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Short Communication

# A scientometric study on herbal medicine and identification of herbaceous agents for oral cancer prevention

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**KEYWORDS**
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Herbal drug;
Oral squamous cell carcinoma;
Oral potentially malignant disorders;
Traditional Chinese medicine

**Abstract** *Background/purpose:* Natural products derived from herbal medicine have been extensively researched in the alternative treatment of oral cancer prevention. The purpose of this study was to analyze the scientometric characteristics of herbal medicine in oral cancer prevention with emphasis on the identification of the herbaceous agents.
*Materials and methods:* All the articles on herbal medicine in oral cancer prevention were comprehensively retrieved from the Scopus database. The common herbaceous agents for oral cancer prevention were identified from the top-100 most-cited articles.
*Results:* A total of 759 articles on herbal medicine in oral cancer prevention were retrieved. The total citation count was 17,958 and the *h* index was 64 for all the articles. The keywords of the study design, experiment methods, clinical and laboratory aspects such as controlled study, animal experiment, drug effect, drug cytotoxicity, histopathology, oxidative stress, signal transduction, metabolism, genetics, tumor xenograft, molecular docking, and DNA damage were included. Various herbs such as curcumin/curcuminoids, black raspberry, resveratrol, aloe vera, green tea extract, rhein, and berberine were frequently cited in oral cancer prevention. They show anticancer effects by causing apoptosis, autophagy, antioxidant, and cell cycle arrest through different signaling pathways such as Akt/mTOR pathway and mitochondrial pathway.

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*Conclusion:* This study for the first time elucidates the scientometric characteristics of all the articles on herbal medicine in oral cancer prevention, and may provide new insights for researchers to comprehend the identification of the herbaceous agents for the prevention of the disease.


## Introduction

Oral cancer, particularly oral squamous cell carcinoma (OSCC), is a prevalent malignant tumor having a significant fatality rate worldwide.[1] OSCC is usually proceed by malignant progression of oral potentially malignant disorders (OPMD). Despite advancements of current treatments, including surgery, chemotherapy, radiotherapy, or combined therapy, the overall survival rate of OSCC patients remains poor. The major reason for the poor outcome is owing to late diagnoses and patient-acquired resistance to treatment.[2] And given side effects during current treatments of this disease, there is thus a critical need to explore alternative therapeutic approaches that can improve patient outcomes. Natural products derived from herbal medicine have been extensively explored as a safer and more acceptable alternative therapy to the current treatments, with numerous studies displaying their potential against oral carcinogenesis.[3–5]

Scientometrics is a useful tool that utilizes citation and bibliometric data to measure scientific output and research trend of a specific research field.[6–8] The previous bibliometric analyses of traditional Chinese medicine in some fields of malignant diseases such as liver cancer, breast cancer, and acute leukemia, have been reported,[9–11] but a similar analysis of herbal medicine in oral cancer 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 oral cancer prevention 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,[6,7] all the articles on herbal medicine in oral cancer prevention were comprehensively retrieved from the Scopus database on 31 Dec 2025. According to the search strategy described in Supplementary Table S1, we used medical subject terms "oral cancer" and "oral potentially malignant disorders" and their synonyms in the title AND "herbal medicine" and "traditional Chinese medicine" and their synonyms in the title/abstract/keywords in literature search without restriction to year of publication. Article was included since this type of publications substantially reflects original research, and 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 759 articles on herbal medicine in oral cancer prevention were retrieved in the Scopus database. The total citation count (after removal of self-citations) was 17,958 (15,678) and the *h* index was 64 (58) for all the articles. To further concretize the trends of scientific output, we assessed the annual number and accumulated citations of the articles during 2006–2025 (Fig. 1A). The annual number of herbal medicine in oral cancer prevention stably increased from 5 to 89 during 2006–2025. The accumulated citations (after removal of self-citations) of these articles steadily increased from 119 (99) to 2254 (2091) during 2006–2025. The detailed information on authors, title, publication year, journal of publication, citation count, institutions, and countries/regions of origin, abstract, and keywords of the top-100 most-cited articles on herbal medicine in oral cancer prevention are presented in Supplementary Table S2.

