

Honey as an Adjunct in Dental Plaque, Gingivitis, and *Streptococcus mutans* Control: A Narrative Review of Clinical Evidence

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ABSTRACT

Background: Honey possesses well-established *in vitro* antibacterial and antibiofilm properties against cariogenic and periodontopathic bacteria. However, most narrative reviews have concentrated on mechanistic and laboratory findings. To date, no narrative review has specifically consolidated clinical trial evidence regarding the effects of honey on dental plaque, gingival inflammation, and *Streptococcus mutans* counts.

Objective: This review summarizes clinical trial evidence on the effectiveness of honey, administered as a mouthrinse, chewable, or topical adjunct, in reducing dental plaque accumulation, gingivitis, and *S. mutans* counts. **Methods:** A single reviewer conducted a structured literature search across PubMed/MEDLINE, Scopus, and Google Scholar (2004-2025) using combinations of the terms honey, manuka honey, dental plaque, gingivitis, and *Streptococcus mutans*. The search was limited to human randomized or controlled clinical trials published in English. Results were synthesized in a narrative, theme-based manner. **Results:** The identified trials indicate that honey, particularly manuka and forest or multifloral variants, consistently reduced plaque scores, gingival indices, and *S. mutans* counts compared to no treatment or water controls, and often performed similarly to 0.2% chlorhexidine. However, results were inconsistent; one pilot trial reported no antiplaque benefit of honey rinsing over saline without mechanical oral hygiene. Variability in honey type, concentration, delivery method, and follow-up duration limited direct comparisons across studies.

Conclusion: Although the clinical evidence remains limited and heterogeneous, it generally supports honey as an encouraging, low-cost, low side-effect adjunct to mechanical oral hygiene for controlling plaque, gingivitis, and *S. mutans*, with efficacy comparable to chlorhexidine in several trials. Standardized, adequately powered randomized controlled trials, ideally adding to a future systematic review and meta-analysis, are necessary to confirm these outcomes and inform practical guidelines.

Keywords: honey; dental plaque; gingivitis; *Streptococcus mutans*; narrative review; chlorhexidine

INTRODUCTION

Dental plaque is a structured microbial biofilm that, if not regularly disrupted, can initiate gingivitis and, over time, contribute to dental caries and periodontal disease. *Streptococcus mutans* is recognized as the principal cariogenic organism in this biofilm because of its acidogenic and aciduric characteristics. Mechanical plaque control via toothbrushing remains the primary preventive strategy; however, chemical adjuncts, particularly chlorhexidine (CHX) mouthwash, are frequently recommended to enhance oral hygiene. Despite their efficacy, these agents are associated with adverse effects such as staining, altered taste, and mucosal irritation during prolonged use.

Honey has garnered renewed attention as a natural adjunct in oral care. *In vitro* studies attribute its antibacterial and antibiofilm activities to multiple mechanisms, including hydrogen peroxide production, low pH, high osmolarity, polyphenols, and bioactive peptides, with demonstrated inhibitory effects on *S. mutans* and *Lactobacillus* species [1,2]. Two recent narrative reviews have summarized this evidence [1,2]; however, both focus primarily on mechanistic and *in vitro* findings and do not consolidate the expanding body of clinical trials evaluating honey's effects on plaque, gingival inflammation, and *S. mutans* counts into a coherent clinical evidence base.

Separate systematic reviews have examined honey for oral ulcerative lesions, such as chemotherapy- or radiotherapy-induced mucositis and aphthous stomatitis, which represent distinct clinical questions not addressed in this review.

The objective of this narrative review is to synthesize and critically appraise clinical trial evidence regarding the effectiveness of honey, administered as a mouthrinse, chewable, or topical application, in reducing dental plaque accumulation, gingival inflammation, and *S. mutans* counts. It compares these interventions with no treatment, placebo, or active comparators such as chlorhexidine and xylitol. This review also identifies practical implications and gaps to inform future research.

