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Short Communication

A scientometric study on the characteristics of herbal medicine and identification of herbaceous agents for treatment of periodontal diseases

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Abstract *Background/purpose:* Natural products derived from herbal medicine have been extensively researched in the alternative treatment of various inflammatory diseases including periodontitis. The purpose of this study was to analyze the scientometric characteristics of herbal medicine in periodontics research with emphasis on the identification of the herbaceous agents.
Materials and methods: All the articles on herbal medicine in periodontics research were comprehensively retrieved from the Scopus database. The common herbaceous agents for periodontal disease were identified from the top-100 most-cited articles.
Results: A total of 600 articles on herbal medicine in periodontics research were retrieved. The total citation count was 9663 and the *h* index was 50 for all the articles. The keywords of the study design, experiment methods, clinical and laboratory aspects such as randomized controlled trial, pathology, protein expression, pathogenic bacteria, cytokines, metabolism, macrophages, molecular docking, and drug delivery were included. Various herbs such as green tea, ginger rhizome, propolis, resveratrol, justicia glauca, althaea officinalis, arnica montana, hamamelis virginiana, aloe vera, grape seed proanthocyanidin, and berberine were frequently cited in the treatment of periodontitis. These herbs have been reported to exhibit a range of

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therapeutic effects, including antiinfective, antiinflammatory, antibacterial, antioxidant, antifungal, and antimicrobial properties.
Conclusion: This study for the first time elucidated the scientometric characteristics of all the articles on herbal medicine in periodontics, and would provide new insights for researchers to comprehend the identification of the herbaceous agents for periodontal diseases.

Introduction

Periodontitis, as the most important periodontal disease, is a leading cause of tooth loss and poses a general health challenge worldwide.[1] It is a chronic inflammatory disease caused by microbial infection and mediated by the host's immune reaction. In periodontitis, the accumulation of local bacteria and their byproducts initiates the disease, while the progression is largely determined by the host's immune response.[2] Current treatments for periodontitis predominantly rely on anti-inflammatory drugs mainly antibiotics such as metronidazole and chlorhexidine.[3] Although effective, these drugs can lead to side effects like drug resistance and microbial imbalances. Given the increasing misuse of antibiotics, there is an urgent need to explore nonantibiotic antimicrobial and anti-inflammatory alternatives for clinical use.[4] Significantly, natural products derived from herbal medicine have been extensively researched in the alternative treatment of various inflammatory diseases including periodontitis.[5–7]

Scientometrics is a useful tool that utilizes citation and bibliometric data to measure scientific output and research trend of a specific research field.[8–10] Hundreds of studies on natural products in herbal medicine in periodontics have been published, and more than a hundred herbaceous agents have been researched, either alone or as adjuncts, in treating periodontitis. The previous bibliometric analyses of herbal medicine in some fields of inflammatory diseases such as rheumatoid arthritis, osteoarthritis, and inflammatory bowel disease, have been reported,[11–13] but a similar analysis of herbal medicine in periodontics is lacking. Such analysis would be important for understanding the research output and hotspots of this field and guiding future research directions. Hence, the purpose of the current study was to analyze the scientometric characteristics of herbal medicine in periodontics with emphasis on the identification of the herbaceous agents, so as to give inspiration and strategies of basic and clinical research in this field.

Materials and methods

As per the methodology described previously,[8–10] All the articles on herbal medicine in periodontics research were comprehensively retrieved from the Scopus database on 30 Aug 2025. According to the search strategy described in supplementary Table S1, we used medical subject terms "periodont*" in the title AND herbal medicine and traditional Chinse medicine and their synonyms in the title/abstract/keywords in literature search. The asterisk indicates a wildcard used to search for all endings including fifth or more root words. Only English literature was included because it is an international knowledge-exchange language. The scientometric characteristics of all the eligible articles were recorded for the following information: title, keyword, citation count, publication year, journal of publication, article type, authorship, affiliation, and country/region of origin. Data search and extraction were performed independently by two investigators, and any discrepancy of results was resolved in a consensus symposium. Microsoft Office Excel 365 was used for index model building, and the Bibliometrix Biblioshiny R-package software was used for bibliometric statistics. In this descriptive study, variables were presented as numbers and percentages. No comparisons were made, and thus no *P*-values were set.

