REVIEW ARTICLE

Herbal and Chemical Mouthwashes in Pediatric Population: A Scoping Review

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Abstract

The pediatric population is one of the groups having age-specific oral hygiene requirements. Due to lack of manual dexterity, inability to spit till a certain age, and dependence on the caregiver for the performance of oral hygiene due to various other reasons present challenges in achieving a good oral hygiene score. This, therefore, warrants the use of adjunctive oral hygiene aids such as mouthwashes with therapeutic ingredients in children. Safety concerns over the use of chemical mouthwashes in children call for the need for mouthwashes with a high safety profile. This scoping review is an attempt to review the present literature regarding the interventions involving herbal and chemical mouthwashes and their effect on plaque, gingivitis, and cariogenic microflora in children.

Keywords: Chlorhexidine, Fluoride mouthwash, Herbal.

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Introduction

With the ever-expanding research in the field of preventive dentistry, it becomes pertinent to timely assimilate our knowledge about the utility and safety of various preventive measures. Plaque control by mechanical and chemical methods is of utmost importance to prevent and control dental caries and gingival diseases. Certain factors such as lack of dexterity, individual understanding and motivation restrict the effectiveness of toothbrushing, particularly in children.[1,2] Besides, less accessible areas like subgingival and interproximal areas sometimes require additional adjuncts like chemotherapeutic agents for plaque control.[3] Moreover, literature not only suggests the role of *Streptococcus mutans* in the formation of pit and fissure caries in the primary, mixed, and permanent dentition but also emphasizes the relation of its quantity in the saliva to the number of colonized surfaces, making it absolutely logical to use chemical plaque control methods as an adjunct to mechanical, to decrease the incidence of dental caries.

Although among the chemotherapeutic agents, chlorhexidine is the "gold standard" but certain side effects like brown discoloration, bitter taste, oral mucosal erosion, etc., entail the need to find an alternative agent with similar efficacy yet fewer side effects, consequently shifting the focus to biogenic agents.[4] Substantial number of herbal mouthwashes have achieved encouraging results in the reduction of *S. mutans* count in saliva[5] as well as control of plaque and gingivitis.[6] Herbal mouthwashes are prepared with ingredients from plants with therapeutic components and active agents such as tannins, catechins, and flavonoids,[7] and apart from antimicrobial efficacy can have analgesic, anti-inflammatory, and antioxidant properties.

Numerous herbal extracts such as *Triphala*,[8] *Mangifera indica* leaf,[9] and *Terminalia chebula*[10,11] are known to provide therapeutic benefits in the oral cavity. A perusal of dental literature divulges the fact that the effects of the use of herbal mouthwashes in the general population have been systematically reviewed and meta analyzed[4] but the data available for the pediatric population specifically, has not been compiled yet which makes it implausible to provide comprehensive evidence-based advice to the patients and dental healthcare providers. Hence, this study aimed to conduct a review of available literature to compare the overall effects of herbal mouthwashes on plaque, gingivitis, cariogenic microflora, and oral hygiene status in the pediatric population.

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Materials and Methods

The review of the literature was done with a background to compare the studies involving interventions using herbal mouthwashes in the pediatric population. The review was conducted using electronic databases Google Scholar, Cochrane Database, PubMed, Science Direct, Springer Link, and Scopus. The articles published in English from the year 1995 to January 2020 were screened for clinical trials evaluating the efficacy of herbal mouthwashes on plaque, gingivitis, cariogenic microflora in the pediatric population aged 6–14 years. The search strategy involved the use of the following keywords: herbal, mouthwash, chlorhexidine, pediatric, fluoride, randomized clinical trials. The articles were then selected and screened for relevant studies. The full texts of relevant studies were read independently to exclude the studies which were not eligible.

Literature Review

Randomized Clinical Trials to Evaluate the Efficacy of Herbal Mouthwashes and Chlorhexidine for the Control of Plaque and Gingivitis (Table 1)

Alnouri et al. in a triple-blind randomized clinical trial assessed the efficacy of Aloe as compared to chlorhexidine and placebo. The presence of bradykinase and peptidase in aloe has been proved to be responsible for anti-inflammatory effects. In the study, Aloe was found to perform equivalent to chlorhexidine in improving the gingival health, reducing the plaque, gingival, and bleeding indices.[12]

