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Original Article

Dentistry Section

Efficacy of *Commiphora myrrha* (*Myrrh*) in Management of Gingivitis: A Systematic Review

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ABSTRACT

Introduction: The oral cavity is the second largest microbial niche in the human body, following the gut. The colonisation of microorganisms on the teeth and gums harbours harmful bacteria, which can trigger inflammation, potentially leading to periodontal breakdown and tooth loss. To eliminate bacterial biofilms, several methods are employed. Among these, the most effective are chemical methods, which include antiseptic and antimicrobial agents. Although these agents can have potential benefits, they also come with side-effects. To minimise the side-effects of chemical-based plaque control, there is a paradigm shift towards herbal alternatives. One such plant known for its medicinal properties is *Commiphora myrrha*, which possesses antimicrobial properties that improve plaque control.

Aim: To assess the efficacy of *Commiphora myrrha* in the management of gingivitis.

Materials and Methods: A comprehensive search was conducted using Medline via PubMed, Cochrane, ProQuest and Google Scholar. The combination of keywords used was: Myrrh OR *Commiphora myrrha* OR Herbal extract AND Gingivitis AND Plaque AND Inflammation, Myrrh AND *Commiphora myrrha* AND Gingivitis. Articles published from January 1, 2014, to December 31, 2024, were included to identify the efficacy of *Commiphora myrrha* in the management of gingivitis. After a thorough search, a total of five articles were included in the review. The inclusion criteria were: patients aged between 18-35 years, signs of chronic gingivitis in at least six sites, Bleeding on Probing (BOP) and periodontal pockets with a depth of no more than 3 mm. Exclusion criteria included patients with periodontal pockets greater than 3 mm, those with severe malocclusion, use of antibiotic or anti-inflammatory medication, pregnant or breastfeeding women, oral prophylaxis in the past six months, a history of allergy to chemical or herbal products and patients using smoking or smokeless tobacco. The reporting of this systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The quality assessment of the studies was performed using the Cochrane risk of bias assessment tool for Randomised Controlled Trials (RCT), the Risk of Bias in Non randomised Studies (ROBINS) tool for non randomised trials and the Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework.

Results: A total of five studies were included (four randomised and one non randomised controlled trial), comprising 166 patients who met the inclusion criteria. One of these studies was conducted in India, three in the Kingdom of Saudi Arabia and one in Egypt. Diagnoses in all five studies were based on clinical and histological examination. The p-values of the included studies were as follows: $p<0.006$, $p<0.05$, $p=0.08$, $p<0.001$ and Zahid $p>0.05$. All five studies found *Commiphora myrrha* to be effective in reducing gingival inflammation, with results comparable to chemical plaque control and minimal side-effects. Therefore, *Commiphora myrrha* shows promise as an effective adjunct therapy for managing gingivitis.

Conclusion: The present systematic review demonstrates that *Commiphora myrrha* exhibits significant anti-inflammatory properties. When used in combination with other oral healthcare regimens, *Commiphora myrrha* could offer beneficial effects in improving overall oral health and managing gingivitis.

Keywords: Herbs, Inflammation, Mouthwash, Periodontitis, Plaque

INTRODUCTION

The overall prevalence of periodontitis in India is 46.6% [1]. Gingivitis, characterised by inflammation of the gingiva, can progress into periodontitis if not treated properly [2]. To prevent this, various plaque control measures—such as mechanical and chemical methods—are employed [3].

Chemical-based mouthwashes are effective against a broad range of bacteria; however, repeated use can lead to adaptive resistance in certain bacterial species. Other adverse effects include altered taste sensation, tooth discolouration and changes in the oral microbiome [4]. Currently, the world is contending with the side-effects of chemical-based methods, prompting a shift toward alternative medicine. These natural alternatives include ingredients like *Commiphora myrrha* (*Myrrh*), aloe vera, tea tree oil and chamomile, which offer antimicrobial and anti-inflammatory benefits. The word "myrrh" is derived from the word "mur," meaning "bitter" [5].

Myrrh has potential benefits in managing gingivitis and recurrent aphthous stomatitis primarily due to its anti-inflammatory and antimicrobial properties [6]. Studies have compared the clinical effects of Myrrh on gingival inflammation when used in conjunction with chemical plaque control [7,8].

