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Multi-Center Randomized Trial on The Safety and Efficacy of Herbal Mouthwashes in Preventing Gingivitis

Mohit Kumar Sahu[1], Gitanjali Kashyap[1], Aakansha Pandey[1], Ajita Khichariya[1], Vinay Sagar Verma[1]*

[1]Kamla Institute of Pharmaceutical Sciences, Bhilai, 490020, India

***Corresponding Author E-mail: vinaysagarverma@gmail.com**

Abstract:

Gingivitis is a more common and reversible periodontal disease that mostly happens due to dental plaque build-up and such a periodontal disease is mostly treated using chemical mouthwashes like chlorhexidine, but despite its use in the prevention of the disease, the use of such type of mouthwashes is usually linked to several undesirable side effects. It was a multi-center randomized controlled clinical trial that assessed the safety and effectiveness of herbal mouthwash standardized to prevent gingivitis. Two hundred individuals who had mild to moderate gingivitis were selected in three dental care facilities and then randomly allocated into either the herbal mouthwash or control group to undergo 12 weeks of intervention. Clinical results were measured with the help of the Gingivar Index (GI) and the Plaque Index (PI) at baseline, 4, 8, and 12 weeks and the safety and tolerability measured with the structured adverse-event reporting. The findings showed statistically significant and progressive depressing effects of the herbal mouthwash group on both GI and PI scores relative to the control group at all intervals of the follow-up ($p < 0.001$). Inter-group analysis established that there were better improvements of gingival inflammation and plaque control in those subjects that used the herbal mouthwash. No severe adverse events were mentioned, and mild transient side effects only were noticed, which is a sign of good tolerance. This paper finds that herbal mouthwash is a safe and an effective supplement in the prevention of gingivitis and can be used as an alternative to the traditional chemistry-based mouthwash as a long term means of maintaining oral health.

Keywords: Herbal mouthwash, Gingivitis, Plaque index, Gingival index, Randomized controlled trial

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1.INTRODUCTION

Oral health is a significant constituent to the total well-being and is a very important element in the quality of life [1]. Periodontal diseases are a major public health issue as a form of oral diseases because of their prevalence, chronicity, and their link to other systemic disorders like diabetes mellitus, cardiovascular diseases, and poor pregnancy outcomes [2]. Oral hygiene measures that prevent rather than treat periodontal diseases such as mechanical plaque control and adjunctive use of mouthwashes are thus critical in decreasing the burden of periodontal diseases [3]. There has been a growing interest in natural and plant-based oral care products in recent years and is part of a wider global movement to complementary and alternative medicine [4]. In this scenario, herbal mouthwashes have been revealed as hopeful agents of sustaining the health of the gums, which should undergo stringent scientific assessment of their clinical efficacy and safety [5].

1.1. Background Information

Gingivitis is among the most common periodontal diseases across the globe, which is the inflammation of the gingival tissues caused mainly due to the accumulation of the dental plaque [6]. Gingivitis has clinical manifestations of gingivitis redness and swelling, bleeding on probing, and discomfort. Though gingivitis is not very serious on its initial stages, lack of proper management and control of the condition could lead to its development into periodontitis, a periodontal disease that is destructive and may lead to irreversible loss of attachment, destruction of alveolar bone and consequent loss of teeth [7]. In addition, periodontal inflammation has been progressively associated with systemic health complications, and the reason is the importance of prevention programs and proper management in the early stages [8].

The traditional chemical mouthwashes, especially those that contain chlorhexidine, have long been considered the standard of treatment in the use of chemicals in plaque control because of their wide-spectrum antimicrobial effects. The chronic nature of such agents is, however, often allied with the unwanted side effects such as discoloration of teeth, change in taste, erythema of the oral mucosa and in some instances, dysfunction of the normal oral microbiota. These negative effects reduce patient following and determine their inappropriateness in long-term applications in everyday oral hygiene procedures [9].

As an answer to these drawbacks, herbal mouthwashes have attracted more and more interest as a possible alternative. Plant extracts, including neem (Azadirachta indica), clove (Syzygium aromaticum), tea tree oil (Melaleuca alternifolia), aloe vera (Aloe barbadensis), as well as turmeric

(Curcuma longa), are traditionally associated with antimicrobial properties, anti-inflammatory properties, antioxidant properties and wound-healing properties. These bioactive compounds have the potential to prevent the formation of plaques, to decrease gingival inflammation, and overall oral health that has fewer adverse effects. Although they have increasingly become commercially available and are widely used, scientific validation of the use of herbal mouthwash using well-designed multi-centered randomized clinical studies is still scarce [10].

