International Journal of Web of Multidisciplinary Studies
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
website: https://ijwos.com OPEN ACCESS E-ISSN : 3049-2424
Volume 3 Issue 7 , July 2026 DOI: https://doi.org/10.71366/ijwos03072696927

Propolis Supplementation for Glycemic Control and Inflammation in Type 2 Diabetes Mellitus: A Review

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Article Info

Article History:

Published: 21 July 2026

Publication Issue:
Volume 3, Issue 7
July-2026

Page Number:
441-448

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Abstract:

Propolis contains polyphenols and other bioactive compounds with antioxidant and immunomodulatory activity, but its clinical value in type 2 diabetes mellitus (T2DM) remains uncertain because products, doses, outcomes, and reporting vary substantially. The aim of this review was to critically synthesize evidence on propolis supplementation for glycemic control and inflammation in adults with T2DM, with particular attention to direct comparison with standard medication. This structured narrative review reorganized 16 records from google scholar and semantic scholar database. Most placebo-controlled trials reported improvements in one or more glycemic indices, although null findings also occurred. Effects on inflammatory markers were less consistent. A single 36-participant, 12-week trial compared propolis (600 mg/day) with metformin (1,700 mg/day); both groups improved from baseline, but the study was not designed to demonstrate equivalence or non-inferiority. Recent meta-analyses suggest small average reductions in fasting glucose and HbA1c, with substantial clinical and methodological heterogeneity. Propolis supports a clinical research hypothesis as an adjunctive nutraceutical, not an established alternative to diabetes medication. Larger preregistered trials using chemically standardized products, clinically meaningful endpoints, adequate safety monitoring, and active-comparator designs are needed.

Keywords: Propolis; type 2 diabetes mellitus; glycemic control; inflammation; metformin; nutraceutical; randomized controlled trial

1. Introduction

Type 2 diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia arising from variable combinations of insulin resistance and progressive pancreatic β-cell dysfunction. Sustained glycemic exposure contributes to microvascular and macrovascular complications, making individualized lifestyle management and evidence-based pharmacotherapy the foundation of care [1,2]. Low-grade inflammation is not merely an associated finding: innate immune activation, adipose-tissue inflammation, oxidative stress, and cytokine signaling can reinforce insulin resistance and β-cell stress [3].

Propolis is a resinous material produced by bees from plant exudates and modified with wax and salivary enzymes. It contains phenolic acids, flavonoids, terpenoids, and other constituents, but composition varies with botanical source, geography, season, bee species, extraction method, and manufacturing conditions. Consequently, “propolis” should not be treated as a chemically uniform intervention, and biological findings cannot automatically be generalized across products [4].

Clinical studies have examined propolis as an adjunct to usual diabetes care, principally because antioxidant and immunomodulatory effects might influence glycemic regulation and metabolic inflammation. The published trials, however, use different products (including Iranian, Chinese, and Brazilian green propolis), doses of approximately

400–1,500 mg/day, treatment periods from 8 weeks to 6 months, and diverse outcomes. Some source records also appear to describe overlapping cohorts or secondary analyses. These features complicate causal interpretation and make a simple question whether propolis performs as well as standard medication difficult to answer.

This review therefore evaluates the direction, consistency, and clinical meaning of reported glycemic and inflammatory effects; separates placebo-controlled evidence from direct active-comparator evidence; identifies likely overlap and reporting limitations; and defines research needed before propolis could be considered a clinically reliable adjunct. The review does not assess propolis as a substitute for established diabetes treatment.

2. Review methodology

2.1 Design and review question

A structured narrative-review design was used by using google scholar and semantic scholar database [5]. The SANRA framework informed attention to the review's importance, aims, search description, referencing, scientific reasoning, and presentation of relevant endpoint data [6]. The guiding question was: in adults with T2DM, what clinical evidence supports propolis supplementation for glycemic control and inflammatory outcomes, and how does that evidence compare with standard glucose-lowering medication?