Commiphora myrrha exhibits diverse pharmacological actions, primarily due to its rich phytochemical content, which includes sesquiterpenoids, furano-sesquiterpenoids and triterpenoids—all of which have proven anti-inflammatory and antimicrobial properties [8]. Its anti-inflammatory activity is mediated by the inhibition of proinflammatory mediators, such as Prostaglandin E2 (PGE2) and cytokines like Interleukin (IL)-1β and stimulated IL-6 and IL-8 [9]. Myrrh exerts its antiviral properties by inactivating viral particles and disrupting the virion envelope; additionally, it inhibits viral Deoxyribonucleic Acid (DNA) polymerase, thereby reducing viral replication [8].

Myrrh has been extensively studied for its wound healing properties across various clinical and experimental contexts. Its efficacy has

been demonstrated during the healing process following tooth extraction and dental implant placement, showing comparable outcomes to conventional agents such as Chlorhexidine (CHX) mouthwash [10,11]. In-vitro studies have further highlighted its role in modulating leukocyte responses during the healing of gastric ulcers and skin injuries [12]. Myrrh-based gels have also proven effective in the topical management of minor recurrent aphthous stomatitis, particularly in alleviating pain [13].

Apart from its use in oral and dermatological care, Myrrh possesses gynaecological properties and has been reported to effectively facilitate the resolution of retained products of conception, presenting a potential alternative treatment for patients with incomplete abortion [14].

Despite the growing interest in herbal alternatives for oral healthcare, no previous systematic review has synthesised the clinical evidence on the use of Myrrh in managing gingivitis. According to existing literature, no prior systematic review has comprehensively assessed the efficacy of Myrrh in the management of gingivitis, which, if left untreated, may progress into periodontitis and tooth loss.

The present systematic review aimed to evaluate the efficacy of *Commiphora myrrha* in the management of gingivitis Hence the objective was to evaluate the efficacy of Myrrh in reducing gingival inflammation and to compare the efficacy of Myrrh with chemical plaque control. The research question addressed was: "Is Commiphora myrrha efficacious in the management of gingivitis?".

MATERIALS AND METHODS

Protocol and Registration: The present study was registered in International Prospective Register of Systematic Reviews (PROSPERO): The protocol was designed according to Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2009 and is registered under number CRD42024572589.

Focused Question: The present systematic review was conducted following the guidelines of the "PRISMA" as well as the principles of "Participants, Intervention, Control, Outcome, Study design (PICOS)."

Eligibility Criteria:

- Population (P): Patients who were clinically diagnosed with gingivitis and had no history of prior treatment for the condition.
- Intervention (I): Myrrh in any form.
- Comparison (C): Conventional methods such as 0.1% Chlorhexidine mouthwashes, placebo, normal saline, or any relevant intervention.
- Treatment Outcome (O): Reduction in gingival inflammation and Bleeding on Probing (BOP).
- Study Design (S): Clinical trials (both randomised and non randomised).

Language: English: The following studies were excluded: case reports, case series, systematic reviews and animal studies.

Inclusion Criteria:

- Patients aged between 18-35 years.
- Chronic gingivitis at a minimum of 6 sites.
- Presence of BOP.
- Periodontal pocket depth not exceeding 3 mm.
- Patients not under any medication or suffering from systemic diseases.
- More than 20 teeth (at least 5 teeth in each quadrant).
- No clinical attachment loss.

Exclusion criteria:

- Pocket depth greater than 3 mm.
- Patients with malocclusion.
- Presence of intraoral appliances.
- Use of antibiotics or anti-inflammatory drugs within the past 6 months.
- History of tobacco consumption.
- Pregnant or breastfeeding women.

Search Strategy: Databases such as Medline via PubMed (18 studies), Cochrane (42 studies), ProQuest (18 studies) and Google Scholar (first 100 articles) were searched for all relevant studies published in the English language between January 1, 2014 and December 31, 2024. A combination of the following keywords was used [Table/Fig-1]

	PubMed	Cochrane	ProQuest	Google scholar
Keywords	*Myrrh* OR *Commiphora myrrha* OR Herbal extract AND Gingivitis AND Plaque AND Inflammation	*Myrrh* AND *Commiphora myrrha* AND Gingivitis	*Myrrh* AND *Commiphora myrrha* AND Gingivitis	*Myrrh* OR *Commiphora myrrha* OR Herbal extract AND Gingivitis AND Plaque AND Inflammation.