1.2. Statement of the Problem

Despite the growing focus and acceptance of herbal mouthwashes as safer and natural as opposed to chemical preparations, there is no quality clinical evidence sufficient to indicate their effectiveness in the prevention and treatment of gingivitis. Current literature has limitations because small samples, brief follow-up, or single institutions are the main characteristics of the majority of studies, and it is not always easy to extrapolate the results to different populations and clinical environments. This evidence gap requires an international multi-centered randomized trial that would objectively determine the safety and efficacy of the herbal mouthwashes in the prevention of gingivitis.

1.3. Objectives of the Study

The primary objectives of this study were:

- To determine the effectiveness of herbal mouthwashes in decreasing gingival inflammation and dental plaque deposition in persons with gingivitis.
- To estimate the safety, tolerability, and the occurrence of untoward effects of the routine use of herbal mouthwashes.
- To make comparisons of clinical outcomes in participants who utilized herbal mouthwashes and controls across different clinical centers.

1.4. Hypotheses

- Null Hypothesis (H_0): There is no statistically significant difference in gingival health outcomes, including gingival inflammation and plaque levels, between users of herbal mouthwashes and the control group.
- Alternative Hypothesis (H_1): Herbal mouthwashes significantly reduce gingival inflammation and plaque accumulation compared to the control group.

2. METHODOLOGY

This research was created to produce high-quality and generalizable clinical data on the safety and effectiveness of herbal mouthwashes in the prevention of gingivitis. Standardized protocols were adopted in all the participating centers to maintain methodological rigor and the study design was such that it incorporated randomization and control comparison and did repeated outcome assessments. The research conducted on humans was guided by ethical principles, such as informed consent, participant confidentiality and minimization of risks which were maintained in the course of the investigation.

2.1. Description of Research Design

Multi-center, randomized, controlled clinical trial was done during a 12 weeks period to determine the clinical efficacy of herbal mouthwashes. The research design used was parallel-group design whereby the participants were divided into intervention group and control group and were observed at the same time over the period of the study. The randomization was done using a computer-generated random sequence therefore reducing selection bias. The trial was conducted in accordance with global ethical standards of human research and was approved by institutional ethics committees of the centers involving the trial.

2.2. Participants

They recruited 200 participants in three dental care centers to guarantee the diversity of the population and their clinical features. The target population was adult individuals (18 to 60 years old) with a clinical diagnosis of mild to moderate gingivitis according to usual periodontal indices. People with systemic diseases, those undergoing continuing periodontal therapy, pregnant or lactating women, smokers, and the ones with known hypersensitivity or allergy to herbal ingredients were not allowed to participate in the study to counter confounding factors. After the eligibility screening, the participants were randomly selected and divided into two groups namely the herbal mouthwash group and the control group in the same proportion.

2.3. Instruments and Materials Used

The major intervention was an herbal mouthwash with standardized plant extracts which are antimicrobial and anti-inflammatory in nature. There was a control mouthwash which was a placebo or a regular non-herbal preparation. Clinical measurements were performed by using periodontal indices that had been verified, such as the Gingivial Index (GI) to assess for gingivial

inflammation and Plaque Index (PI) to test dental plaque accumulation. Intraoral assessments were carried out through oral examination kits and structured adverse event reporting form was adopted to record any side effects or discomfort felt by the subjects in the course of the study.

2.4. Procedure and Data Collection Methods

All participants received a thorough oral examination at baseline, with GI and PI scores being documented by trained dental professionals. The participants were then told to wash their mouth with the given mouthwash twice a day according to the standardized oral hygiene instructions until the end of the study. The clinical measures of the changes in the health of the gums and the plaque were followed up at 4, 8, and 12 weeks. Self-reported usage records were used to determine their compliance with the participants and any adverse effects recorded in a systematic way and at every follow-up visit.

2.5. Data Analysis Techniques

Data that were collected were analyzed through statistical software. Demographic characteristics and baseline clinical data were summarized using descriptive statistics, such as means, standard deviations, and percentages. Paired t-tests and analysis of variance (ANOVA) were conducted as inferential statistical tests to compare intra-groups and inter-groups differences in GI and PI scores at different intervals of time. The values short of 0.05 were taken to be statistically significant meaning that there were meaningful differences between the study groups.

