The Role of Herbs in Influencing Periodontal Health: A Systematic Review

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ABSTRACT
Background: Herbal formulations have received attention in the recent past owing to its anti-inflammatory, antimicrobial and anti-oxidative effects. They can be either used alone or as a mixture in the form of dentifrices or mouth rinses. The current review aimed to assess the effectiveness and safety of various herbal formulations on gingival health.
Materials and Methods: Total 18 articles were used for data extraction; all of them were randomised controlled trials which were searched from Pubmed / Scopus published from 2001 to 2019.
Results: All the studies included showed that the herbal formulation used were effective in controlling plaque and gingivitis.
Conclusion: Herbs prove to be promising in improving oral health, either when used alone or in combination.
Keywords: Herbal formulations, Gingival health, Dentifrice, Mouth rinse, Plaque.

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Introduction:
Herbal formulations in health sector are professed to render therapeutic benefits [1]. They are preferred as it provides benefits of natural activity, safe and lesser cost. They are even safe from adverse effects. Herbal therapy is gradually gaining popularity over modern drugs to combat side effects like antibiotic resistance.
Herbs are utilised in dentistry to treat tooth ache, gingival inflammation and canker sores [2]. Literature has shown that plant extracts exhibit antiseptic, antibacterial, antimicrobial, antifungal, antioxidant, antiviral and analgesic properties [3]. Various plant extracts like propolis, noni fruit, burdock root, neem extract, tulsi and curcumin have been tested in dentistry showing promising results [4].
The mildest form of periodontal disease is gingivitis seen as plaque accumulation on tissues of the oral cavity [5]. Dental plaque accumulation is the prime reason of all dental diseases [6]. It is described as a reversible condition, but can progress to periodontitis if not treated, resulting in bone loss and connective tissue [7]. Ideal method to remove

plaque and prevent gingivitis is through mechanical plaque control such as tooth brushing and flossing. Additional oral health aides are also used like chlorhexidine, essential oils as mouthwashes which are approved by American Dental Association as antiseptic formulations [8]. Cases of hypersensitivity, formation of stains, irritation to oral mucosa and dysguesia are reported with these usage [9]. Multiple drug resistant organisms with the use of antibiotic formulations are also increasing in the oral cavity.

Studies have demonstrated that gingivitis is associated with various systemic diseases [10]. Hence, prevention and control of gingival inflammation is imperative to maintain overall health through oral health [11].

Herbal formulations used as dentifrice or mouth rinses can be used as a single ingredient or as a combination of different medicinal plants. The aim of the review was to comprehensively present an overview on the efficacy, safety and utilization of herbal products on periodontal diseases.

Materials and Methods:

A hypothesis of "Are herbal formulations effective in influencing periodontal health" was framed to be tested through this review. Literature search began by scrutinizing search engines of PubMed – Medline data base, Scopus and Journal of Web, from 2000 to 2019. Articles testing the efficacy of herbal dentifrice formulations of periodontal health, Randomized Controlled trials testing the herbal formulation with either a placebo or a gold standard agent were included, irrespective of the ages tested on. Review articles, unpublished data, articles without open access, dissertations and articles published in any other language apart from English were excluded. An independent researcher looked into the data base using the MeSH terms herbs, herbal dentifrice, herbal formulation, periodontitis and gingivitis.

Each selected article was reviewed for the risk of any bias by using the Cochrane Collaboration's tool for risk assessment. The search obtained was carefully scanned by the reviewer initially. Papers were chosen to be fully read only if the MeSH terms appeared in the title or abstract. The abstracts of the selected articles were then scrutinized for eligibility criteria.

Only those trials or studies which tested the herbal formulation along with a test group and subjects above 18 years of age were included for the review. Only if they fulfilled the eligibility criteria, then full text articles were read. Parameters evaluated were study design, sample size, indices recorded, herbs used and results obtained.

The search yielded a total of 327 articles, out of which 127 had to be excluded because of duplicate results. 8 articles investigated other oral diseases like premalignant lesions and dental caries and thus had to be excluded. 18 articles were included for the review finally which fulfilled the eligibility criteria (Figure 1). Outcomes in terms of disease reduction or change in indices scores was compared between the herbal component (mentioned as test group) and control group (gold standard formulation) or placebo.