Hambire et al. compared the effect of 0.5% *Camellia sinensis* extract, 0.05% sodium fluoride, and 0.2% chlorhexidine mouthwashes on the oral health of children. Green tea fared better than NaF and CHX in improving the plaque score, gingival health, and salivary pH. The authors concluded that although green tea is completely safe for ingestion in children, its dosage, concentrations, and long-term effectiveness should be assessed further for patient recommendation.[13]

Mehta et al. conducted a randomized controlled trial to compare the efficacy of a commercially available herbal mouthwash freshol and chlorhexidine against plaque, gingivitis. Freshol was found to be as effective as CHX against plaque and gingivitis.[14]

Ihsan et al. evaluated the efficacy of Fuji apple extract and CHX and found a significant difference in the plaque index before and after rinsing with both Fuji apple extract as well as chlorhexidine. The authors added that the presence of tannins, flavonoids, and catechins was responsible for the antiplaque effect of Fuji apple.[15]

Bhattacharjee in a randomized double-blind study compared 0.6% aqueous extract of triphala to 0.12% CHX and found a significant reduction in plaque and gingival index at the end of 2 weeks in both groups. There was a similar improvement in the gingival health in both groups but more reduction was found for plaque index in the CHX group.[8]

Chewing on neem and mango twigs has been a traditional practice in India. Bhat et al. compared the efficacy of mango leaves with CHX and found CHX to have better antimicrobial efficacy, plaque inhibition but no side effects such as staining and cytotoxicity were observed for mango leaf mouthwash.[9]

Sharma et al. carried out a triple-blind randomized clinical trial to compare the effect of the crude extract of two herbal mouthwashes (neem and mango leaf) and chlorhexidine on the gingival health of school children. A statistically significant reduction ($p < 0.001$) in plaque index and the gingival index was found in all the three mouthwash groups at 21 days, 1 month, and 2 months intervals. Neem and CHX showed comparable plaque scores at 21 days, 1 month, and 2 months, whereas for gingival scores CHX and neem showed equivalent results at 21 days, 1 month with neem scoring better at 2 months.[1]

Bajaj and Tandon's studies compared Triphala mouthwash (0.6%) with 0.1% chlorhexidine over a period of 9 months and observed a progressive decrease in plaque scores and a similar effect on gingival health. A similar inhibitory effect on microbial counts was also found except for *Lactobacillus* counts where Triphala had shown better results than chlorhexidine and they concluded that there was no significant difference between the Triphala and the chlorhexidine mouthwash.[10]

Randomized Clinical Trials to Evaluate the Efficacy of Herbal, Chlorhexidine, and Fluoride Mouthwashes against the Cariogenic Bacteria (Table 2)

Shah et al. evaluated the antimicrobial effect of a commercial mouthwash containing *Terminalia chebula* (Oratreat) and 0.2% CHX against *S. mutans*. The authors found more reduction of colony-forming units (CFUs) in the Oratreat group after 15 days as compared to 0.2% CHX.[17]

Sharma et al. compared Hiora (commercially available Herbal mouthwash), Floritop (200 ppm NaF), and 0.2% chlorhexidine. A significant reduction in *S. mutans* count was found in chlorhexidine and fluoritop group whereas reduction in Hiora group was not statistically significant as compared to caries-free subjects after 15 days.[18]

In a randomized clinical trial, Padiyar et al. compared the effect of garlic extract mouthwash, Triphala mouthwash, and 0.2% CHX mouthwash on *S. mutans* and oral hygiene status. Significant improvement was found in plaque index in all three groups and in the CHX group, the *S. mutans* count dropped significantly more followed by triphala and garlic extract.[19]

Mon et al. evaluated the antibacterial effect of ozonated water (OW), herbal water (Dentas palsas tulsi drops 10 drops in 10 mL of water), and 0.12% chlorhexidine mouthrinses on the oral hygiene status of children. A significant reduction was seen in debris index (DI), calculus index (CI), and oral hygiene index scores (OHI-S) with all the three mouthrinses as compared to water at 15 and 30 days. Ozonated water had a minimum DI score at 15 and 30 days of all the mouthrinses.