METHODS

This review is narrative rather than systematic; therefore, it does not follow the PRISMA 2020 guidelines or require dual independent reviewers. Nevertheless, we implemented a structured search strategy to enhance transparency and minimize selection bias. Searches were conducted in PubMed/MEDLINE, Scopus, and Google Scholar using combinations of the terms “honey”, “manuka honey”, “dental plaque”, “gingivitis”, and “*Streptococcus*

mutans”, limited to studies published in English from 2004 to 2025. Eligible studies included randomized or controlled clinical trials involving human participants of any age, in which honey was administered in any form (mouthrinse, chewable, or topical) and at least one of the following outcomes was reported: plaque index, gingival index, or *S. mutans* count. *In vitro* and animal studies, as well as trials focusing exclusively on honey for oral ulcers or mucositis, were excluded because these topics are addressed by existing systematic reviews on separate clinical questions.

A single reviewer conducted both the search and study selection processes. This limitation is explicitly acknowledged, in accordance with the SANRA (Scale for the Assessment of Narrative Review Articles) recommendation that narrative reviews transparently disclose their search methodology and be interpreted in that context. Findings are synthesized thematically rather than statistically pooled.

REVIEW OF CLINICAL EVIDENCE

Table 1 summarizes the nine clinical trials identified for this review, in the order discussed in the thematic synthesis below.

TABLE 1: Summary of Clinical Trials on Honey for Dental Plaque, Gingivitis, and Streptococcus Mutans Control.

Study (Author, Year)	Country	Design /N	Honey Type & Delivery	Comparator (S)	Duration	Key Finding
Nayak et al., 2010 [3]	India	Parallel RCT, N=60	Manuka honey, topical (sulcus application)	0.2% CHX; xylitol gum	72 hours	Plaque score: manuka honey (1.37) $\approx$ CHX (1.35); both significantly lower than xylitol gum (1.57), $p = 0.004$
Jain et al., 2015 [4]	India	Parallel RCT, N=90	Honey, topical (sulcus application)	0.2% CHX; CHX + xylitol	30 days	Honey and CHX+xylitol groups showed significantly greater plaque reduction than CHX alone at 15 and 30 days.
Singhal et al., 2018 [5]	India	Field RCT, children 12–15 y	40% Manuka & 20% Raw Honey, Mouthrinse	0.2% CHX	21 days (evaluated at day 22 & 28)	All groups: significant $\downarrow$ plaque & gingival scores ($p < 0.001$); manuka $\approx$ raw honey; CHX showed greatest reduction
Yasmin et al., 2020 [6]	Indonesia	Controlled trial, N=52, children 9–12 y	10% forest honey, mouth rinse	DISTILLED WATER	4 days	Significant reduction in plaque score vs. water control ($p < 0.001$)
Husna et al., 2025[7]	Indonesia	Quasi-experimental, N=40, orthodontic patients	10% forest honey, gargle	DISTILLED WATER	4, 6, 8 days	Significant $\downarrow$ orthodontic plaque index at 6 and 8 days; not significant at 4 days

Study (Author, Year)	Country	Design /N	Honey Type & Delivery	Comparator (S)	Duration	Key Finding
Reduan et al., 2025 [8]	Malaysia	Pilot RCT, N=30, no brushing	20% stingless bee honey, mouth rinse	0.12% CHX; saline	3 days	No significant difference in plaque vs. saline; CHX significantly reduced plaque. Honey rated with better taste and lower burning sensation
Abullais et al., 2022 [9]	Saudi Arabia	Parallel RCT, N=45	Manuka honey, mouth rinse	0.2% CHX; probiotic rinse	14 days (evaluated up to 28 days)	No significant differences between manuka and CHX for plaque, gingival, or bleeding index at all time points
Atwa et al., 2014 [10]	Egypt	RCT, N=20, orthodontic patients	Honey, chewing	10% sucrose; 10% sorbitol	Single exposure (0–30 min)	Plaque pH stayed above 5.5 (unlike sucrose); significantly ↓ S. mutans, Lactobacilli, P. gingivalis counts. (p ≤ 0.001)
Sruthi et al., 2021 [11]	India	Parallel RCT, N=60, children 12–15 y	Manuka honey (UMF > 15), mouth rinse	0.2% CHX	14 days	No significant differences between manuka honey and CHX; both significantly reduced plaque, gingivitis, and salivary S. mutans counts. (p < 0.01)

CHX = chlorhexidine; RCT = randomized controlled trial. Reference numbers correspond to the References section.