Results

Citation characteristics

With the search strategy algorithm, a total of 600 articles on herbal medicine in periodontics research were retrieved in the Scopus database. The total citation count (after removal of self-citations) was 9663 (8727) and the *h* index was 50 (47) for all the articles. To further concretize the trends of scientific output, we assessed the annual number and accumulated citations of the articles during 2005–2024 (Fig. 1A). The annual number of herbal medicine in periodontics research stably increased from 5 to 73 during 2005–2024. The accumulated citations (after removal of self-citations) of these articles steadily increased from 40 (38) to 1272 (1146) during 2005–2024. The detailed information on authors, title, publication year, journal of publication, citation count, institution and country of origin, abstract, and keywords of the top-100 most-cited articles on herbal medicine in periodontics research are presented in supplementary Table S2.

Bibliometric characteristics

Figure 1B displays cloud graphs of journals of publications, contributing authors, institutions, and countries/regions of origin of the articles on herbal medicine in periodontics

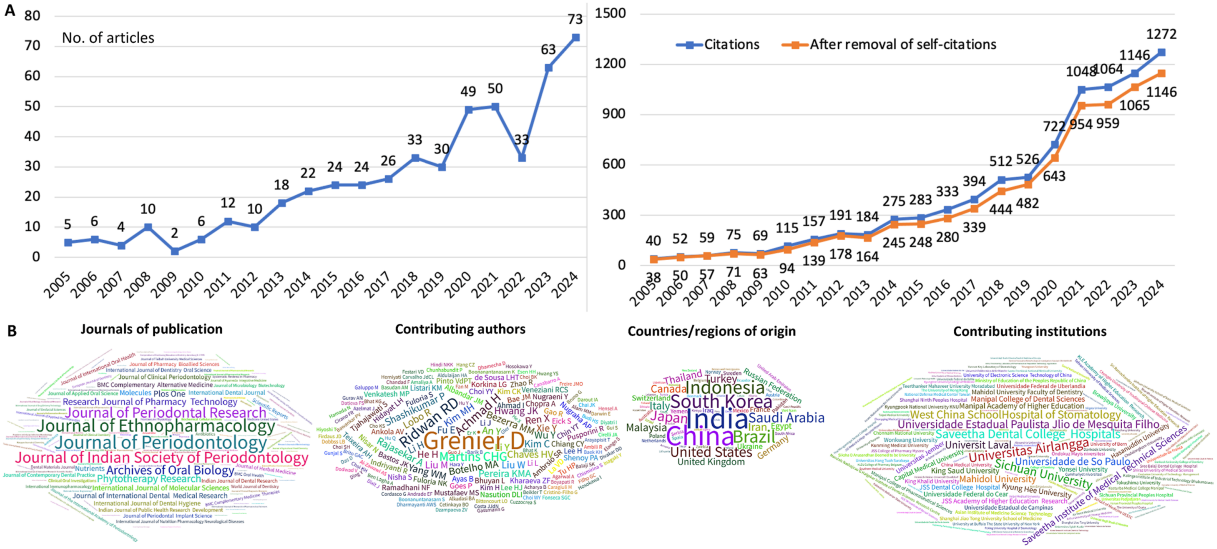

Figure 1 Bibliometric characteristics of the articles on herbal medicine in periodontics. (**A**) The annual number and accumulated citations of the articles during 2005—2024. (**B**) Cloud graphs of journal of publication, contributing authors, countries and institutions of origin. The font size indicates the number of articles; a larger size means more articles in the cloud graphs.

research. The journal with largest number was *Journal of Periodontology* (n = 18), followed by *Journal of Ethnopharmacology* (n = 17) and *Journal of Indian Society of Periodontology* (n = 15). The contributing author with largest number of articles was Grenier, D. (n = 10), followed by Ridwan, R.D. (n = 6), Achmad, H. and Martins, C.H.G. (both n = 5). The contributing institution of origin with the maximum number was Universitas Airlangga (n = 14), followed by Sichuan University and Saveetha Dental College & Hospitals (both n = 13). The contributing region of origin with the largest number was India (n = 121), followed by China (n = 110) and South Korea (n = 53).

