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Short Communication

A scientometric study on research trends and characteristics of oral submucous fibrosis

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Received 25 April 2024; Final revision received 7 May 2024

Available online 18 May 2024

KEYWORDS

Areca nut;
Bibliometrics;
India;
Oral cancer;
Oral submucous
fibrosis;
Research
characteristics

Abstract *Background/purpose:* Oral submucous fibrosis (OSF) affecting populations is considered a public health issue in South/Southeast Asia. The purpose of this study was to analyze the scientometric characteristics and research trends of OSF.

Materials and methods: All the papers on OSF were comprehensively retrieved from the Scopus database. Regional comparison (India versus outside of India) and chronological comparison (before 2015 versus after 2015) were performed.

Results: Among all the 1357 papers on OSF, 930 (68.5%) were from India. In India, biology research on antioxidant, oxidative stress, angiogenesis, and extracellular matrix were distinctive keywords. Risk factors of smokeless tobacco and gutkha and the roles of saliva and blood sampling were also distinctive keywords in India. In outside of India, biology research on myofibroblast, alpha smooth muscle actin, microRNA, long untranslated RNA, and protein p53 were distinctive keywords. The trend of biology research on connective tissue, genotype, genetic predisposition, messenger RNA, and cytology before 2015 has changed to research on myofibroblast, biological marker, microRNA, epithelial mesenchymal transition, extracellular matrix, and oxidative stress after 2015. The trend of clinical aspects of surgery and mouth hygiene

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<https://doi.org/10.1016/j.jds.2024.05.006>

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before 2015 has changed to the aspects of adverse event/effects, complication, and quality of life after 2015.

Conclusion: This scientometric study elucidated the current scenario and research trends of OSF, and would help in improving in reciprocal collaboration and communication for this disease control in South/Southeast Asia.

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Introduction

Oral submucous fibrosis (OSF) is an insidious chronic potentially malignant disorder affecting the oral cavity, oropharynx, and upper third of the esophagus.¹ World Health Organization data indicate that there are approximately 5 million cases suffering from OSF globally, and the highest number (10.54%) of cases are reported from South and Southeast Asia with a defined geographical distribution.² OSF affecting populations is considered a public health issue in South/Southeast Asian regions including India, Bangladesh, Malaysia, Taiwan and mainland of China.² Among the countries worldwide, the highest number of cases are reported from India with the prevalence ranging from <1% to 30%.³ Although there are various etiological factors that play roles in the pathogenesis of OSF, it is widely established that the main factor is the consumption of areca nut (raw and baked) and its associated commercial products such as betel quid and gutka.^{4,5}

Approximately 600 million people globally chew areca nut, and most of them are from the Asia-Pacific region.⁶ Epidemiological studies reported about 23.9% (223.79 million people) of areca nut chewers in general population in India, and around 10% (2 million) population having areca nut chewing habit in Chinese Taiwan.⁷ A pooled prevalence of OSF in areca nut chewers was estimated to be 5% (95% confidence interval, 3–8%).⁷ The low prevalence clearly indicated the under estimation of OSF prevalence considering number of areca nut chewers, especially in South/Southeast Asia, because majority studies reporting the OSF prevalence were from either hospital based or a cohort conveniently selected for study.⁷ Therefore, number of OSF cases does not correspond to areca nut chewers.⁷ After the scientometric analysis of areca nut/betel quid chewing and oral cancer and precancerous lesions,⁸ we further focus on the analysis of research trends and characteristics of OSF.

Materials and methods

As per the methodology described previously,^{8–10} all the papers on OSF in the Scopus database were retrieved on 10 Apr 2024. We used medical subject terms “oral” and “submuco*” and “fibrosis” in the Title in literature search, without restriction to paper type and year of publication. The name of the relevant countries was selected in the filter of Country/Region, and only English literature was included because it is an international knowledge-exchange language. The scientometric characteristics of all the

eligible papers were reviewed and recorded for the following information: title, keyword, citation count, publication year, journal of publication, 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. Bibliometrix Biblioshiny R-package software (K-Synth Srl Inc., Naples, Italy) was used to analyze the relevant bibliometric data.

Results

Citation characteristics of all the papers on OSF

With the search strategy algorithm, a total of 1357 papers on OSF were retrieved in the Scopus database. As presented in Fig. 1A, India (n = 930) was the country publishing most papers on OSF, followed by Chinese mainland (n = 116) and Taiwan (n = 109). The regions of origin of the papers were divided into India region (930 papers) and outside of India region (427 papers), so that the number of papers can be to some extent compared in the analysis. The total citation count was 12,718 and the *h* index was 53 for the papers from India, and the total count was 13,670 and the *h* index was 49 for the papers from outside of India (Fig. 1B). To further concretize the trends of scientific output in the regions, we assessed the annual number of the papers (Fig. 1C) and annual accumulated citations of the papers (Fig. 1D) during 2008–2023. The annual number of papers from India stably raised from 6 to 64 during 2008–2023, and overwhelmingly exceeded that from outside of India from 2010 to 2023. On the other side, the accumulated citations of the papers from India increased from 99 to 1383 during 2008–2023, and exceeded that from outside of India from 2016 to 2023. The cloud graphs of journal names, contributing authors, institutions of origin are shown in Fig. 2.