### Bibliometric characteristics

Fig. 1B displays cloud graphs of journals of publications, contributing authors, institutions, and countries/regions of origin of the articles on herbal medicine in oral cancer prevention. The journal with largest number was *Environmental Toxicology* (n = 17), followed by *Phytomedicine* (n = 15) and *Asian Pacific Journal of Cancer Prevention* (n = 13). The contributing author with largest number of articles was Chang, H.W. (n = 27), followed by Tang, J.Y. (n = 22) and Chung, J.G. (n = 17). The contributing

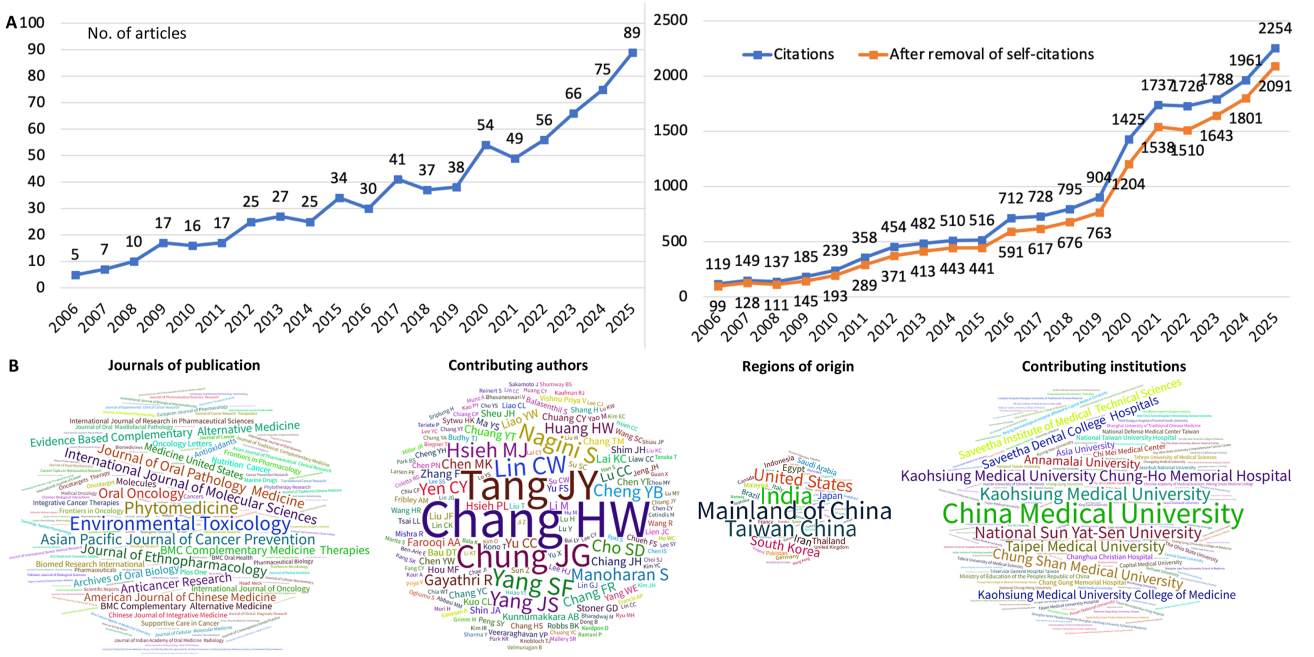


**Figure 1** Bibliometric characteristics of the articles on herbal medicine in oral cancer prevention. (**A**) The annual number and accumulated citations of the articles during 2005–2024. (**B**) Cloud graphs of journal of publication, contributing authors, regions of origin, and contributing institutions.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

institution of origin with the maximum number was China Medical University (n = 61), followed by Kaohsiung Medical University (n = 39) and National Sun Yat-Sen University (n = 38). The contributing region of origin with the largest number was mainland of China (n = 181), followed by India (n = 171) and Taiwan, China (n = 152).