Research characteristics

Based on the frequency of the main keywords in all the articles on herbal medicine in periodontics research (Fig. 2A), a list of the common keywords is automatically recognized by the database, respectively. The most common study design was controlled study, followed by animal experiment, in vitro study, and randomized controlled trial. The most frequent experiment method was protein expression, followed by cell viability test and enzyme linked immunosorbent assay. The common keywords of clinical aspect included drug effect, antiinfective, antiinflammatory, antibacterial, alveolar bone loss, osteolysis, chlorhexidine, mouth hygiene, tooth plaque, drug therapy, mouthwash, plaque index, gingival index, and periodontal pocket depth. The frequent keywords of laboratory aspect included pathogenic bacteria including porphyromonas gingivalis, aggregatibacter actinomycetemcomitans, fusobacterium nucleatum, streptococcus mutans, microbiology, biofilm, pathology, lipopolysaccharide, metabolism, cytokines such as interleukin (IL)-1beta, IL-6, IL-8, tumor necrosis factor (TNF), osteoclast differentiation factor, antimicrobial, antioxidant, oxidative stress, microbial sensitivity tests, signal transduction, molecular docking, gelatinase B, local drug delivery, and macrophage.

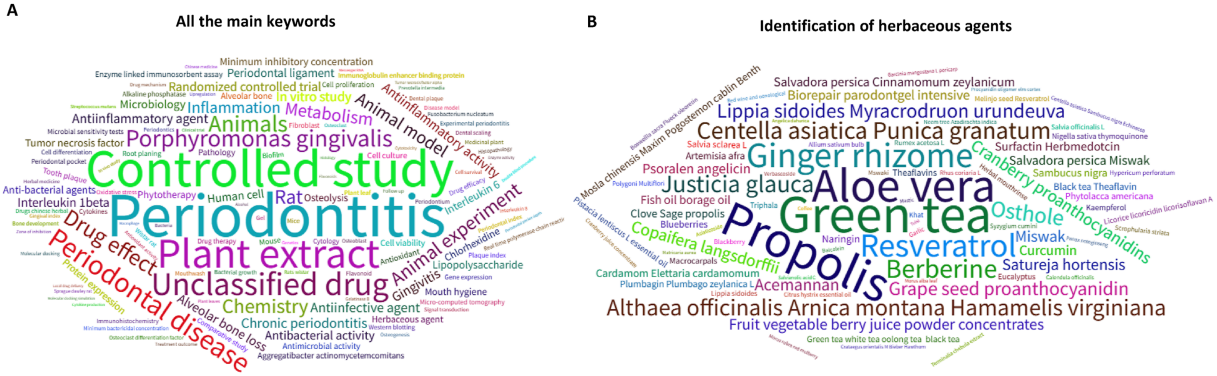

Figure 2 Research characteristics of the articles on herbal medicine in periodontics. (**A**) Cloud graph of all the main keywords. The font size indicates the number of articles; a larger size means more articles in this cloud graph. (**B**) Identification of the common herbaceous agents in periodontics. The font size indicates citation count; a larger size means more citations in this cloud graph.

Identification of herbaceous agents

We highlighted the identification of the common herbaceous agents for periodontal disease, which can reflect the hotspots and drug discovery of periodontics research. Among the top-100 most-cited articles on herbal medicine in periodontics research, a total of 107 herbaceous agents were identified (Fig. 2B). Of these, there were 8 studies on green tea, 4 on aloe vera, 2 on curcumin, 2 on berberine, 2 on lippia sidoides and myracrodruon urundeuva. Based on the accumulated citations of the top-100 most-cited articles, the research on the herbaceous agent for periodontal disease with most citation count was green tea (313 citations), followed by aloe vera (281 citations), ginger rhizome (208 citations), propolis (205 citations), resveratrol (194 citations), berberine (158 citations), justicia glauca (145 citations), althaea officinalis, arnica montana, hamamelis virginiana (139 citations), Lippia sidoides, myracrodruon urundeuva (119 citations), grape seed proanthocyanidin (114 citations), and cranberry proanthocyanidins (101 citations).