2.2 Evidence discovery and eligibility

The source report are collected from google scholar and semantic scholar database [7]. The report did not provide a search date, complete Boolean strategy, deduplication log, names or number of independent screeners, protocol registration, or full-text exclusion list. Those details were not reconstructed by assumption. Eligible evidence comprised adult human studies of propolis in T2DM reporting glycemic, insulin-resistance, inflammatory, or related oxidative-stress outcomes; systematic reviews and meta-analyses were used as contextual syntheses rather than counted as new primary trials.

2.3 Evidence classification and synthesis

Records were classified as (i) primary randomized or controlled clinical trials; (ii) systematic reviews/meta-analyses; (iii) commentaries or evidence summaries; or (iv) incomplete, mismatched, or potentially overlapping records. Extracted variables included intervention source and dose, comparator, duration, sample size, glycemic outcomes, inflammatory outcomes, safety reporting, and limitations. The synthesis prioritized between-group findings, consistency across studies, directness to the comparison question, product characterization, and whether a result came from an independent cohort [8]. Accordingly, quotation-style evidence tokens from the source report were removed, and uncertain records were not silently completed.

3. Clinical evidence base

3.1 Study characteristics

The core evidence consists mainly of small randomized trials conducted in Iran and China, with one study of Brazilian green propolis and one trial in patients receiving periodontal therapy. Most studies compared propolis with placebo while background diabetes care continued. Only the Ochoa-Morales trial included metformin as an active comparator. Table 1 summarizes the traceable primary studies; incomplete or likely overlapping source records are discussed separately rather than counted as independent trials.

Table 1. Principal clinical studies of propolis supplementation in adults with type 2 diabetes mellitus

Study	n	Intervention	Comparator	Duration	Interpretation / main limitation

Yousefi, 2023 [9]	60	Iranian propolis, 1,500 mg/day	Placebo	8 weeks	Improved FBG, insulin resistance, IL-6 and IL-17; limited product characterization.
Samadi, 2017 [10]	66	Propolis, 900 mg/day	Placebo	12 weeks	Improved FBG and HbA1c; small, short trial.
El-Sharkawy, 2016 [11]	50	Propolis, 400 mg/day + SRP	Placebo + SRP	6 months	HbA1c and periodontal outcomes improved; periodontal co-intervention limits attribution.
Ochoa-Morales, 2023 [12]	36	Propolis, 600 mg/day	Metformin 1,700 mg/day; placebo	12 weeks	Only direct medication comparison; underpowered for equivalence/non-inferiority.
Zakerkish, 2019 [13]	94	Iranian propolis, 1,000 mg/day	Placebo	90 days	Improved HbA1c, HOMA-IR, hs-CRP and TNF-α; IL-1β/IL-6 not improved.
Zhao, 2016 [14]	65	Brazilian green propolis, 900 mg/day	Placebo	18 weeks	Antioxidant effects; no clear glycemic benefit.
Afsharpour, 2019 [15]	62	Iranian propolis, 1,500 mg/day	Placebo	8 weeks	Improved glycemic and antioxidant indices; cohort overlap requires checking.
Gao, 2018 [16]	61	Chinese propolis, 900 mg/day	Placebo	18 weeks	Antioxidant effects; glycemic outcomes largely unchanged.
Hesami, 2019 [17]	62	Iranian propolis, 1,500 mg/day	Placebo	8 weeks	Fructosamine and metabolic outcomes reported; possible overlap with Iranian reports.
Fukuda, 2015 [18]	80	Brazilian green propolis, 226.8 mg/day	Placebo	8 weeks	Exploratory metabolic outcomes; product and dose differ from later trials.

Abbreviations: FBG, fasting blood glucose; HbA1c, glycated hemoglobin; HOMA-IR, homeostatic model assessment of insulin resistance; IL, interleukin; SRP, scaling and root planing; TNF-α, tumor necrosis factor alpha.