3. RESULTS

Among 200 respondents in the study who were initially registered, all respondents had gone through the 12 weeks of follow-up making the study 100 percent in terms of completion. The participants were divided equally into two groups the herbal mouthwash (n = 100) and the control group (n = 100). The baseline demographic and clinical characteristics were similar in the two groups which shows successful randomization. Table 1 demonstrates the demographic profile and initial clinical parameters of the participants in herbal mouthwash and the control group. Age, gender distribution, baseline Gingivial index (GI) and baseline Plaque index (PI) are the variables and they show the comparability of the two groups before the intervention.

Table 1: Baseline Demographic Characteristics of Study Participants

Variable	Herbal Mouthwash Group (n=100)	Control Group (n=100)
Mean Age (years ± SD)	36.8 ± 9.4	37.2 ± 8.9
Gender (Male/Female)	54 / 46	56 / 44
Baseline Gingival Index (GI)	1.84 ± 0.31	1.82 ± 0.29
Baseline Plaque Index (PI)	2.12 ± 0.34	2.10 ± 0.36

The upper and lower demographic and clinical information of the participants of both groups did not show statistically significant differences in age, gender composition, gingivitis, and plaque ($p > 0.05$). The homogeneity serves to indicate successful randomization, and later differences next to the intervention can be explained not by existing disparities, but by the intervention.

3.1. Changes in Gingival Index (GI) Scores

The herbal mouthwash group experienced progressive reduction of gingivitis inflammation in all follow-up visits. Conversely, the control group was only experiencing a slight decrease during the same time. Table 2 is a summary of the mean Gingival Index (GI) scores at baseline and 4-, 8-, and 12-week follow-up of the herbal mouthwash and control groups in terms of mean and standard deviation.

Table 2: Mean Gingival Index Scores at Baseline and Follow-Up Visits

Time Point	Herbal Mouthwash Group (Mean ± SD)	Control Group (Mean ± SD)
Baseline	1.84 ± 0.31	1.82 ± 0.29
4 Weeks	1.32 ± 0.28	1.61 ± 0.30
8 Weeks	1.05 ± 0.25	1.48 ± 0.31
12 Weeks	0.88 ± 0.22	1.36 ± 0.33

It was found that, the scores of Gingival Index decreased steadily in both groups during the 12 weeks study period; although, the extent of the decrease was always higher in the case of the herbal mouthwash group at all-follow-up. The group difference was also increased with longer use time, and it was observed that the herbal mouthwash was more effective in the reduction of gingival inflammation with the length of the use time.

The trend in mean scores of the Gingival Index (GI) at baseline and 12 weeks is depicted in figure 1 in participants who used the herbal mouthwash and control formulation. Herbal mouthwash group shows a steady and stiffer GI score decrease in all follow-up intervals in comparison with control group.

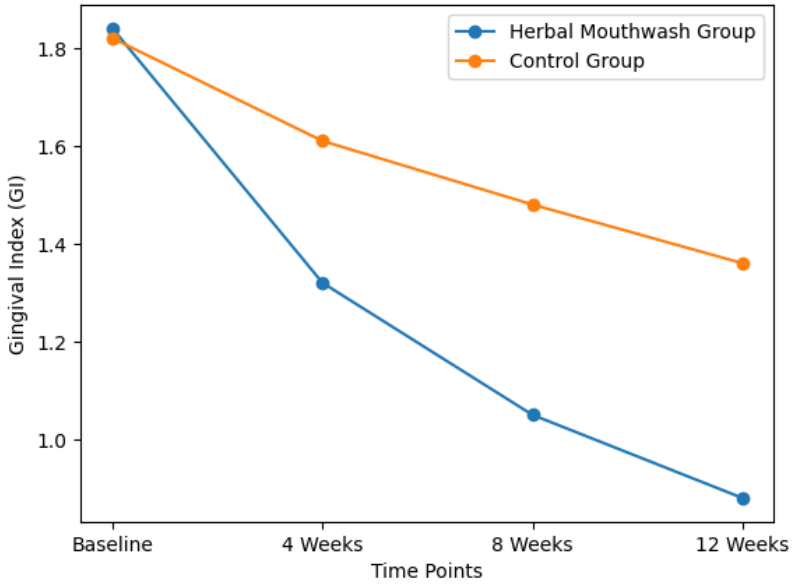

Figure 1: Temporal Changes in Gingival Index Scores in Herbal Mouthwash and Control Groups

A gradual decrease in the Gingival Index marks over the time of the study in the herbal mouthwash group is a sign of significant improvement of gingival health. On the contrary, the control group was characterised by a slower and less noticeable deterioration. This direction indicates that the frequent application of the herbal mouthwash had a higher level of effectiveness in lingual inflammation reduction with time.