## Research characteristics

Based on the frequency of the main keywords in all the articles on herbal medicine in oral cancer prevention (Fig. 2A), a list of the common keywords is automatically recognized by the database. The most common study design was controlled study, followed by animal experiment, in vitro study, in vivo study, and randomized controlled trial. The most frequent experiment method was western blotting, followed by flow cytometry and MTT assay. The common keywords of clinical aspect included drug effect, drug cytotoxicity, dose response, drug safety, concentration response, oral cancer, carcinogenesis, squamous cell carcinoma of head and neck, mouth mucosa, oral lichen planus, oral mucositis, histopathology, metastasis, cancer chemotherapy, cancer radiotherapy, treatment outcome, antineoplastic agents, cisplatin, fluorouracil, cancer prevention, chemoprophylaxis, and chemo prevention.

The frequent keywords of laboratory aspect contained apoptosis, autophagy, cell proliferation, cell viability, cell migration, cell cycle arrest, colony formation, cell invasion, cell movement, cell motion, cell survival, cell death, cell culture, Cal-27 cell line, cancer inhibition, IC50, antineoplastic activity, metabolism, genetics, tumor xenograft, molecular docking, drug screening, drug mechanism, reactive oxygen metabolite, reactive oxygen species, antioxidant activity, enzyme activity, oxidative stress, signal transduction, gene expression, gene expression regulation, protein expression, caspases (e.g. caspase-3, -8, and -9), immunoglobulin enhancer binding protein, protein Bcl-2, Bax, p53, protein kinase B, lipocortin 5, proto-oncogene c-AKT, nicotinamide adenine dinucleotide adenosine diphosphate ribosyltransferase (NAD-ADPR), mitochondrion, mitochondrial membrane potential, DNA damage, and DNA fragmentation.

## Identification of herbaceous agents

We highlighted the identification of the common herbaceous agents for oral cancer prevention, which can reflect the hotspots and drug discovery of oral cancer prevention. Among the top-100 most-cited articles on herbal medicine in OPMD/OSCC research, a total of 96 herbaceous agents were identified (Fig. 2B). Of these, there were 11 studies on curcumin/curcuminoids, 7 on black raspberry, 4 on aloe vera, and 3 on resveratrol. Based on the accumulated citations of the top-100 most-cited articles, the research on the herbaceous agent for oral cancer prevention with most citation count was curcumin/curcuminoids (782 citations), followed by black raspberry (540 citations), resveratrol (500 citations), syzygium cumini (L.) skeels (499 citations), aloe vera (339 citations), green tea extract (275 citations), rhein (220 citations), berberine (206 citations), beta-carotene (196 citations), hesperidin (196 citations), aloe-emodin (185 citations), nimbolide (172 citations), and silibinin (168 citations).