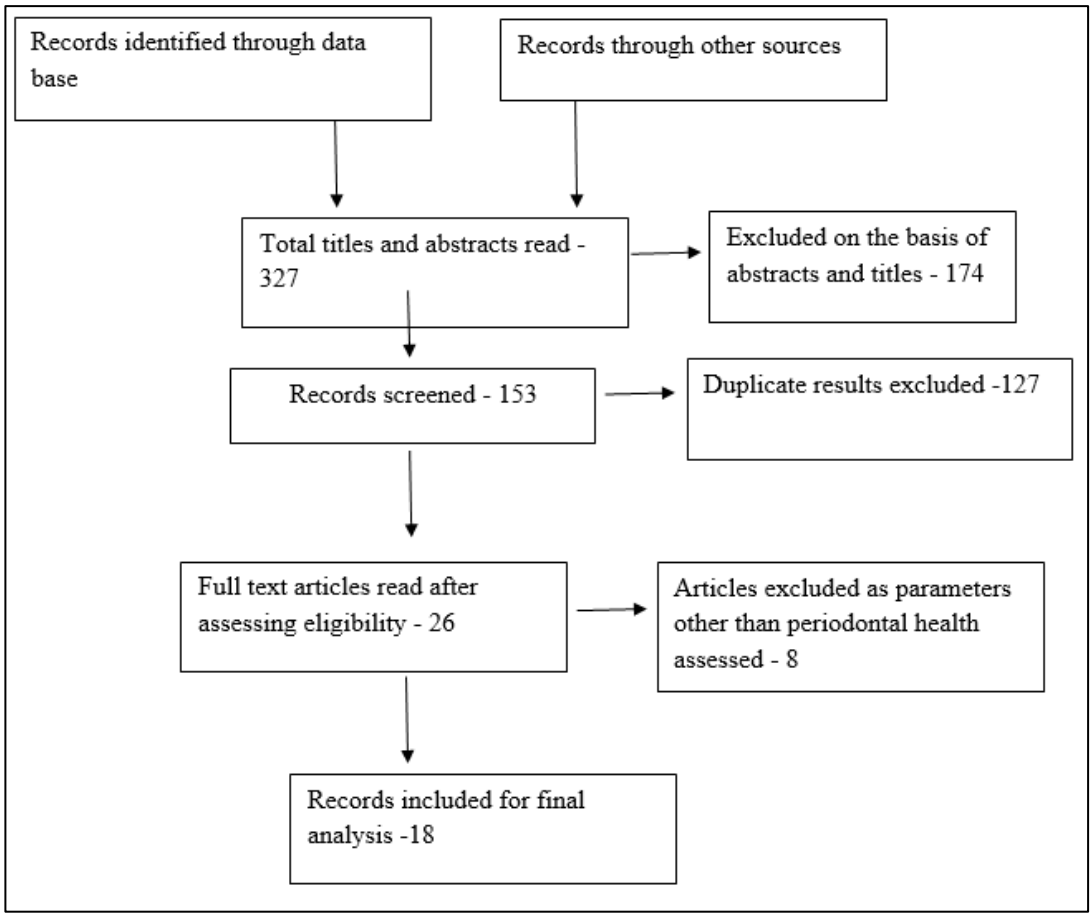

Figure 1 - Flow chart representing the number of articles screened and evaluated

Risk of bias was assessed on the basis of Cochrane Collaboration into low risk, high risk or unclear risk which considered factors like Random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data and selective reporting. Studies were included only if they had low risk of bias which independently reviewed by the author.

Results:

Total 18 articles were included after full text was read independently by the reviewer. The most commonly used herbal formulations in oral health were dentifrices and mouthwashes. Hence, both of these were included in the review. The review of the trials included is presented in Table 1.