3.2. Changes in Plaque Index (PI) Scores

Among the similar trends were accumulation of plaque. The individuals who used the herbal mouthwash showed a strong and steady decrease in PI scores after 12 weeks. Table 3 shows the average scores of the Plaque Index (PI) as mean standard deviation of the Plaque Index at the

baseline, and the 4-, 8-, and 12-week follow-up of the participants in the herbal mouthwash and control experimental groups.

Table 3: Mean Plaque Index Scores at Baseline and Follow-Up Visits

Time Point	Herbal Mouthwash Group (Mean ± SD)	Control Group (Mean ± SD)
Baseline	2.12 ± 0.34	2.10 ± 0.36
4 Weeks	1.63 ± 0.30	1.92 ± 0.35
8 Weeks	1.28 ± 0.27	1.76 ± 0.34
12 Weeks	1.05 ± 0.24	1.62 ± 0.33

The two groups showed that Plaque Index scores had declined during the study time, but the difference between the two groups was that the participants using herbal mouthwash showed significantly higher and consistent covering at each of the follow-up periods. The increases in the mean PI scores across time denote the ability to increase the effectiveness of the plaque control of the herbal formulation compared with the control mouthwash.

Figure 2 shows a comparison between the herbal mouthwash and the control group in terms of changes in mean scores of Plaque Index (PI) at the baseline, 4 weeks, 8 weeks, and 12 weeks. The increased and sustained decrease in the accumulation of the plaque is seen in the herbal mouthwash group over the period of the study.

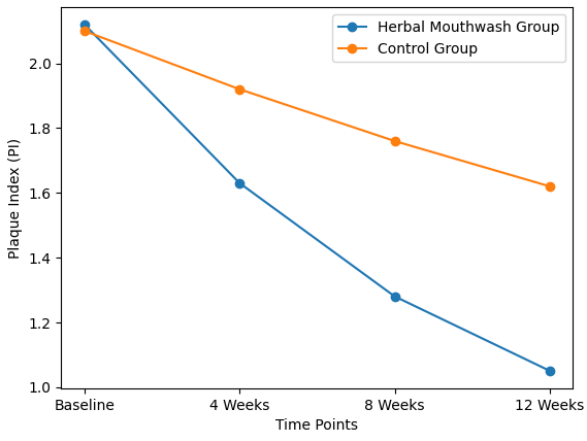

Figure 2: Trend of Plaque Index Reduction Over Time in Study Groups

The line graph shows that there was significant reduction in the plaque accumulation of the participants who used the herbal mouthwash as opposed to the control group. The steady decrease in the PI scores in consecutive follow ups is a pointer of better plaque control activity of the herbal preparation when used regularly.

3.3. Inter-Group Statistical Comparison

The inferential statistical analysis on ANOVA showed statistically significant differences between both groups at 4, 8 and 12 weeks on both GI and PI scores. Table 4 will represent a comparison of means Gingivval Index (GI) and Plaque Index (PI) scores in both herbal mouthwash and control groups made at the end of the 12-week study period with the p-values.

Table 4: Inter-Group Comparison of GI and PI Scores at 12 Weeks

Parameter	Herbal Mouthwash Group (Mean ± SD)	Control Group (Mean ± SD)	p-value
Gingival Index (GI)	0.88 ± 0.22	1.36 ± 0.33	<0.001
Plaque Index (PI)	1.05 ± 0.24	1.62 ± 0.33	<0.001

Compared to the control group, the Gingival Index and Plaque Index scores were significantly reduced at 12 weeks in herbal mouthwash compared to Gingivism control group. The difference between the inter-groups was found to be statistically significant ($p < 0.001$ on both parameters), and the reduction in the level of gingival inflammation and plaque among the participants who used the herbal mouthwash was superior.