Herbal water had minimum CI scores at 15 and 30 days. At 15 days, OW had minimum OHI scores followed by CHX and at 30 days HW had minimum OHI score. At 30 days, *S. mutans* score was found to be minimum for CHX followed by herbal water and OW.[20]

Oznurhan et al. in their study evaluated the effect of 0.2% CHX (positive control), Licorice, and normal saline (negative control) on reducing *S. mutans* levels in children. A statistically significant reduction was seen in *S. mutans* count both in Licorice and CHX group. The authors suggested that if an effective substance in licorice could be prepared as a gargling solution, patients could be safeguarded from side effects of CHX as Licorice was found to be equally effective in reducing *S. mutans* count.[21]

Bhat et al. compared mango leaf mouthwash and CHX mouthwash against salivary *S. mutans*, gingival inflammation, plaque accumulation and found a significant reduction in *S. mutans* count, improved gingival health, and decrease in the plaque index in both the groups but the results were better in CHX group.[9]

Thomas et al. conducted a randomized controlled trial to evaluate the efficacy of green tea and chlorhexidine mouthwash against cariogenic microbes *S. mutans*, Lactobacilli, and *Candida albicans* in children aged 4–6 years with severe early childhood caries. The authors found a significant decrease in colony count for both lactobacilli and *S. mutans*. Green tea was found to be better than CHX against *S. mutans* whereas for lactobacilli CHX fared better. The anticandidal activity was observed in the green tea group though it was not statistically significant. The authors concluded that green tea could serve as a cost-effective mouthwash and should be evaluated further for long-term use.[22]

Another similar study by Hedge et al. compared 0.5% green tea extract with a 0.12% CHX mouthwash and a combination mouthwash of CHX and NaF. A statistically significant reduction

Q4 **Table 1:** Randomized clinical trials to evaluate the efficacy of chlorhexidine and herbal mouthwashes for the control of plaque and gingivitis

1	*Alnouri et al. 1*	*Plaque index*	T_0	T_1 *3rd day*	T_2 *8th day*	*p value*	*Gingival index*	T_0	T_1 *3rd day*	T_2 *8th day*	*p value*	*Conclusion*
Q5		Aloe vera	23.50	23.94	16.50	CHX-0.090, Placebo-0.000 Placebo-0.003	Aloe vera	19.40	24.50	17.88	CHX-0.377, Placebo-0.000 Placebo-0.000	Use of Aloe vera is effective in improving (PI), (GI) in children
		CHX	31.06	33.32	23.91		CHX	35.59	24.50	21.76		
		Placebo	23.44	20.74	30.59		Placebo	23.41	29.00	38.35		

2	*Bhatt et al. 2*	*Plaque index (mean ± SD)*	*½ an hour-5 days difference*	*p value*	*Gingival index (mean ± SD)*	*½ an hour-5 days difference*	*p value*	
		Mango	0.806 ± 0.160	0.001	Mango	0.747 ± 0.115	<0.001	Both the mango leaf and CHX were effective against plaque inhibition, and improved gingival health. CHX showed higher efficacy but mango leaf has antimicrobial activity with no side effects such as dental staining and other cytotoxic effects
		CHX	1.069 ± 0.030	0.001	CHX	1.042 ± 0.042	<0.001	

3	*Bhattacharya et al. 1*	*Plaque index (mean ± SD)*	*Baseline*	*2 weeks*	*p value*	*Gingival index (mean ± SD)*	*Baseline*	*2 weeks*	*p value*	
		Triphala	1.11 ± 0.15	0.76 ± 0.14	<0.001	Triphala	0.93 ± 0.25	0.53 ± 0.16	<0.001	The effectiveness of triphala in the reduction of plaque and gingivitis was comparable to chlorhexidine and can be used for short-term purposes without potential side effects. It is a cost-effective alternative in reducing plaque and gingivitis
		CHX	1.17 ± 0.20	0.73 ± 0.20	<0.001	CHX	0.72 ± 0.20	0.42 ± 0.18	<0.001	

4	*Hambire et al. 1*	*Plaque index (mean ± SD)*	*Baseline*	*2 weeks*	*p value*	*Gingival index (mean ± SD)*	*Baseline*	*2 weeks*	*p value*	
		CHX	1.51 ± 0.04	0.64 ± 0.46	Baseline 0.547	CHX	2.68 ± 1.00	1.17 ± 0.45	Baseline 0.811475	Green tea has a comparable antiplaque efficacy to chlorhexidine when used for a period of 14 days
		NaF	1.50 ± 0.07	1.08 ± 0.5	2 weeks	NaF	2.54 ± 0.85	1.5 ± 0.65	2 weeks	
		C. senensis	1.52 ± 0.05	0.56 ± 0.04	0.016	*C. senensis*	2.34 ± 0.65	1.10 ± 0.05	0.4625	