[Table/Fig-1]: Combination of the following keywords among different databases. Relevant modifications in keywords were made for each to retrieve the most relevant studies and reduce the inclusion of unrelated or duplicate articles

- Myrrh OR *Commiphora myrrha* OR Herbal extract AND Gingivitis AND Plaque AND Inflammation
- Myrrh AND *Commiphora myrrha* AND Gingivitis

Study selection: The titles and abstracts of all retrieved studies were screened independently by three reviewers, and irrelevant studies were excluded. Full-text articles of potentially eligible studies published in English were subsequently obtained and assessed independently by the same reviewers for final inclusion.

Data collection process: Data collection was performed using a customised data extraction form, which included the following contents:

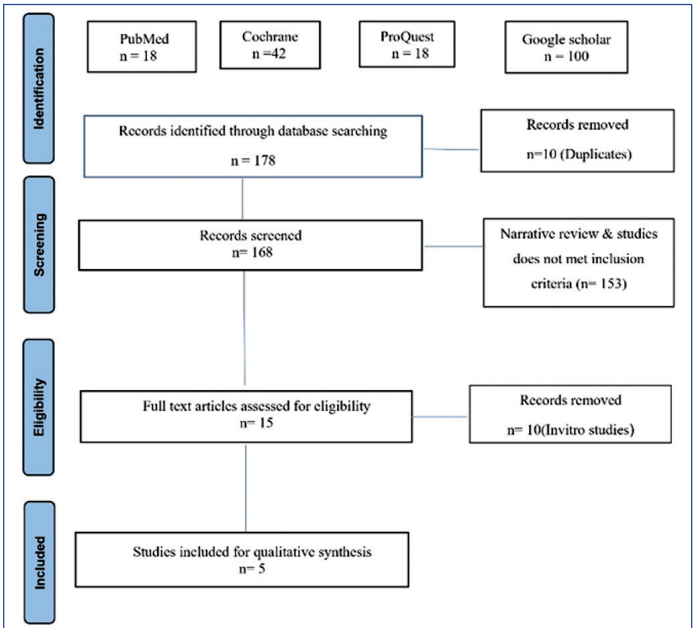
- Title of the study
- Author's name
- Duration of the study
- Year of publication
- Study setting
- Study design
- Study population
- Method of randomization used (if applicable)
- Types of intervention
- Types of comparator
- Characteristics of participants (age and gender)
- Inclusion and exclusion criteria
- Time of measurement
- Outcomes (primary and secondary)
- Concluding remarks

Quality Assessment: The quality of included studies was assessed using the Cochrane Risk of Bias tool (RoB2) for randomised controlled trials and the ROBINS tool for non randomised controlled trials. Two independent reviewers conducted the assessment and any disagreements were resolved through discussion with a third reviewer. Recommendations for Myrrh were assessed based on evidence-based clinical practice guidelines and a GRADE assessment for the quality of included studies was performed.

RESULTS

Literature Search and Selection of Studies: The study selection process was conducted according to PRISMA guidelines. A total of 178 articles were obtained through hand searches (including the first 100 articles from Google Scholar). After the removal of 10 duplicate studies, 168 articles were screened, of which 153 were excluded for being narrative reviews or failing to meet inclusion criteria.

The remaining 15 articles were assessed for eligibility and 10 were found to be In-vitro studies. Ultimately, five articles were included in the systematic review [Table/Fig-2].



[Table/Fig-2]: PRISMA flowchart.

Study Characteristics and Outcomes: The characteristics and outcomes of the studies included (4 randomised and 1 non randomised control trial) are presented in [Table/Fig-3,4]. The trials included a total of 166 individuals. One of the five studies was conducted in India, three in the Kingdom of Saudi Arabia and one in Egypt. Diagnosis was established in all five studies based on clinical and histological examinations. The age of the subjects ranged from 18 to 35 years, with female predominance in four studies and male predominance in one. The follow-up period for all five studies was one to two weeks.