Figure 3 is a comparison between mean Gingival Index (GI) and Plaque Index (PI) scores between the control and the herbal mouthwash group at the end of the 12 weeks of study. The herbal mouthwash group is significantly low in both indices.

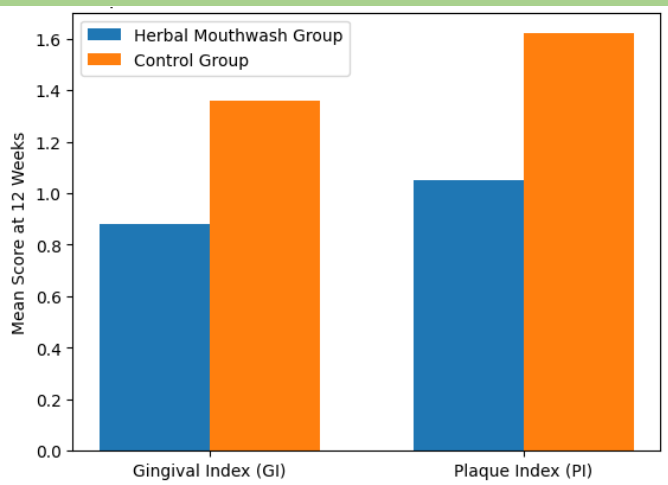

Figure 3: Comparison of Mean Gingival and Plaque Index Scores Between Groups at 12 Weeks

The bar chart reveals that there are considerable differences in the level of gingivitis and the level of plaque built up among the two groups in the end of the study. The reduction in mean GI and PI scores in the herbal mouthwash group strengthens findings of better clinical efficacy in the course of the trial and proves the null hypothesis rejection.

3.4. Safety and Tolerability Outcomes

There were no significant unfavorable outcomes identified in the 12 weeks study among both groups. The proportion of the side effects was insignificant and mild and transient, and did not necessitate any medical intervention or termination of the allocated mouthwash. Burning sensation and slight change in the taste perception were the most frequently reported adverse effects. The symptoms were self-limiting and healed on their own as the study went on which shows that both formulations were tolerated well. Table 5 presents the frequency and percentage of the adverse events reported during the 12-week study period by the participants in the herbal mouthwash and control groups, both of mild and serious occurrence.

Table 5: Distribution of Reported Adverse Effects Among Study Participants

Adverse Effect	Herbal Mouthwash Group (n=100)	Control Group (n=100)
Temporary burning sensation	4 (4%)	6 (6%)
Altered taste sensation	2 (2%)	3 (3%)

Oral irritation	0 (0%)	0 (0%)
Serious adverse events	0 (0%)	0 (0%)
Total participants reporting adverse effects	**6 (6%)**	**9 (9%)**

Both groups of studies had complained of only minor and temporary adverse effects with less incidence in the herbal mouthwash group than in the control group. None of the cases of oral irritation or severe adverse events were observed in either group. Such results show that the herbal mouthwash formulation is safe and tolerable when used normally.

3.5. Statistical Analysis Summary

The statistical significance of changes in the herbal mouthwash group of Gingival Index (GI) and Plaque Index (PI) scores between the baseline and 12 weeks were statistically significant using paired t-tests ($p < 0.001$). Control group on the other hand demonstrated relatively smaller yet all statistically significant reductions in same period. One-way analysis of variance (ANOVA) of inter-group comparisons showed that the degree of gingival inflammation reduction and decrease in plaque accumulation was significantly higher in the herbal mouthwash group compared to control group at all the follow-up periods. The null hypothesis (H_0) was therefore rejected and the alternative hypothesis (H_1) accepted. Table 6 shows the outcomes of intra- and inter-group statistical tests on the scores of Gingival Index (GI) and Plaque Index (PI). Within-group comparisons of changes between baseline and 12 weeks were done using paired t-tests, and inter-group comparisons were done using one-way analysis of variance (ANOVA).

Table 6: Summary of Intra-Group and Inter-Group Statistical Analysis

Parameter	Statistical Test	Herbal Mouthwash Group (p-value)	Control Group (p-value)	Inter-Group Comparison (ANOVA p-value)
Gingival Index (GI)	Paired t-test	< 0.001	< 0.05	< 0.001
Plaque Index (PI)	Paired t-test	< 0.001	< 0.05	< 0.001

The statistical results showed a significant decrease in the scores of both Gingivall Index and Plaque Index groups in the herbal mouthwash group ($p < 0.001$) with substantial significance. Though the control group too had statistically significant improvements, the extent of change was less. The inter-group comparison of the clinical parameters showed a significant difference in both parameters as per the herbal mouth wash group ($p < 0.001$) which represented the rejection of the null hypothesis.