3.2 Glycemic outcomes

Several placebo-controlled trials reported reductions in fasting glucose, HbA1c, insulin, or HOMA-IR [9,10,13,15,17]. However, null or limited glycemic effects were observed in trials centered on antioxidant outcomes [14,16], and one periodontal study combined propolis with scaling and root planing [11]. The pattern is therefore suggestive rather than uniformly reproducible. Within-group improvement is also not sufficient to establish treatment efficacy when background therapy, regression to the mean, or concurrent clinical care could influence outcomes.

Recent quantitative syntheses generally report small average improvements. A 2024 GRADE-assessed meta-analysis of 21 randomized trials estimated reductions in fasting glucose, insulin, HbA1c, and HOMA-IR, including a pooled HbA1c difference of approximately −0.46 percentage points [21]. Earlier and later meta-analyses reported effects in a similar direction, but heterogeneity in propolis source, dose, intervention duration, background therapy, and trial quality limits the certainty and portability of pooled estimates [19,20,23,24].

Table 2. Summary of glycemic findings and confidence in interpretation

Outcome	Overall direction	Evidence signal	Principal limitation	Confidence
Fasting glucose	Frequently improved	Several small placebo-controlled RCTs; meta-analyses	Product and background-care heterogeneity	Low–moderate
HbA1c	Small average reduction	Multiple RCTs; pooled estimate ≈ −0.46 percentage points [21]	Short duration; baseline control varies	Low–moderate
Insulin / HOMA-IR	Often improved	Iranian trials and meta-analysis [13,15,21]	Assays and reporting differ; possible cohort overlap	Low
Postprandial glucose	Improvement in some studies	Ochoa-Morales and Zakerkish [12,13]	Sparse reporting; small samples	Low
Equivalence to metformin	Not established	One 36-participant active-comparator RCT [12]	No non-inferiority design or adequate power	Very low

3.3 Inflammation and oxidative stress

Inflammatory findings were less consistent than glycemic findings. Yousefi et al. reported lower IL-6 and IL-17 [9], whereas Zakerkish et al. observed improvements in hs-CRP and TNF-α without significant improvement in IL-1β or IL-6 [13]. Chinese and Brazilian green propolis trials more consistently suggested antioxidant than glucose-lowering effects [14,16]. Because biomarkers were variably selected and frequently secondary endpoints, isolated changes should not be equated with reduced clinical complications.

A 2024 meta-analysis focused on inflammatory biomarkers and a broader 2025 synthesis support possible reductions in selected markers, but both emphasize substantial heterogeneity [22,23]. Differences in baseline inflammation, propolis chemistry, co-medication, assay methods, and follow-up duration make a single anti-inflammatory effect size difficult to defend.

Table 3. Inflammatory and oxidative-stress outcomes

Domain	Observed signal	Interpretive constraint	Confidence

IL-6 / IL-17	Reduced in one Iranian trial [9]	Not consistently reproduced	Low
hs-CRP / TNF-α	Improved in Zakerkish et al. [13]	Other cytokines were unchanged	Low
IL-1β	No clear improvement [13]	Sparse data	Very low
Antioxidant status	Often favorable [14–16]	Surrogate endpoints; product-specific	Low–moderate
Clinical inflammatory complications	Not established	Trials were not powered for complications	Very low

3.4 Direct comparison with metformin

Ochoa-Morales et al. randomized 36 treatment-naïve adults to propolis 300 mg twice daily, metformin 850 mg twice daily, or placebo for 12 weeks [12]. Fasting glucose, 2-hour post-load glucose, and HbA1c improved from baseline in both active groups. This finding shows that propolis had biological activity in that setting; it does not demonstrate that propolis was equal or superior to metformin. The sample was small, follow-up was short, and no prespecified non-inferiority margin or adequately powered head-to-head analysis was reported. Thus, the comparative evidence is insufficient to support medication substitution.

4. Mechanistic plausibility

Polyphenols and flavonoids in propolis may influence oxidative stress, nuclear factor erythroid 2–related factor 2 signaling, inflammatory transcription pathways, glucose transport, hepatic glucose production, and insulin signaling. These mechanisms are compatible with the clinical signals reported in some trials. Yet composition-dependent activity is expected: a result obtained with Iranian, Chinese, or Brazilian green propolis cannot be transferred to an uncharacterized commercial preparation. Mechanistic plausibility supports further testing but cannot compensate for limited clinical trial design or product standardization [4].