5	*Ihsan et al. 1*	*Plaque index (mean ± SD)*	*Before rinse*	*After rinse*	*p value*	*Gingival index (mean ± SD)*	*Before rinse*	*After rinse*	
		Fuji apple	32.59 ± 0.39	28.89 ± 0.60	0.20	Fuji apple	–	–	There were differences between plaque index score in the rinsing group with Fuji apple (*Malus sylvestris*) extract 100% and the control group of chlorhexidine 0.2%
		CHX	33.72 ± 0.41	30.62 ± 0.36	0.20	CHX	–	–	

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6	Ratika et al. 1N	Plaque index (mean ± SD)	21 days	30 days	60 days	90 days	p value	Gingival index (mean ± SD)	21 days	30 days	60 days	90 days	p value	
		Neem	0.40 ± 0.33	0.64 ± 0.37	1.23 ± 0.31	1.30 ± 0.29	0.71	Neem	0.30 ± 0.21	0.32 ± 0.21	1.03 ± 0.31	1.25 ± 0.31	0.184	Neem and mango extract have a beneficial effect on oral health. Plaque and gingival scores were reduced in both the experimental mouthwash groups
		Mango	0.61 ± 0.35	1.01 ± 0.28	1.40 ± 0.26	1.44 ± 0.27	0.133	Mango	0.60 ± 0.32	0.65 ± 0.33	1.03 ± 0.26	1.23 ± 0.29	0.101	
		CHX	0.41 ± 0.29	0.78 ± 0.44	1.20 ± 0.21	1.29 ± 0.24	0.112	CHX	0.23 ± 0.23	0.25 ± 0.22	0.76 ± 0.32	1.30 ± 0.24	0.015	
7	Mehta et al. 1	Plaque index (mean ± SD)	Baseline	Final (10 days)	p value	Gingival index (mean ± SD)	Baseline	Final (10 days)	p value					
		Freshol	1.161 ± 0.149	1.055 ± 0.079	<0.001	Freshol	2.119 ± 0.285	1.148 ± 0.302	<0.001					Herbal alternatives like Freshol can prove to be an effective or better alternative to CHX in improving the oral health of the child with minimal side effects
		CHX	1.143 ± 0.153	1.061 ± 0.104	<0.001	CHX	2.235 ± 0.190	1.530 ± 0.326	<0.001					

was found in *S. mutans* and lactobacillus counts in the CHX group followed by green tea and combination mouthwash group. The authors concluded that green tea can be recommended as promising preventive therapy for dental caries worldwide.[23]

Kankariya et al. evaluated the effect of different concentrations of water-soluble azadirachtin (neem metabolite) on *S. mutans* against chlorhexidine and found 40% water-soluble azadirachtin as effective as 0.2% CHX.[24]

In a long-term study (1 year) by Somaraj et al., an effective reduction in *S. mutans* count was achieved using herbal mouthwash comparable to that of fluoride mouthwash. This finding suggests that herbal mouthrinses could show their effect when used over a longer period to produce a definite change in oral microbiota.[25]

Discussion

With the rise in concerns regarding the safety of chemical and synthetic ingredients in various cosmetic and medicinal products; researchers are now looking for herbal alternatives. To bring herbal medicine into the mainstream, it only requires a high-quality drug trial and marketing. The companies abroad spend millions of dollars for drug trials and patents for herbal medicines and the majority of these drugs belong to the Ayurveda, Siddha, and Unani system of medicine in India; also known as bioprospecting of herbal remedies. In the past decade, there has been an upward trend of incorporating herbs in chemical-based oral hygiene aids such as dentifrices and mouthwashes to give them an edge over chemical-based products. Researchers are now focusing on providing complete herbal-based alternatives in dentistry in the form of irrigating solutions, as remedies for oral lesions, dentifrices as well as mouthwashes. The use of traditional medicine holds a great potential to be a harbinger of a new age of cheap and safer drugs. Mouthwashes as an oral hygiene aid are technically less demanding and form an important adjunct to mechanical means specifically in children due to lack of motivation, manual dexterity, and need of supervision.

