al^[8], the study is singleblinded randomized parallel controlled clinical trial. The experiment is done to compare the effect of Aloe Vera mouthwash and 0.2% chlorhexidine gluconate mouthwash on de novo plaque formation. 90 individuals are taken for this study in which 45 are male and 45 are female participants. 90 individuals are divided into 3 groups where there are 30 individuals in each group. 3 groups are divided to use aloe Vera mouthwash, 0.2% chlorhexidine gluconate mouthwash and flavored distilled water. Participants are instructed to do regular tooth brushing or flossing and mouthwash for 4 days. Each bottle contains 150ml solution of mouthwash and instructed to use 10 ml solution everyday two times for one minute. Each 10 ml contains 99.6% (w/v) Aloe Vera juice 0.02% (w/v) citric acid crystal, .02% (w/v) sodium benzoate crystal (preservative), orange flavour. The plaque score was taken before and after the experiment. The score shows that there is a significant reduction in plaque in individuals who used chlorhexidine and aloe Vera mouthwash but there is no significant difference in plaque score between aloe vera and chlorhexidine group. There is not much reduction in plaque for placebo group. It can be concluded that aloe vera and chlorhexidine both have equal effectiveness in maintaining oral hygiene. Due to the ill effect of synthetic products, there is increased demand for the alternative

product. The phytochemicals present in Aloe Vera has been proven better than synthetic medicine. ^[15,16] As chlorhexidine has some side effects, Aloe Vera can mouthwash can be an alternative as it has equal efficacy as 0.2% chlorhexidine gluconate solution.

Karim, B. et al^[9] conducted a study to compare the efficiency of aloe Vera mouthwash with chlorhexidine mouthwash, which is a triple blinded randomized control study. A total of 1785 undergraduate university student was taken. Among that 345 students are taken after fulfilling exclusion and inclusion criteria. Total of 345 students was divided into 3 groups. Each group had 115 subjects. Group 1 was given aloe vera mouthwash and were instructed to use 10 ml twice a day for 30 days. Group 2 was given chlorhexidine mouthwash and instructed to use 10 ml twice a day for 30 days and group 3 is placebo and are instructed to use distilled water 10 ml twice a day for 30 days after breakfast and lunch. Aloe Vera mouthwash consists of 99% aloe juice, 0.2% preservative, 0.001% lemon-lime flavor, and sweetened with sorbitol. Placebo and chlorhexidine solution also made of same consistency and astringency as aloe Vera mouthwash to blind the participants. the investigator/examiner, assistants, data analyzer were also unaware of the allocation and randomization of the study. The gingival index and plaque index were taken at baseline, 15th day and 30th day. All the participants followed the same oral hygiene practice with the same toothbrush and fluoride whitening toothpaste given to all the participant along with the mouthwashes allocated for each group. This was done in order to lessen the risk of bias. The result shows there was risk difference in plaque and gingival index at baseline as no oral prophylaxis was given. At 15th day and 30th day, there was a significant reduction in plaque and gingival score in Aloe Vera and chlorhexidine group at the level of 5% significant. Chlorhexidine group shows the maximum reduction in plaque and gingival score but the difference of plaque and gingival score between Aloe Vera and chlorhexidine was not significant. Whereas the score between placebo and Aloe Vera and placebo and chlorhexidine was significant. So the result shows the plaque control efficacy of aloe Vera mouth was is nearly similar to the control group that is chlorhexidine. Although chlorhexidine or other synthetic chemicals are widely used as a mouthwash due to wide antibacterial spectrum. But these synthetic chemicals have side effects like hypersensitivity, toxicity, staining etc. chlorhexidine has cytotoxic effect to the periodontal ligament and it affects the activity of mitochondria. It also inhibits protein synthesis. Aloe Vera activates polymorphonuclear cells which inhibits the production of free oxygen radicals which stops gum bleeding and relieves swelling. It also has antifungal action. ^[17] Vitamin c in aloe vera causes an increase in collagen synthesis and increases the oxygen concentration in dilated blood vessels in the inflamed site. So aloe Vera can be used as a herbal mouthwash with a similar effect as chlorhexidine.

Nair, A.A. and Malaiappan, S. ^[10], et al conducted a study to compare the efficacy of aloe Vera mouthwash

chlorhexidine and distilled water on periodontal health. The study was done with the patients who were reported in the college outpatient clinic. Participants were taken randomly after fulfilling the exclusion inclusion criteria. A total of 90 participants were included in this study and the age ranges from 18 to 70 years. Participants were divided randomly into 3 groups where 1st groups were given with aloe vera mouthwash, 2nd group was given with chlorhexidine and the 3rd group was given with saline and were instructed to use their respective mouthwashes daily for 30 days. The composition of aloe Vera mouthwash is commercially available pure Aloe Vera drink which is diluted water. Participants were provided with oral prophylaxis and oral hygiene instruction along with 300 ml of mouth rinse and were instructed to use 10ml twice daily for 30 days. Plaque and gingival index were taken at baseline, 15th day and 30th day. The highest percentage of reduction is shown in chlorhexidine (67%) followed by aloe Vera mouthwash (66%) and placebo (55%). In this study, there is no significant difference in the plaque and gingival score between Aloe Vera and chlorhexidine group. But both the group showed a significant difference when compared to the placebo group. so aloe Vera can be used as an alternative to chlorhexidine and it is low cost and easily available. It also has minimal side effects.

Yeturu, S.K., Acharya, S., Urala, A.S. and Pentapati, K.C. ^[11] conducted a study which is single centered single-blinded randomized control trial. The study was done with individuals who are undergoing orthodontic treatment and has fixed appliances for more than 3 months. Study subjects should have more visible plaque and gingivitis in more than 30% of the teeth. After screen 150 individuals 90 subjects were included in the study. participants were randomly allocated in 3 groups that are Aloe Vera, chlorhexidine and chlorine dioxide and were instructed use 10ml twice daily for 1 minute for 15 days. Plaque and gingival index were taken at baseline and on the 15th day. The result shows a less significant difference in plaque and gingival score between Aloe Vera and chlorhexidine but no significant difference in the score of chlorhexidine and chlorine dioxide. Hence it can be said that chlorine dioxide and Aloe Vera can be alternative to the gold standard chlorhexidine mouthwash.

Almost all of the above studies show that Aloe Vera has a nearly equal efficacy of plaque control in periodontal health when compared to the gold standard chlorhexidine mouthwash.

CONCLUSION:

The studies done to compare the efficacy of Aloe Vera and chlorhexidine mouthwash shows that Aloe vera has a significant reduction in the plaque and gingival score which is comparable to chlorhexidine mouthwash. Though chlorhexidine has slightly higher reduction than aloe Vera mouthwash but the difference is not significant. Chlorhexidine being a synthetic chemical it produces hypersensitivity and toxic effects in individuals. But aloe Vera being an organic product its less harmful. It is low in cost and easily available. So it can be concluded that Aloe vera mouthwash is a suitable alternative to the gold

standard chlorhexidine mouthwash for maintaining periodontal health.

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