Table 1: Review of clinical trials assessing herbal formulations on gingival health

Authors / Year	Study design	Sample Size	Age	Tested formulation	Study duration	Index used	Findings
KalyanaChakravarthy et al [12], 2019	RCT, double blind parallel arm	75	>18 years	Clove, cinnamon, black pepper, bakul and camphor extract dentifrice	30 days	Turesky Gilmore Glickman modification of plaque index, Tabott Mandel Chilton modification of Loe and Silness Gingival index	No significant difference in clinical indices between test and control group

ShahabeSaquib, 2017[13]	RCT parallel group, blinded study	112	21-40 years	Babul, Vajradanthi and bakul	4 weeks	Gingival Index	Reduction in gingival inflammation was similar in test and control group
Pradeep AR et al, 2016 [14]	RCT double blind parallel study	90		Triphala mouthwash	60 days	PI, GI, OHI –S, Microbiolgoic colony count	No significant differences was noticed in reduction of PI,GI, OHI-S and microbiology ic colony count
Devanand Gupta et al 2015[15]	RCT, blinded parallel study	60	20 – 25 years	Cinnamon and T.Chebula extract mouthrinse	3 days	Turesky et al modification of Quigley Hein Plaque Index	Herbal extract inhibited plaque formation though not not as comparable as chlorhexidine mouthrinse.
Bhat N et al, 2015 [16]	RCT double blind cross over study	30	18-22 years	Propolis and Miswak mouthwash (separate test groups	24 hours	MGMPI plaque index	MGMPI plaque score was lesser in propolis followed by miswak and control group
AravindTatikonda et al, 2014[17]	RCT double blind parallel study	30	35-43 years	Dabur red	30 days	GI, PI	Reduction of plaque and gingivitis was similar in both test and control groups
Chinani et al 2014 [18]	RCT	120	13-16 years	Herbal mouthwash	30 days	GI, PI	A significant reduction in GI and PI scores was noted in test group as effective as the control group
ShivanandAspalli et al 2014 [19]	RCT parallel double blind	100	20 – 45 years	Herbal mouthwash	21 days	Gingival Index, Plaque Index, Gingival Bleeding Index	Test group effectively reduced plaque induced gingivitis and statistically significant reduction was observed in GI, BI, GBI scores
Ajmera et al 2013 [20]	RCT	45	18-65 years	Herbal mouthwash		Gingival Index	A significant reduction in gingival inflammation

Makaram et al 2013 [21]	RCT parallel study	45	11-12 years	Herbal dentrifrice (Barberry gel)	20 days	GI, PI	The test group was effective in reduding gingivitis similar to the control group
Chandrahas B, 2012 [22]	RCT double blind	120	18-25 years	Herbal mouthrinse Aloevera 100%	22 days	Modified Gingival Index, PI, Bleeding Index	Reduction in gingival inflammation was noted
Mali et al, 2012 [23]	RCT parallel double blind study	60	>15 years	Turmeric mouth wash	20 days	GI, PI	No statistical difference between test and control groups
Tangde PS et al 2012 [24]	RCT, double blind cross over	60		Herbal dentrifrice	28 days	GI, QHI, BOP	Significant reduction in indices was noted in test group
Waghmare PF et al, 2011 [25]	RCT, double blind parallel study	100	25-35 years	Turmeric mouthwash	21 days	GI, PI, Total microbial count	No significant difference in mean GI, PI and total microbial count between test and control group
Amoian B et al, 2010 [26]	RCT, double blind parallel study	40		Calendula officinalis Dentrifrice	28 days	PI,GI, BOP	Decrease in PI, GI, BOP in both test and control groups
George Jacob et al, 2009 [27]	RCT double blind parallel study	30	18-65 years	Colgate herbal	30 days	Turesky modification of Quigley Hein Plaque Index, GI, salivary pH	Significant reduction in PI and GI, chang in salivary pH was not statistically significant
Ozaki et al, 2006 [28]	RCT, double blind parallel study	42	18-69 years	Paradontax	28 days	Turesky modification of Quigley Hein Index, Gingival Index	Significant reduction in PI and GI in test group
Pannuti et al 2003 [29]	RCT parallel double blind	31	18-35	Paradontax	3 weeks	Turesky modification of Quigley Hein plaque Index, GI	No statistically significant difference was observed between test and control groups after study duration.