Chlorhexidine mouthwash has remained the gold standard due to its substantivity, antiplaque, and antimicrobial efficacy. Although due to the shortcomings like staining, discoloration, altered taste sensation, mucosal desquamation, impaired wound healing, anaphylactic reactions (rare), antimicrobial resistance; its long-term and safe use in children has never been advocated. Many clinical trials have also reported the taste of chlorhexidine quite unacceptable to children.[26]

Various other therapeutic mouthwashes containing cetylpyridinium chloride (CPC)[27,28] and essential oil mouthwashes[29–31] have also been evaluated and were found to be efficacious in terms of reducing gingival inflammation, plaque control, and penetration of plaque biofilm. Few studies have also used these mouthwashes as a positive control instead of chlorhexidine to mitigate the side effects in long-term studies. Although these mouthwashes too present with the limitations such as staining in case of CPC though less severe than CHX and safety issues with regard to essential oil mouthwash in children due to the absence of systematic toxicological studies.[32–34]

Fluoride mouthrinses, on the other hand, with established anticariogenic and remineralizing potential are considered as the cornerstone for caries prevention. Early colonization of *S. mutans* in children leads to higher caries incidence in children younger than 4 years. However, the administration of fluoride mouthrinses needs supervision to prevent the events of acute and chronic toxicity due to the risk of ingestion in children younger than 6 years.

Table 2: Randomized clinical trials to evaluate the efficacy of herbal, chlorhexidine and fluoride mouthwashes against the cariogenic bacteria

1	*Mehta et al.*	*CFU's*	*Baseline*	*Final 10 days*	*p value*	
		Freshol	96.7143 ± 70.21629	35.9412 ± 45.71714	0.001	Conclusion Freshol can prove to be an effective or better alternative to CHX in improving the oral health of the child with minimal side effects
		CHX	70.9500 ± 83.37138	28.950 ± 44.01253	0.001	
2	*Shah et al.*	*CFU's*	*Baseline*	*Final 15 days*	*p value*	
		CHX	201.00	24.80	<0.001	0.2% CHX and Oratreat reduce the salivary *S. mutans* count. Oratreat herbal mouthwash has proved to be better as compared to 0.2% CHX
		Oratreat	210.47	4.20	<0.001	
		D. water	220.00	212.87	0.364	
3	*Sharma et al.*	*CFU's*	*Baseline*	*Final 15 days*	*p value*	
		CHX	1.259×10^5	0.214×10^5	0.003	All the mouth rinses used in the study have shown a definite decline in *S. mutans* count.
		Hiora	0.649×10^5	0.297×10^5	0.057	
		NaF	1.624×10^5	0.238×10^5	0.028	
		Plain water	0.795×10^5	0.786×10^5	0.184	
4	*Padiyar et al.*	*CFU's*	*Baseline*	*15 days*	*30 days*	*p value*
		Triphala	8.26×10^5	1.93×10^5	3.10×10^5	<0.001	All the three mouthwashes containing *triphala*, CHX, and garlic were comparably efficient in reducing the salivary *S. mutans* count as well as in limiting plaque score; chlorhexidine was the most effective in this aspect. In the comparison of the two natural ingredients, i.e., *triphala* and garlic, the former is more effective in its antimicrobial effect
		CHX	7.93×10^5	1.24×10^5	2.51×10^5	
		Garlic	7.71×10^5	2.31×10^5	3.30×10^5	
		Control	8.42×10^5	6.03×10^5	8.35×10^5	
5	*Mon et al.*	*CFU's*	*Baseline*	*T_2 15 days*	*T_3 30 days*	*p value*
		Herbal water	19.20 ± 30.5	4.87 ± 3.5	2.87 ± 1.56	<0.001	Herbal water and ozone water can be used as an alternative to CHX in maintaining oral health status. Ozonated water was more effective in reducing debris followed by herbal water and CHX. Herbal water was the only mouth rinse that was found to be effective in reducing calculus. CHX was found to be the most effective in reducing *S. mutans* count
		Ozonated water	12.76 ± 9.7	6.14 ± 4.04	2.23 ± 0.76	<0.001	
		Water	15.41 ± 11.89	17.37 ± 17.25	15.33 ± 3.0	0.42	
		CHX	14.13 ± 12.8	3.043 ± 1.9	1.86 ± 1.74	<0.001	
6	*Oznurhan et al.*	*CFU's*	*Baseline*	*T_1 5 minutes*	*T_2 60 minutes*	*p value*
		CHX	69.26 ± 20.86	89.33 ± 12.88	20.87 ± 12.92		Licorice might be a useful tool for dental procedures and further studies are needed to learn more about the dose of licorice, the ratio of glycyrrhizin, and the duration of dental therapy
		Licorice	39.70 ± 16.18	69.18 ± 14.88	29.47 ± 17.01		
		Saline	23.14 ± 11.27	20.08 ± 10.71	11.03 ± 10.27		
7	*Bhatt et al.*	*CFU's*	*Baseline*	*½ hour*	*5 days*	*p value*
		Mango	–	1203.1	1879.6	<0.001	Both the mango leaf (2%) and CHX (0.12%) were effective against the salivary microbial population. CHX showed higher efficacy than mango leaf but mango leaf has antimicrobial activity with no side effects such as dental staining and other cytotoxic effects when compared to CHX
		CHX	–	1773	2860.4		