Formulation-intervention and control groups: Bassiouny G and Al Barrak H (2014) [15] compared the efficacy of Myrrh with 0.2% chlorhexidine and miswak mouthwash, administered twice a day for three weeks. Zahid TM and Alblowi JA (2019) evaluated the efficacy of Myrrh using 15 mL of chlorhexidine and 0.9% Sodium Chloride (NaCl). Alotaibi RA et al., (2020) compared Myrrh with 10 mL of chlorhexidine gluconate dispensed in half a cup of water [16,17]. Lenka B et al., (2021) assessed the efficacy of Myrrh with glycerol [18]. Zahid TM and Alblowi JA (2022) examined the anti-inflammatory and anti-plaque effects of Myrrh mouthwash [19].

Clinical Parameters:

The primary outcomes analysed in all five studies included gingival index, plaque index and Plaque Control Record (PCR). One out of the five studies utilised the proinflammatory biomarker Interleukin (IL)-1β, along with BOP.

Outcome Measures:

A study by Bassiouny G and Al Barrak H (2014) revealed a statistically significant difference in the reduction of gingival and plaque indices [15].

A study by Zahid TM and Alblowi JA (2019) showed a statistically significant reduction in inflammation and plaque in patients using Myrrh mouthwash [16].

Author	Year of study	Country of origin	Study design	Objective	Subjects enrolled	Diagnostic criteria	Gender and age (in year)
Bassiouny G and Al Barrak H 2014 [15]	2014	Egypt	RCT	Effect of Myrrh and Miswak mouthwashes (MWs) on plaque accumulation and gingival inflammation were compared with chlorhexidine gluconate MW 0.2%	Group A- 10 Group B- 10 Group C- 10	Least 6 sites with chronic gingivitis according to (Armitage, 1999) with Bleeding On Probing (BOP),	F- 30
Zahid TM and Alblowi JA 2019 [16]	2019	Saudi Arabia	RCT	Effectiveness of a myrrh containing mouthwash in dental plaque and gingivitis control in comparison to a commercially available chlorhexidine mouthwash	Group A- 4 Group B- 4 Group C- 4	Clinically diagnosed with gingivitis	M-2 F-10 Mean age Group A 29±12.67 Group B 23.25±1.5 Group C 22.75±2.75
Alotaibi RA et al., 2020 [17]	2020	Saudi Arabia	Non RCT	Effectiveness of Myrrh mouthwash in reducing gingival inflammation and plaque accumulation in comparison with chlorhexidine	Group A- 45 Group B- 30	Gingival inflammation was evaluated using the Gingival Index (GI)	M - 36 F - 39 Mean age - 34
Lenka B et al., 2021 [18]	2021	India	RCT	Assess the anti-plaque, anti-inflammatory and antimicrobial efficacy of Myrrh oil as an adjunct to scaling and root planing in the treatment of gingival inflammation	Group A- 15 Group B- 15	Moderate to Severe gingivitis (Gingival Index score ≥ 2)	M – 14 F=16 Mean age-24.19±2.63
Zahid TM and Alblowi JA2022 [19]	2022	Saudi Arabia	RCT	Effectivity of 1% myrrh mouthwash with 0.2% chlorhexidine mouthwash and 0.9% of normal saline in terms of inhibition of the activity of plaque and gingivitis and decrease of proinflammatory cytokines	Group A- 6 Group B- 7 Group C- 6	Clinically diagnosed with gingivitis	M- 10 F - 9 Mean age -30±10.55

[Table/Fig-3]: General characteristics of studies [15-19].