4. DISCUSSION

The Discussion section is intended to critically examine and put into perspective the findings of the current research in connection with the mentioned objective, hypotheses, and existing scientific body. Through interpretation of the observed clinical outcomes, comparison with other previous studies, and the general implications of the same, this section aims to show how the study has contributed to the existing body of knowledge on the use of herbal mouthwashes in chronic gingivitis management. Also, the strengths, limitations, and future researches are discussed so as to present the totality of the relevance and applicability of the study.

4.1. Interpretation of Results

The current multi-center randomized controlled trial gives convincing evidence that herbal mouthwash works well in the reduction of gingivitis inflammation as well as dental plaque among patients with mild to moderate gingivitis. The improvement in Gingival Index (GI) and Plaque Index (PI) scores of participants who used the herbal mouthwash was statistically significant and consistent at all the follow up periods of the study as compared to the control group. The fact that there was a progressive decrease in the period during which the study was carried out (12 weeks) indicates a lasting therapeutic effect than a temporary enhancement effect.

The degree of decrease in GI and PI scores was much higher in herbal mouthwash group and this was corroborated by inter-group ANOVA scores. These results show that the herbal formulation does not only promote the health of the gingivae but also it is more effective in plaque control, in comparison to the control formulation. Also, the fact that mild and self-limiting adverse effects have low rates and no major safety issues are reported indicates the positive safety and tolerability profile of the herbal mouthwash. As a whole, these findings allow to reject the null hypothesis and accept the alternative hypothesis and declare the clinical effectiveness of herbal mouthwash in the prevention of gingivitis.

4.2. Comparison with Existing Studies

The results of this study are in line with and contribute to the amount of literature available on the use of herbal agents in periodontal care. The study by Rahman et al. (2023) has indicated that the anti-inflammatory effect of a herbal combination is suitable because it has shown a considerable reduction in gingival inflammation when Nigella sativa oil is used in the randomized clinical trial. Likewise, the systematic review conducted by Safiaghdam et al. (2018) has found several medicinal plants possessing anti-gingivitis effect, but stated that further clinical trials should be designed to prove their effectiveness.

As reported in comparative clinical studies, like that of Shah et al., chlorhexidine-based mouth rinses have shown to have good gingival effects although with a higher rate of adverse effects. The reviews by Soesanto et al. (2023) also stated promising efficacy of herbal mouthwashes of similar quality as chlorhexidine but emphasized the dearth of long-term randomized data. Moreover, Tartaglia et al. (2019) have found that chemical mouthrinses are commonly linked to adverse events in the case of long-term use.

Table 7: Comparative Analysis of Recent Clinical Studies on Herbal Mouthwashes and Gingivitis Management

Author(s) & Year	Objective	Method Used	Key Findings	Superiority of Present Study
Rahman et al., 2023 [11]	To evaluate the efficacy of Nigella sativa oil in the treatment of gingivitis	Randomized active-control clinical trial	Nigella sativa oil significantly reduced gingival inflammation compared to control	The present study expands beyond a single herbal agent by evaluating a standardized multi-herbal mouthwash across multiple centers with repeated outcome assessments
Safiaghdam et al., 2018 [12]	To review medicinal plants used for gingivitis management	Systematic review of clinical trials	Identified several medicinal plants with anti-gingivitis potential but noted lack of high-quality trials	Unlike this review, the present study provides direct clinical evidence through a randomized, controlled, multi-center trial design
Shah et al., Year not specified [13]	To compare chlorhexidine and hyaluronic acid	Prospective, open-label, multi-center	Both formulations improved gingival health, with	The present study demonstrates comparable gingival improvement

	mouth rinses for post-surgical gum health	comparative study	chlorhexidine showing higher efficacy but associated side effects	using herbal formulations with fewer adverse effects, supporting long-term safety
Soesanto et al., 2023 [14]	To assess whether herbal mouthwashes are as effective as chlorhexidine	Narrative review of comparative studies	Concluded that herbal mouthwashes show promising efficacy but emphasized need for stronger clinical evidence	The present study addresses this gap by providing statistically validated clinical outcomes over a 12-week period
Tartaglia et al., 2019 [15]	To assess adverse events associated with home use of mouthrinses	Systematic review of safety data	Reported higher incidence of adverse effects with chemical mouthrinses	The present study confirms superior tolerability of herbal mouthwash with no serious adverse events in a controlled clinical setting