Effect of Honey on Dental Plaque

Several controlled trials report reduced plaque scores after honey use. In a study of 60 dental students, mean plaque scores after 72 hours without mechanical hygiene were 1.37 in the manuka honey group and 1.35 in the 0.2% chlorhexidine group, both significantly lower than the 1.57 recorded in the xylitol chewing-gum group (ANOVA $F = 5.99$, $p = 0.004$), indicating that manuka honey's antiplaque effect was statistically indistinguishable from chlorhexidine and superior to xylitol gum [3]. In a 30-day randomized trial of 90 dental students comparing honey, chlorhexidine alone, and chlorhexidine plus xylitol, post-hoc analysis showed that the honey group and the chlorhexidine-plus-xylitol group achieved significantly greater plaque reduction than chlorhexidine alone at both 15 and 30 days [4]. A double-blind field trial in 12-15-year-old schoolchildren comparing manuka honey, raw honey, and chlorhexidine mouthwashes found statistically significant reductions in plaque scores in all three groups by days 22 and 28; manuka and raw honey performed equivalently, while chlorhexidine produced the greatest overall reduction [5]. Two Indonesian trials of 10% forest honey mouthrinse likewise reported reductions in plaque scores in children and fixed-orthodontic patients, though the effect in the orthodontic-patient trial reached statistical significance only after 6-8 days of rinsing, not after 4 days, suggesting a duration-dependent effect [6,7].

Not all evidence is uniformly favorable. A 2025 pilot randomized trial testing stingless bee honey rinse without any mechanical oral hygiene for three days found no significant difference in plaque accumulation between the honey and saline groups, while chlorhexidine produced a significant reduction versus baseline; honey was, however, rated more favorably for taste and less burning sensation than chlorhexidine [8]. This finding indicates that honey's antiplaque benefit may depend on formulation, concentration, and duration of use, and should not be assumed to substitute for mechanical hygiene or chlorhexidine when used alone over very short periods.

Effect of Honey on Gingival Inflammation

Gingival index outcomes broadly mirror the plaque findings. In the school-children field trial described above, gingival scores improved significantly in all three mouthwash groups (manuka honey, raw honey, chlorhexidine) by day 28 [5]. In a randomized trial of 45 adults with chronic gingivitis comparing chlorhexidine, a commercial manuka honey mouthwash, and a probiotic mouthwash over 28 days, no statistically significant differences were observed between the chlorhexidine and manuka groups across plaque index, gingival index, or bleeding index at any time point, leading the authors to conclude that manuka mouthwash was as effective as chlorhexidine for managing chronic gingivitis [9].

A pH-kinetics study in orthodontic patients further showed that, unlike 10% sucrose, chewing honey did not depress plaque pH below the critical demineralization threshold of 5.5, with pH recovering within 10-20 minutes of exposure - a biologically plausible mechanism consistent with a favorable effect on the plaque-driven inflammatory cascade underlying gingivitis [10].

Effect of Honey on *Streptococcus mutans* Counts

Fewer trials report microbiological outcomes, but available data are broadly consistent with the clinical findings above. In the orthodontic pH-kinetics trial, bacterial counts recovered from plaque - including *S. mutans*, *Lactobacilli*, and *Porphyromonas gingivalis* - were significantly reduced in the honey group compared with sucrose- and sorbitol-exposed groups ($p \leq 0.001$), alongside honey's demonstrated *in vitro* antibacterial activity against common oral pathogens [10]. A separate randomized trial in 60 children specifically compared manuka honey (UMF > 15) with 0.2% chlorhexidine mouthwash over 14 days, demonstrating statistically equivalent reductions in both gingival scores and salivary *S. mutans* colony counts at days 7 and 14 ($p < 0.01$ within groups, $p > 0.05$ between groups), highlighting manuka honey as a comparable natural alternative without chlorhexidine's long-term side effects [11].

Honey versus Active Comparators

Across the trials reviewed, honey - especially manuka honey - most often performed comparably to 0.2% chlorhexidine, occasionally outperforming chlorhexidine alone in plaque reduction over 15-30 days [4], and occasionally underperforming it, with chlorhexidine retaining a modest edge in some head-to-head comparisons [5]. This pattern parallels findings from the broader literature on herbal/natural mouthwashes: a systematic review and meta-analysis of 13 RCTs on herbal mouthwashes for gingivitis found significant benefit over placebo across multiple plaque and gingival indices (Quigley-Hein Plaque Index weighted mean difference -0.61, 95% CI -0.80 to -0.42; Gingival Index -0.28; Modified Gingival Index -0.59; Gingival Bleeding Index -0.06; all $p \leq 0.02$), but no significant difference compared with chlorhexidine [12]. Honey therefore appears to fit within a wider class of natural agents that are generally superior to no treatment and roughly comparable to, rather than consistently superior to, the chlorhexidine gold standard.