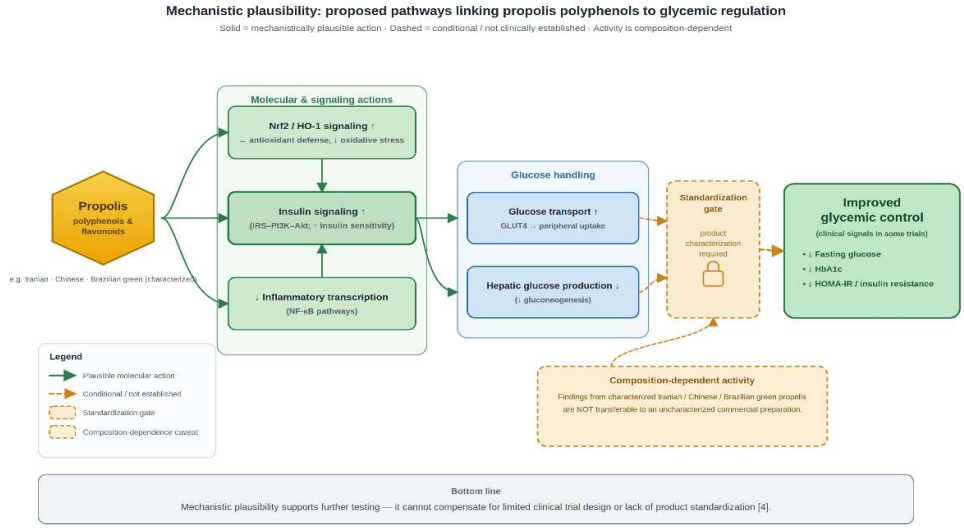

Figure 1. Mechanistic plausibility

5. Safety and interactions

Short trials generally did not identify major safety signals, but safety reporting was inconsistent and exposure was brief. Propolis may cause allergic reactions, particularly in individuals sensitive to bee products, and product contamination or batch variation remains relevant. Concomitant use with glucose-lowering medication also requires monitoring because additive glucose reduction is plausible. Absence of harm in small trials should not be interpreted as evidence of long-term safety in pregnancy, severe renal or hepatic disease, polypharmacy, or people with prior hypersensitivity.

6. Translational priorities

A clinically decisive research program should use preregistered, adequately powered, multicenter randomized trials; a chemically standardized and independently tested product; placebo plus usual-care and, where justified, active-comparator arms; allocation concealment and blinded outcome assessment; at least 6–12 months of follow-up; prespecified HbA1c and safety endpoints; and transparent reporting of background medication changes, adherence, adverse events, and attrition. If equivalence to metformin or another drug is claimed, a justified non-inferiority margin and appropriate statistical design are essential. Trials should also determine whether propolis adds benefit to standard therapy rather than asking participants to replace proven treatment with an inadequately characterized supplement.

7. Limitations of this review

This review was reconstructed from a single Elicit/Semantic Scholar report and was not based on a de novo, reproducible multi-database search. The search date, complete search string, duplicate-removal process, independent screening procedure, and full-text exclusion log were unavailable. No formal risk-of-bias assessment was conducted. Some source citations were incomplete or potentially overlapping, and not every numerical extraction could be independently confirmed from full text; uncertain values were therefore omitted rather than inferred. Recent meta-analyses were added to contextualize the findings, but they do not remove limitations in the underlying trials. These constraints mean the review should be read as a critical structured narrative synthesis, not a PRISMA-compliant systematic review.