Author	Intervention group	Control group	Myrrh formulation and duration of application	Primary outcome variables	Secondary Outcome variables	Follow-up	Results	Conclusion	Adverse effects
Bassiouny G and Al Barrak H 2014 [15]	1% of myrrh mouthwash	Miswak mouthwash 1%	To be rinsed twice a day until 3 weeks	Reductions in the gingival and plaque indices	-	3 weeks	Myrrh mouthwash showed superior results over CHX and miswak mouthwash in reduction of inflammation and plaque accumulation, although a statistically significant difference was found p<0.006	The effect of Myrrh and Miswak MWs in controlling plaque accumulation and reducing gingival inflammation was found to be comparable to that of CHX	-
Zahid TM and Alblowi JA 2019 [16]	1% Myrrh mouthwash	Saline Chlorhexidine mouthwash	15 mL of mouthwash used twice daily for 1 minute	Reductions in the gingival and plaque indices	-	2 weeks	Myrrh group showed a significant difference (p<0.05) with respect to PI between baseline and two weeks after intervention (p-value<0.05)	1. Clinical improvement in plaque reduction and gingival inflammation parameter h2. Myrrh may be considered as a potential therapeutic agent in treating gingivitis	-
Alotaibi RA et al., 2020 [17]	Myrrh-based mouthwash	Chlorhexidine mouthwash	10 mL of the mouthwash in a half cup of water for at 30 seconds	Reduction in gingival indices and Plaque Control Record (PCR)	-	2 weeks	Reduction of GI mean score was similar in the two groups (1.0±0.2 vs. 1.09±0.2 p=0.08)	Reduction in dental plaque and gingival inflammation on the short term with minimal side-effects	Altered taste sensation and staining of tooth
Lenka B et al., 2021 [18]	Myrrh oil	Glycerol	Apply the two drops of the dispensed product twice daily with their finger on the gums for 1 minute and rinse with water after tooth -brushing	Plaque Index (PI), Gingival Index (GI) and microbiological analysis	-	1 week	Reduction in plaque and gingival index (p<0.001)	Myrrh oil when used as an adjunct with scaling and root planning significantly reduced the gingival inflammation in 48 hrs and Gram negative bacteria after 1 week	-
Zahid TM and Alblowi JA 2022 [19]	1% of myrrh mouthwash	Chlorhexidine gluconate 0.2% and normal saline 0.9% NaCl solution	15 mL of the given mouthwash two times every day for one minute	Modified gingival index, plaque index, Proinflammatory Interleukin (IL)-1β biomarker and BOP	-	2 weeks	No significant difference in the mean PI and average IL-1β scores was found between the treatment groups at any time points. The post-intervention mean values of the MGI and BOP were considerably lesser in the myrrh group than the saline group (p=0.016 and p<0.001) The chlorhexidine group also had lower scores in these two parameters than the saline; however, its mean difference in the MGI did not reach statistical significance (p=0.09). No significant difference in the mean PI and average IL-1β scores was found between the treatment groups at any time points	1% myrrh mouthwash was as good as 0.2% chlorhexidine mouthwash in reducing gingival inflammation and BOP	

[Table/Fig-4]: Outcome of the included studies [17-21].

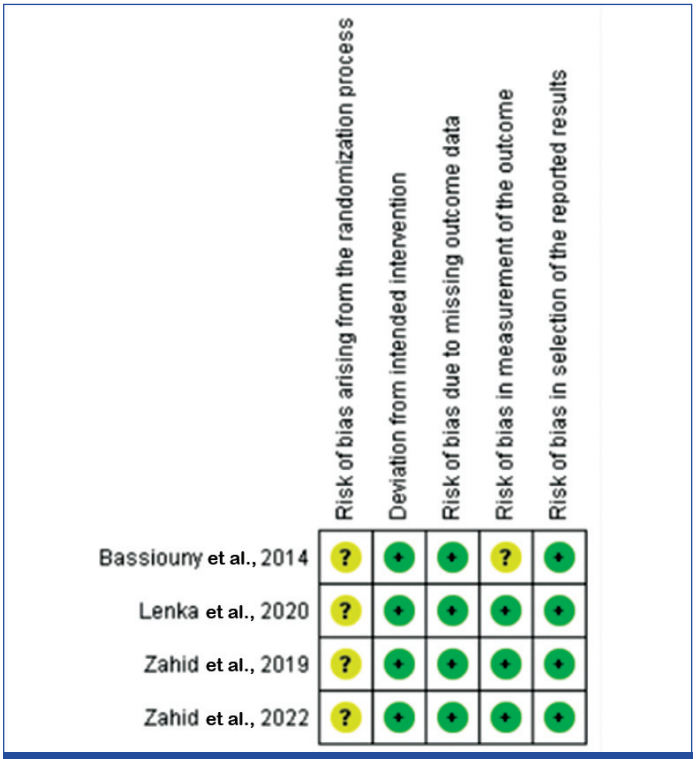
A study by Alotaibi RA et al., (2020) found a statistically significant difference in the reduction of gingival index, PCR and BOP [17].