Out of 18 studies reviewed, 16 were randomised controlled trial of parallel design while 2 were randomised controlled experiments of cross over type. All the included studies were double blinded. While all studies assessed periodontal

disease by GI and PI, Pradeep AR et al [14] and Waghmare PF et al [25] in addition evaluated microbial colony count and George Jacob et al recorded salivary pH. All included studies recruited individuals with gingivitis and were above 13 years. There were no significant differences in the outcome parameters evaluated between the test and control group in all studies, proving the efficacy of herbal formulation as similar to that of a gold standard formulation.
Study conducted by Kalyana Chakravarthy [12] mentioned hypersensitivity in one subject using herbal dentifrice. No other adverse effects or gingival desquamation was noted in any studies.

Discussion:
The main culprit in both dental caries and gingival inflammation is dental plaque. Gingival inflammation of chronic type leads to tissue destruction which if not treated, progresses to the destroy periodontium [30]. Hence, maintaining proper oral health can control plaque and subsequently gingivitis. This is attained by efficient mechanical plaque control through toothbrushes and therapeutic toothpastes.
The use of an adjunctive antimicrobial agent in treating patients with chronic periodontitis along with scaling and root planning enhances patient outcomes when scaling alone is done [31]. Though the recent chemotherapeutic agents' project marked efficiency in bettering periodontal health, adverse effects like discoloration of teeth and mucosal surfaces, alteration of taste and increased cost cannot be overlooked. In this context herbal products are used increasingly in the recent times particularly benefitting the lower socio-economic strata across the globe [32]. Chlorhexidine, the gold standard drug, was developed way back in 1950 which still remains the most effective plaque cessation agent. But the long term usage gets restricted due its adverse effects.
Out of the 18 articles reviewed, 16 followed the parallel design while two studies were of cross over study design. All the studies the trials were double blinded ensuring non discrepancy of study results. While the effect of herbal extract was evaluated for 24 hours by Bhat N etal [16] which formed the least time frame in the review, Pradeep et al [14] assessed the efficacy of Triphala formulation over 60 days on plaque. It also assessed microbiological counts in plaque. But the subjects in the study of Bhat N et al [16] were instructed to refrain from oral hygiene practices completely, which might have been the reason for such a short time period as obtaining patient compliance will be difficult. In both the trials mentioned, gingival inflammation reduced significantly in the test group which was as comparable to that of control group.
All the studies showed no difference between herbal extract formulations and control group in treating gingival health, excepting for the study done by Devanand et al [15] in which the herbal extract mouthrinse reduced plaque formation in slightly lesser proportion as compared to the control group.
Herbal formulations form natural photochemical which can be substituted to antibiotics and is an important alternative approach to manage oral and periodontal infections [33, 34].
Herbal components were delivered in various formulations and modes. While turmeric mouth wash was tested in studies conducted by Mali et al [23] and Waghnmore et al [25], Paradontax was tested in the studies of George Jacob [27], Ozaki [28] and Pannutti et al [29]. Barberry and Aloe vera gel was tested by Makaram [21] andChandrahas et al [22] respectively.
Study conducted by Pannuti et al [29] and Devanand et al [15] was done on dental students. Hawthorne effect could have influenced the outcome of this study as mere participation in the trial could have improved the scores by motivating participants to adopt better oral hygiene behaviours irrespective of whichever group they were in.
The main mechanism by which herbal formulations resulted in decreasing gingival inflammation was by reducing markers of inflammation like IL –B, IL – 2,IL – 6, IFN –Y and also reduces the pathogenic bacteria count in the oral cavity.
The review results suggest that herbal formulations in any mode improved gingival health in all the studies included and also reduced the bacterial count in the plaque as seen in the study done by Pradeep et al [14]. None of the studies had followed proper sample size calculation in recruiting study participants. Also, the fact that patient compliance determined the study results must not be overlooked in any study. None of the studies were conducted for a long

term, so no data regarding adverse effect of any herbal formulation related to its long term usage is available till now. Clinical trials designed with larger sample size and for a longer time frame are recommended.

Conclusion:

Based on the existing clinical evidence available, the review supports the effectiveness of herbal formulations in treating gingivitis. Studies involving amalgamation of various herbs to optimise their anti - plaque potential efficacy is needed to overcome the adverse side effects associated with the conventional plaque control formulations.

Competing interests

Author declares no competing interests.

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None

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