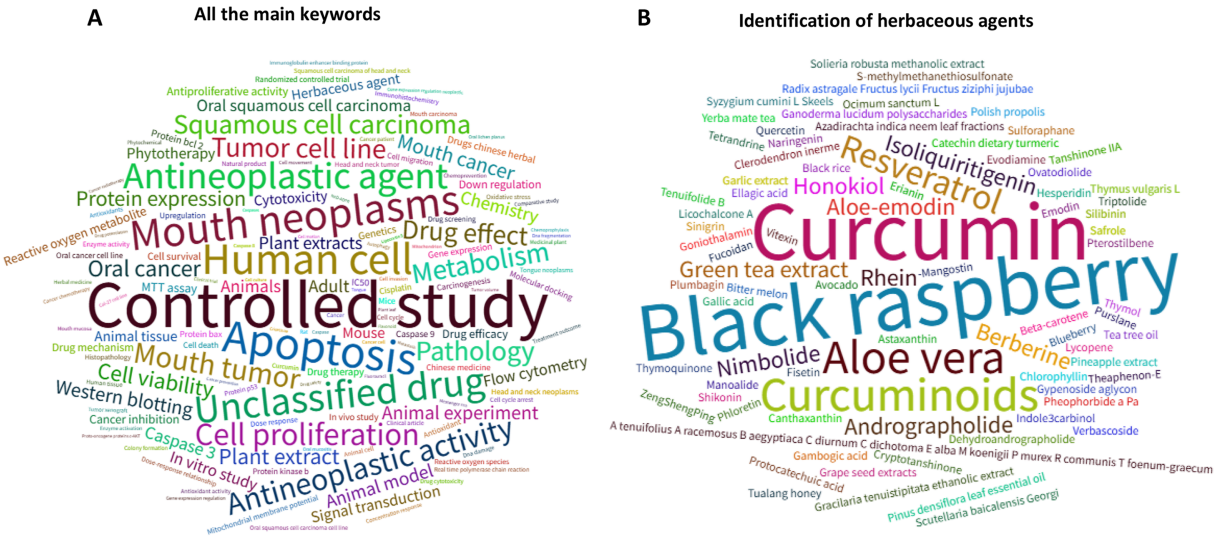


**Figure 2** Research characteristics of the articles on herbal medicine in oral cancer prevention. (**A**) Cloud graph of all the main keywords. The font size indicates the number of articles; a larger size means more articles in this cloud graph. (**B**) Identification of the common herbaceous agents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

## Discussion

This scientometric study attempted to analyze the bibliometric characteristics and research trends of all the articles on herbal medicine in oral cancer prevention 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 (389 papers) in the last six years (2020—2025) was more than that (370 papers) before 2020, indicating that herbal medicine in oral cancer prevention 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 OPMD/OSCC research. Importantly, we identified the keywords of the study design, experiment methods, clinical and laboratory aspects, which would provide a better comprehensive understanding of the clinical and basic research in this field.

Natural products have been a valuable source of anticancer agents in various fields. The strength of this study was to identify herbaceous agents in oral cancer prevention (Fig. 2B). Various agents such as curcumin/curcuminoids, black raspberry, resveratrol, aloe vera, green tea extract, rhein, and berberine were frequently cited in oral cancer prevention.[12—15] They show anticancer effects by causing apoptosis, autophagy, antioxidant and cell cycle arrest through different signaling pathways include Akt/mTOR pathway, notch pathway, and mitochondrial pathway.[12,16—19] By targeting multiple pathways involved in carcinogenesis, they possess the capacity to hinder tumor growth and development, promote programmed cell death, and impede the progression of oral cancer. These effects tend to be longer-lasting, and side effects are usually milder due to enhanced tolerance and low cytotoxicity.

Herbal medicine is increasingly being considered as viable alternatives to chemically synthesized drugs for oral cancer prevention. However, certain limitations exist in the research of herbal medicine in OPMD/OSCC research. The precise mechanisms underlying the anticancer effects of herbaceous agents remain incompletely understood. In the current analysis, 759 articles on herbal medicine in oral cancer prevention were derived from human, animal and cell culture studies with different proportions. Most of the studies were carried out with various agents on preclinical models of OSCC, either in vitro or in vivo.[20,21] To enhance patient acceptance and recognition of herbal medicine, increased promotion and gathering of robust human clinical studies are necessary. Other limitations include low solubility and low bioavailability of herbaceous agents, and thus a high-efficiency drug delivery system is required to enhance the bioavailability and anticancer efficacy.[22]

In summary, the current study for the first time elucidated the scientometric characteristics of all the articles on herbal medicine in oral cancer prevention. This study did support the idea that some herbal products can be a valuable strategy for oral cancer prevention, and provide new insights for researchers to comprehend the identification of the herbaceous agents for OPMD/OSCC research. 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.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jds.2026.01.022.

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