A study by Lenka B et al., (2021) indicated a statistically significant reduction in gingival inflammation and gram-negative bacteria [18].

A study by Zahid TM and Alblowi JA (2022) revealed statistically significant reductions in gingival index, inflammatory biomarkers and BOP [19]. All five included studies reported that Myrrh is effective and produced similar results in the management of gingivitis compared to chemical and mechanical methods.

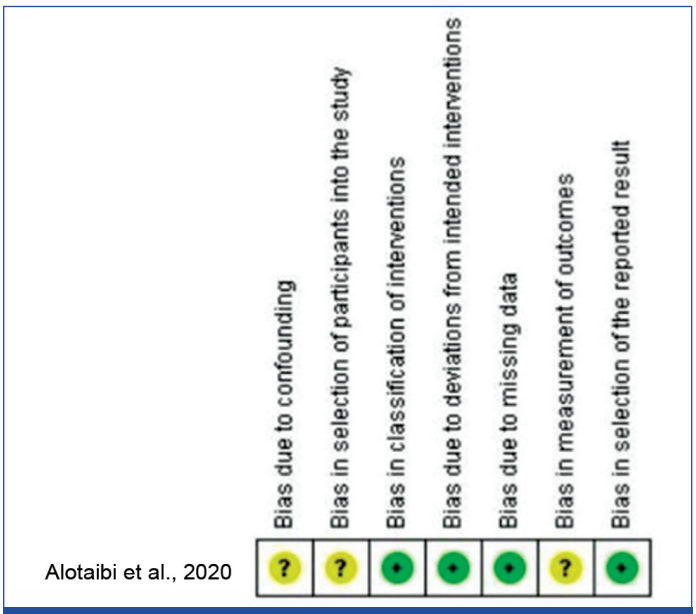
Quality assessment: The Cochrane Risk of Bias tool (RoB2) for RCTs and the ROBINS tool for non randomised control trials were employed by two independent reviewers to assess study quality. The RoB2 tool evaluated five domains: bias arising from the randomisation process, deviations from intended interventions,

missing outcome data, measurement of the outcomes and selection of reported results. Each study was judged to have low, some concerns, or high risk of bias [Table/Fig-5].



[Table/Fig-5]: Risk of Bias assessment tool version-2 (RoB2)- for randomised controlled trials- Yellow indicates some concerns and green indicates low risk in the studies.

The ROBINS tool evaluated seven domains: bias due to confounding, selection of participants into the study, classification of interventions, deviation from intended interventions, missing data, measurement of outcomes and selection of reported results [Table/Fig-6]. All five included studies demonstrated a moderate risk of bias.. Any disputes were resolved through discussions with a third expert.



[Table/Fig-6]: Risk Of Bias In Non randomised Control Studies (ROBINS) yellow indicates some concerns and green indicates low risk in the studies.

The quality of the included studies was further evaluated using the GRADE framework, presented in [Table/Fig-7] [15-19] This assessed evidence based on five domains: risk of bias, inconsistency, indirectness, imprecision and publication bias. Results indicated moderate quality of evidence for two studies [17,18] and low quality of evidence for three studies [15,16,19].

Study design	Initial quality of evidence	GRADE quality assessment
Randomised controlled trial 2014 [15]	Low	Low
Randomised controlled trial 2019 [16]	low	low
Non randomised controlled trial 2020 [17]	Low	Moderate
Randomised controlled trial 2021 [18]	High	Moderate
Randomised controlled trial 2022 [19]	low	low

[Table/Fig-7]: GRADE quality assessment [15-19].

DISCUSSION

Gingivitis Overview: Gingivitis is a chronic inflammatory condition caused by bacterial infection, restricted to gingival tissue and is characterised by clinical features such as swelling, redness, tenderness and BOP. Various factors contribute to the onset of gingivitis, including plaque deposits, pregnancy, metabolic disorders, smoking and drugs [20].