Discussion

This scientometric study attempted to analyze the bibliometric characteristics and research trends of all the articles on herbal medicine in periodontics retrieved from the Scopus database. The increasing numbers and citations of these articles each year suggest that the issue has governed increasing attention and investigation. It could be speculated that the numbers and citations will continue to grow in the coming years. The number of articles (332 papers) in the last five years (2020 Jan-2025 Aug) was more than that (268 papers) before 2020, indicating that herbal medicine in periodontics research is undergoing a rapid developmental stage. Bibliometric items in sequence would aid clinicians and researchers in choosing target journals, finding potential collaborators or partner institutions, as well as promoting mutual understanding and more reciprocal cooperation regarding herbal medicine in periodontics research. Importantly, we identified the keywords of the study design, experiment methods, clinical and laboratory aspects such as randomized controlled trial, pathology, protein expression, pathogenic bacteria, cytokines, metabolism, macrophages, molecular docking, and drug delivery.[7,14–17] These would provide a better comprehensive understanding of the clinical and basic research in this field.

The strength of this study was to identify herbaceous agents in periodontics research (Fig. 2B). Various herbs such as green tea, ginger rhizome, propolis, resveratrol, justicia glauca, althaea officinalis, arnica montana, hamamelis virginiana, aloe vera, grape seed proanthocyanidin, and berberine were frequently cited in the treatment of periodontitis.[18–20] These herbs have been reported to exhibit a range of therapeutic effects, including anti-infective, antiinflammatory, antibacterial, antioxidant, antifungal, and antimicrobial properties.[5] These effects tend to be longer-lasting, and side effects are usually milder due to enhanced tolerance and adaptability. Herbal products are known for their wide-ranging biological activity, and are generally well-tolerated and accepted by patients. Their components can be utilized in various forms such as mouth rinse, mouthwash, gel, oil, toothpaste, or tooth powder.[4–6] As a renewable resource, they provide a consistent supply of less costly medicines, and are readily accessible in both developing and developed countries. To assess the therapeutic efficacy of herbal medicine in periodontics, various clinical parameters including plaque index, bleeding on probing, periodontal pocket depth, and gingival recession extent and inflammatory markers such as IL-1β, IL-6, IL-8, and TNF-α are commonly evaluated.

Herbal medicine is increasingly being considered as viable alternatives to chemically synthesized drugs for the treatment of periodontitis. However, certain limitations exist in the research of herbal medicine in periodontics. First, the precise mechanisms underlying the anti-inflammatory effects of natural products in herbal medicine remain incompletely understood. Second, the majority of research on natural products has been confined to the preclinical stage, with a paucity of clinical trial data. Third, the prescribing practices of dentists are often suboptimal, due to a range of factors including insufficient knowledge and societal considerations. Other limitations include low solubility and low bioavailability of herbaceous agents, variations in study design, and small sample sizes of clinical study. To enhance patient acceptance and recognition of herbal medicine preparations, increased promotion and gathering of robust clinical trial data are necessary. Dental professionals' understanding of the suggested principles of herbal prescription practices should be also improved. Guidelines for bettering herbal prescribing practices are strongly recommended. Further investigations are necessary to validate their efficacy and establish standardized protocols for integration into periodontal therapy.

In summary, the current study for the first time elucidated the scientometric characteristics of all the articles on herbal medicine in periodontics. This study did support the idea that some herbal products can be a valuable alternative treatment of periodontitis, and provide new insights for researchers to comprehend the identification of the herbaceous agents for periodontal disease. Nevertheless, more experimental and clinical investigations are required to validate these findings.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jds.2025.12.009.

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