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8	*Thomas et al.*		*CFU's*	*Baseline*	*2 weeks*	*p value*	
		CHX	*S. mutans*	4.7×10^7	5.9×10^3	<0.001	Green tea mouth rinse could be a very good cost-effective mouth rinse. Further studies would be beneficial to evaluate any potential adverse effects with long-term use of this mouth rinse.
			Lactobacilli	5.2×10^5	3.9×10^5	<0.001	
			C. albicans	1.7×10^5	3.03×10^5	0.264	
		Green tea					
			S. mutans	2.9×10^8	1.9×10^8	<0.001	
			Lactobacilli	4.9×10^4	2.2×10^4	<0.001	
			C. albicans	6.4×10^4	4.1×10^4	0.264	
9	Kankariya et al.	CHX	Mean ± SD	74.07 ± 10.60	*p* value <0.001		
		40% Neem	Mean ± SD	75.40 ± 10.2			Study concluded that 40% water-soluble azadirachtin is as effective as 0.2% chlorhexidine mouthrinse in reducing the *S. mutans* count in dental plaque

These factors project the need to provide a safer mouthwash for children for caries prevention. India being a low-middle income country, the majority of the population residing in rural areas cannot afford expensive oral hygiene aids. However, herbal products form a definite option against both dental caries and periodontal disease due to low cost, easy accessibility, high safety profile, more palatability, and good antimicrobial efficacy.

The present review is an attempt to summarize the randomized clinical trials done to evaluate the comparative efficacy of herbal mouthwashes with chlorhexidine and fluoride mouthwashes in children. The majority of trials using herbal mouthwashes with triphala, green tea, neem, and Fuji apple were found to be equally effective as compared to chlorhexidine in improving gingival and plaque indices (Table 1).

Studies comparing commercial herbal mouthwashes containing green tea also performed better or equivalent to fluoride and chlorhexidine mouthwashes in reducing *S. mutans* count whereas OW, licorice, garlic, and mango leaf although were found to be less effective but no side effects were reported with the concentrations used (Table 2).

Due to the binding of CHX to soft and hard tissues, its effect seemed to sustain for a longer period of time after discontinuation of mouthwash as compared to herbal mouthwash. In few clinical trials, the immediate effect (within a week of starting the therapy) of CHX was also found to be better than herbal mouthwashes whereas the efficacy of herbal mouthwashes seemed to maturate after a while as was observed in two long-term studies.[23,24] This could be due to the therapeutic and biological properties of bioactive compounds (tannins, catechins, flavonoids) exerting their multiple beneficial effects (antioxidant, antibacterial, immune-modulatory, anti-allergic, radio-protective, anti-inflammatory) underway on oral health by preventing dysbiosis of oral microflora, negating the oxidative stress, stimulating immune response, and episodes of recurrence. The few limitations of this scoping review were that it could only provide an overview of the literature and did not qualitatively assess and combine the data and could not give a definitive answer regarding the prescription of herbal mouthwash over chemical mouthwash in children. However, the information definitely predicts the potential role of herbal mouthwashes in the pediatric population and could also provide the researchers a baseline to conduct further trials using similar or combinations of herbal extracts and substantiate the results in long-term studies.

Conclusion

Within the limitations of this study, it can be concluded that phytotherapeutic agents when compared to chemotherapeutic agents have shown similar anti-microbial and anti-inflammatory properties and still are devoid of side effects of the latter, which makes them superior. In this scoping review, the majority of studies were short-term, more long-term studies (>6 months according to ADA) are therefore required where a mix of herbs could be evaluated for dosage, efficacy, and adverse effects at various concentrations before recommending herbal mouthwashes as a definite alternative to chemical mouthwashes. Also, in these clinical trials, a variety of indices were used to assess the disease level and improvement of oral hygiene it is therefore recommended that further studies must be undertaken uniformly using herbal mouthwashes with proven efficacy against oral microbes. This fact warrants more clinical high-quality investigations in the form of longitudinal studies and RCTs with a good sample size and adequate standardization to yield more conclusive results.

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