Management of gingivitis: Different methods are employed in the management of gingivitis, encompassing both chemical and mechanical approaches for plaque control. These methods include the use of mouthwashes and toothpaste containing antimicrobial agents, as well as brushing and flossing. However, prolonged use of these chemical methods can lead to side-effects such as tooth discolouration, burning sensations, deafness and alterations in the oral microbiome [21].

Due to growing concerns regarding these side-effects and the long-term impacts of chemical treatments, there has been a noticeable shift towards alternative medicine for the treatment of common ailments.

Myrrh as an alternative treatment: One such plant recognised for its medicinal properties is Myrrh, which is extracted from the tree *Commiphora molmol*. Myrrh is available in three main forms: gums, resins and volatile oil. It has been shown to be effective for the inflamed oral and pharyngeal mucosa and is widely used for treating small wounds, recurrent aphthous stomatitis and gingivitis, with no proven side-effects [22].

Researchers have conducted clinical trials assessing the therapeutic potential of Myrrh for treating oral mucosal lesions. One notable trial by Albishri J (2017) investigated the efficacy of Myrrh in managing Behcet's disease and yielded promising results. This study indicated that Myrrh significantly decreased the pain and size of oral ulcers, underscoring its therapeutic value in symptom relief [23].

Given the lack of systematic evidence regarding Myrrh, the present systematic review was designed to evaluate the role of Myrrh in gingivitis, guided by the research question: "Is *Commiphora myrrha* effective in managing gingivitis?" An extensive search led to the inclusion of four clinical trials and one non randomised trial in the present review. All included studies indicated that Myrrh was effective in the clinical improvement of gingivitis, with primary outcome measures including reductions in the gingival index, Plaque Control Record (PCR), BOP and bacterial count.

Study Findings: The study by Bassiouny G and Al Barrak H (2014) compared the anti-plaque effects of Miswak and Myrrh mouthwashes versus chlorhexidine in the treatment of chronic gingivitis, concluding that there was a reduction in both the gingival and plaque indices [15].

Zahid TM and Alblowi JA (2019) reported a statistically significant reduction in dental plaque-induced inflammation in patients using Myrrh mouthwash [16].

Alotaibi RA et al., (2020) compared the effectiveness of Myrrh with chlorhexidine mouthwash, concluding that there was a reduction

in the gingival index and PCR. Myrrh exhibited minimal side-effects compared to chlorhexidine [17].

Another study conducted by Lenka B et al., (2021) compared the effects of Myrrh oil with a placebo and found that Myrrh oil, when used as an adjunct to mechanical methods of plaque control, significantly reduced gingival inflammation and the levels of Gram-negative bacteria [18].

Zahid TM and Alblowi JA (2022) compared the effects of chlorhexidine with Myrrh, observing reductions in the gingival index, levels of inflammatory mediators and BOP. They concluded that Myrrh had anti-inflammatory effects comparable to those of chlorhexidine [19].

All five studies concluded that Myrrh effectively reduced gingival inflammation, providing results similar to those achieved with chemical plaque control methods, with very minimal side-effects [15-19]. Therefore, it can be concluded that Myrrh may serve as an effective adjunct therapy for gingivitis.

Limitation(s)

The main limitation of the present review is the relative paucity of studies on Myrrh in the management of gingivitis, along with smaller sample sizes, moderate risk of bias and low quality of evidence as assessed by the GRADE criteria. The moderate risk of bias arose from the lack of randomization and blinding. A meta-analysis was not feasible due to significant heterogeneity among the five studies.

CONCLUSION(S)

To mitigate the side-effects associated with chemical plaque control, there has been a significant shift towards natural alternatives that harbours promising options due to their natural antimicrobial properties and minimal side-effects. Clinical studies and evidence-based research indicate that Myrrh effectively reduces plaque and supports oral health, without the drawbacks associated with chemical methods. Myrrh presents a compelling alternative for those seeking a safer, more natural approach to plaque control. Despite the limitations mentioned above, the present review has aimed to summarise the existing evidence on the management of gingivitis using Myrrh as a monotherapy. There is a need for more randomised clinical trials with robust methodologies and larger sample sizes in the future to substantiate Myrrh as an effective therapy in the treatment of gingivitis.

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