Variability by Honey Type and Delivery Method

• Manuka versus multifloral/forest honey

Where directly compared, manuka and raw/multifloral honey produced statistically equivalent reductions in plaque and gingival scores [5], suggesting that antiplaque and anti-gingivitis benefits are not exclusive to manuka honey's characteristic methylglyoxal content, although most trials using diluted (e.g., 10%) forest honey still relied on non-manuka floral sources with apparently adequate effect [6,7].

• Delivery method: rinse, chew, or topical

Chewing honey directly (as in the orthodontic pH-kinetics trial) [10], applying it topically into the gingival sulcus [3,4], and rinsing with diluted or undiluted honey solutions [7] have all shown measurable effects, but studies differ substantially in concentration (from 10% aqueous solutions to undiluted commercial mouthwashes), contact time, and frequency of use, making direct comparison of delivery methods difficult without a formal meta-analysis.

Methodological Quality Considerations

The identified trials are generally small (sample sizes ranging from approximately 20 to 95 participants), of short duration (3 to 30 days), and use heterogeneous outcome instruments (e.g., Quigley-Hein/Turesky-Gilmore-Glickman plaque index, Silness-Loe plaque and gingival indices, Loe-Silness gingival index, or study-specific orthodontic plaque indices). Honey concentration and floral source are inconsistently reported and rarely standardized, and few trials appear to have been prospectively registered. Formal risk-of-bias scoring (e.g., Cochrane RoB 2) was outside the scope of this narrative review, but the variability in blinding, allocation concealment reporting, and follow-up duration across studies should be considered when interpreting the consistency of the findings above.

DISCUSSION

Taken together, clinical trial evidence spanning more than a decade and multiple countries provides reasonably consistent, though not unanimous, support for honey as a biologically plausible and clinically measurable adjunct for reducing dental plaque, gingival inflammation, and *S. mutans* counts. In most head-to-head trials, honey - particularly manuka honey - performed comparably to chlorhexidine, positioning it as an attractive low-cost, low-side-effect alternative or adjunct, especially for patients who cannot tolerate chlorhexidine's staining or taste alteration over prolonged use. At the same time, the one identified trial testing honey without any mechanical oral hygiene over a very short period found no antiplaque advantage over saline, underscoring that honey should currently be regarded as an adjunct to, not a replacement for, mechanical plaque control.

This review adds to the existing literature by shifting the focus from the mechanistic, in-vitro emphasis of prior narrative reviews [1,2] to a synthesis specifically organized around clinical plaque, gingivitis, and *S. mutans* outcomes - a synthesis that, to the best of the author's search, has not previously been assembled as a coherent narrative. It remains distinct from systematic review evidence on honey for oral ulcerative lesions and mucositis, which addresses a different clinical population and outcome set entirely.

This review has clear limitations inherent to the narrative format: search and selection were conducted by a single reviewer without a PRISMA-compliant flow diagram or dual screening, no formal

risk-of-bias tool was applied, and findings were synthesized qualitatively rather than statistically pooled, precluding any quantitative estimate of overall effect size. Given the heterogeneity but general consistency of direction across the identified trials, a fully registered systematic review and meta-analysis - pooling standardized mean differences across plaque, gingival, and microbiological outcomes - represents a logical and valuable next step to quantify honey's clinical effectiveness with greater precision.

CONCLUSIONS

Current clinical trial evidence, while limited in volume and methodologically heterogeneous, generally supports honey - particularly manuka and forest/multifloral variants, administered as a mouthrinse, chewable, or topical application - as an effective adjunct for reducing dental plaque accumulation, gingival inflammation, and *Streptococcus mutans* counts, with efficacy frequently comparable to 0.2% chlorhexidine. Honey cannot yet be recommended as a replacement for established mechanical and chemical plaque-control measures, and its benefit appears dependent on formulation, concentration, and duration of use. Larger, standardized, and prospectively registered randomized controlled trials are needed, ideally feeding into a future systematic review and meta-analysis, to confirm these findings and to establish practical clinical guidelines for honey's use in preventive dentistry.

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