The current investigation can be considered to have overcome some of the weaknesses identified in earlier studies such as multi-center randomized controlled design, larger sample size, standard outcome measures, and repeated measures at a longer follow-up. This study, as summarized in Table 7, adds more clinical evidence to the effectiveness and safety of herbal mouthwashes and thus make the current knowledge go beyond observational studies and short-term studies.

4.3. Implications of Findings

The implications of the findings of this research are valuable clinical and community health. Herbal mouthwashes could be used as effective and safer substitutes to traditional chemical based mouthwashes especially when used on a daily basis. Considering their reduced occurrence of any side effects, and similar effectiveness in minimizing gingival inflammation and plaque build-up, herbal preparations can enhance compliance and satisfaction of the patients.

This might prevent the impact of gingivitis and possibly the development of periodontitis since the use of herbal mouthwashes in daily oral care may be adopted as a preventive measure to slow down the disease. The multi-center aspect of the study also implies that the same can be used in various clinical settings where herbal mouthwashes can be widely implemented as part of community and clinical oral health programs.

4.4. Limitations of the Study

The study has some weaknesses, albeit, strength notwithstanding. The study period was restricted to 12 weeks; this does not allow the evaluation of the long-term effectiveness and safety. One standardized herbal formulation was also tested in the study, thus, the results cannot be generalized to all commercially available herbal mouthwaches of different formulations and different concentrations.

Moreover, microbiological evaluation of plaque samples was not conducted, which would have given more information on the antimicrobial processes that led to clinical improvements observed. The compliance of the participants was measured by self-report, which can be prejudiced to reporting bias.

4.5. Suggestions for Future Research

The future research ought to be conducted in the form of long-term clinical trials to assess long-term effects of herbal mouthwashes. Relative efficacy studies and direct comparisons with gold-standard chemical mouthwashes like chlorhexidine would provide further insight into relative efficacy and safety profiles.

Inclusion of microbiological and biochemical studies can also be used to explain the mechanism of action of herbal constituents on a molecular basis. Also, future research should use larger and more diverse populations, including people with systemic conditions linked to periodontal disease, to make future research more generalized and clinical relevance.

5. CONCLUSION

In this section, the key findings of the research are summarized and their application to clinical practice and future research identified. Through the synthesis of the major results, a clear evaluation of the extensive meaning of the research, and practical suggestions, the conclusion presents the complete closure of the study on the safety and effectiveness of herbal mouthwashes in the prevention of gingivitis.

5.1. Summary of Key Findings

The current multi-center randomized controlled trial showed that routine topical administration of a standardized herbal mouthwash led to a substantial decrease in the levels of inflammation of the gums and dental plaque build-up among patients with mild and moderate levels of gingivitis. The herbal mouthwash group participants demonstrated significantly higher improvements in the scores of both Gingival Index and Plaque Index through all the follow-up periods than the control

group. It was also established in the study that the herbal mouthwash was well tolerated with no serious adverse events and mild and short-term side effects were reported in a small percentage of study participants.

5.2. Significance of the Study

This paper creates strong clinical justifications that herbal mouthwashes are safe and effective in the prevention of gingivitis as adjuncts. The study fills the key gaps that have been found in the past studies by using a multi-center randomized controlled design, standardizing clinical indices, and a thorough safety evaluation. The conclusions can make a valuable contribution to the existing bulk of evidence supporting the notion of the incorporation of scientifically tested herbal preparations into the popular preventive dentistry practice.

5.3. Final Thoughts or Recommendations

Given the clinically significant advantages and positive safety profile, herbal mouthwashes can be suggested as the appropriate substitutes to the traditional chemical mouthwashes, especially in cases of their long-term daily use. The dental practitioners can also include the aspect of using herbal mouth washes as a part of the routine oral hygiene plans of patients with gingivitis. It is recommended that further long-term and comparative studies need to be strengthened to reinforce clinical guidelines and increase the use of herbal oral care product in preventive dentistry.

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