8. Conclusion

Propolis supplementation was associated with improved glycemic control in several small trials and with favorable changes in selected inflammatory or oxidative-stress biomarkers. The totality of evidence supports mechanistic plausibility and a preclinical-to-clinical research hypothesis, but not established therapeutic equivalence to standard diabetes medication. Only one small trial directly compared propolis with metformin, and it was insufficient to demonstrate non-inferiority or replacement value. Until larger, chemically standardized, rigorously reported trials are available, propolis should be considered an investigational adjunct and should not displace guideline-directed diabetes care.

Funding Details

This review did not receive funding.

Disclosure Statement

The authors declare that they have no financial interests or benefits arising from the direct application of this research.

References

[1]. American Diabetes Association Professional Practice Committee. Pharmacologic approaches to glycemic treatment: Standards of Care in Diabetes 2025. Diabetes Care. 2025;48(Suppl 1):S181–S206. https://doi.org/10.2337/dc25-S009

[2]. Galicia-Garcia U, Benito-Vicente A, Jebari S, et al. Pathophysiology of type 2 diabetes mellitus. International Journal of Molecular Sciences. 2020;21(17):6275. https://doi.org/10.3390/ijms21176275
[3]. Donath MY, Meier DT, Böni-Schnetzler M. Inflammation in the pathophysiology and therapy of cardiometabolic disease. Endocrine Reviews. 2019;40(4):1080–1091. https://doi.org/10.1210/er.2019-00002
[4]. Kasote D, Bankova V, Viljoen AM. Propolis: chemical diversity and challenges in quality control. Phytochemistry Reviews. 2022;21(6):1887–1911. https://doi.org/10.1007/s11101-022-09816-1
[5]. Sukhera J. Narrative reviews: flexible, rigorous, and practical. Journal of Graduate Medical Education. 2022;14(4):414–417. https://doi.org/10.4300/JGME-D-22-00480.1
[6]. Baethge C, Goldbeck-Wood S, Mertens S. SANRA—a scale for the quality assessment of narrative review articles. Research Integrity and Peer Review. 2019;4:5. https://doi.org/10.1186/s41073-019-0064-8
[7]. Ammar W, Groeneveld D, Bhagavatula C, et al. Construction of the Literature Graph in Semantic Scholar. Proceedings of NAACL-HLT 2018. 2018:84–91. https://doi.org/10.18653/v1/N18-3011
[8]. van Dijk SHB, Brusse-Keizer MGJ, Bucsán CC, van der Palen J, Doggen CJM, Lenferink A. Artificial intelligence in systematic reviews: promising when appropriately used. BMJ Open. 2023;13(7):e072254. https://doi.org/10.1136/bmjopen-2023-072254
[9]. Yousefi M, Hashemipour S, Shiri-Shahsavar MR, Koushan Y, Haghighian HK. Reducing the inflammatory interleukins with anti-inflammatory and antioxidant effects of propolis in patients with type 2 diabetes: double-blind, randomized controlled, clinical trial. Clinical Diabetology. 2023;12:327–335. https://doi.org/10.5603/cd.96910
[10]. Samadi N, Mozaffari-Khosravi H, Rahmanian M, Askarishahi M. Effects of bee propolis supplementation on glycemic control, lipid profile and insulin resistance indices in patients with type 2 diabetes: a randomized, double-blind clinical trial. Journal of Integrative Medicine. 2017;15(2):124–134. https://doi.org/10.1016/S2095-4964(17)60315-7
[11]. El-Sharkawy HM, Anees MM, Van Dyke TE. Propolis improves periodontal status and glycemic control in patients with type 2 diabetes mellitus and chronic periodontitis: a randomized clinical trial. Journal of Periodontology. 2016;87(12):1418–1426. https://doi.org/10.1902/JOP.2016.150694
[12]. Ochoa-Morales PD, González-Ortiz M, Martínez-Abundis E, Pérez-Rubio KG, Patiño-Laguna ADJ. Anti-hyperglycemic effects of propolis or metformin in type 2 diabetes mellitus. International Journal for Vitamin and Nutrition Research. 2023;93(6):498–506. https://doi.org/10.1024/0300-9831/a000760
[13]. Zakerkish M, Jenabi M, Zaeemzadeh N, Hemmati AA, Neisi N. The effect of Iranian propolis on glucose metabolism, lipid profile, insulin resistance, renal function and inflammatory biomarkers in patients with type 2 diabetes mellitus: a randomized double-blind clinical trial. Scientific Reports. 2019;9:7289. https://doi.org/10.1038/s41598-019-43838-8
[14]. Zhao L, Pu L, Wei J, et al. Brazilian green propolis improves antioxidant function in patients with type 2 diabetes mellitus. International Journal of Environmental Research and Public Health. 2016;13(5):498. https://doi.org/10.3390/ijerph13050498
[15]. Afsharpour F, Javadi M, Hashemipour S, Koushan Y, Haghighian HK. Propolis supplementation improves glycemic and antioxidant status in patients with type 2 diabetes: a randomized, double-blind, placebo-controlled study. Complementary Therapies in Medicine. 2019;43:283–288. https://doi.org/10.1016/j.ctim.2019.03.001
[16]. Gao W, Pu L, Wei J, et al. Serum antioxidant parameters are significantly increased in patients with type 2 diabetes mellitus after consumption of Chinese propolis: a randomized controlled trial based on fasting serum glucose level. Diabetes Therapy. 2018;9(1):101–111. https://doi.org/10.1007/s13300-017-0341-9
[17]. Hesami S, Hashemipour S, Shiri-Shahsavar MR, Koushan Y, Khadem Haghighian H. Administration of Iranian propolis attenuates oxidative stress and blood glucose in type 2 diabetic patients: a randomized, double-blind, placebo-controlled clinical trial. Caspian Journal of Internal Medicine. 2019;10(1):48–54. https://doi.org/10.22088/cjim.10.1.48
[18]. Fukuda T, Fukui M, Tanaka M, et al. Effect of Brazilian green propolis in patients with type 2 diabetes: a double-blind randomized placebo-controlled study. Biomedical Reports. 2015;3(3):355–360. https://doi.org/10.3892/br.2015.436
[19]. Karimian J, Hadi A, Pourmasoumi M, Najafgholizadeh A, Ghavami A. The efficacy of propolis on markers of glycemic control in adults with type 2 diabetes mellitus: a systematic review and meta-analysis. Phytotherapy Research. 2019;33(6):1616–1626. https://doi.org/10.1002/ptr.6356

[20]. Mosallanezhad Z, Clark CCT, Bahreini F, et al. Effect of propolis on glycemic control in patients with type 2 diabetes: an updated systematic review and meta-analysis of randomized controlled trials. Nutrition & Food Science. 2021;51(7):1124–1137. https://doi.org/10.1108/NFS-01-2021-0026

[21]. Adeli S, Maroofi M, Pourteymour Fard Tabrizi F, et al. Effects of propolis consumption on glycemic indices and liver enzymes in adults: a Grading of Recommendations Assessment, Development, and Valuation-assessed systematic review and dose-response meta-analysis. Clinical Therapeutics. 2024;46(9):e6–e14. https://doi.org/10.1016/j.clinthera.2024.06.022

[22]. Luo ZY, Deng ZQ, Xia LQ, Poorasadollah E, Shirvani S. The impact of propolis supplementation on inflammatory biomarkers: a meta-analysis and systematic review of randomized controlled clinical trials. Prostaglandins & Other Lipid Mediators. 2024;175:106915. https://doi.org/10.1016/j.prostaglandins.2024.106915

[23]. Zhang Y, et al. Propolis effects on blood sugar and lipid metabolism, inflammatory indicators, and oxidative stress in people with type 2 diabetes: a systematic review and meta-analysis. Frontiers in Nutrition. 2025;12:1653730. https://doi.org/10.3389/fnut.2025.1653730

[24]. Karimi M, et al. Propolis supplementation improves cardiometabolic health in patients with type 2 diabetes mellitus: findings from a GRADE-assessed systematic review and meta-analysis of RCTs. Journal of Diabetes & Metabolic Disorders. 2025;24:164. https://doi.org/10.1007/s40200-025-01682-w