Research characteristics of papers on OSF from India versus outside of India

Based on the frequency of keywords in all included papers on OSF, the keywords were automatically recognized in the order of highest to lowest frequency in the database. The cloud graphs of all the keywords retrieved in the papers on OSF are shown in Fig. 3A. The same common keywords in India or outside of India were pathology, areca, mouth neoplasms, histopathology, fibrosis, immunohistochemistry, betel nut, malignant transformation, squamous cell

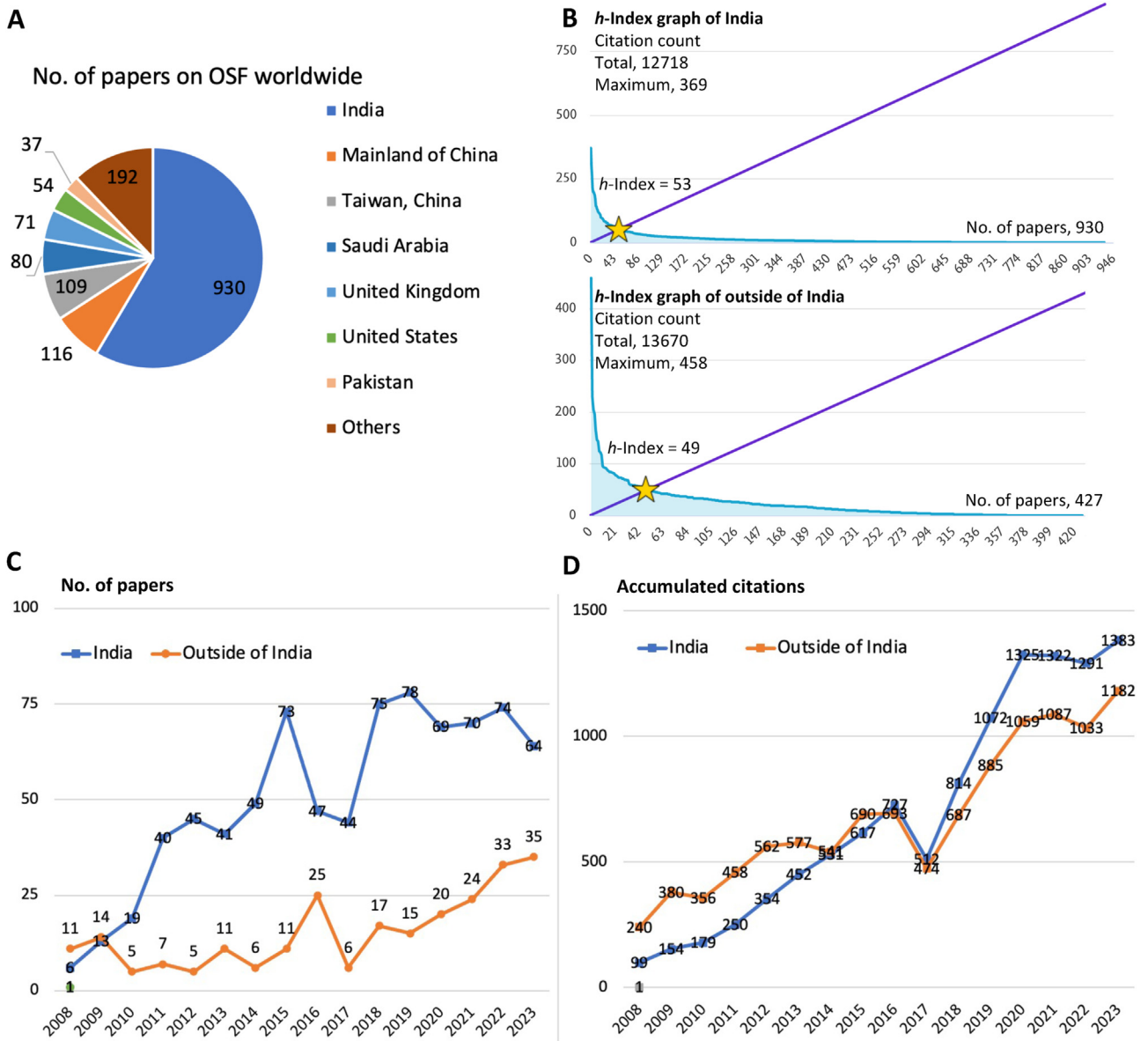


Figure 1 Citation characteristics of the papers on oral submucous fibrosis. (A) The numbers of the papers worldwide. (B) The *h*-Index graphs of the papers from India and outside of India. (C) The annual number of the papers during 2008–2023. (D) The accumulated citations of the paper during 2008–2023.

carcinoma, and precancer. We highlight the analysis of distinctive research keywords (Fig. 3B). In India, biology research on antioxidant, oxidative stress, angiogenesis, and extracellular matrix were distinctive keywords. Drug research on lycopene, curcumin, turmeric, pentoxifylline, aloe vera, trace element, iron, and zinc were distinctive keywords. Clinical aspects of disease progression, complication, mouth opening, and surgical flaps were distinctive keywords. Risk factors of smokeless tobacco and gutkha and the roles of saliva and blood sampling were also distinctive keywords in India. In outside of India, biology research on myofibroblast, alpha smooth muscle actin, microRNA, long untranslated RNA, protein p53, vimentin, fibronectin, and cytokine were distinctive keywords. Experiment methods such as western blotting, cell migration, apoptosis, wound healing, enzyme linked

immunosorbent assay, and flow cytometry were the distinctive keywords. The research on head and neck neoplasms, medicinal plants, and corticosteroid were also the distinctive keywords in outside of India.

Research trends of papers on OSF before 2015 versus after 2015

The years of publication were divided into before 2015 (542 papers) and after 2015 (815 papers, nearly a decade), so that the number of papers can be to some extent compared in the analysis of research trends. There have always been the same common keywords such as pathology, mouth neoplasms, precancer, metabolism, areca, histopathology, immunohistochemistry, squamous cell carcinoma, and

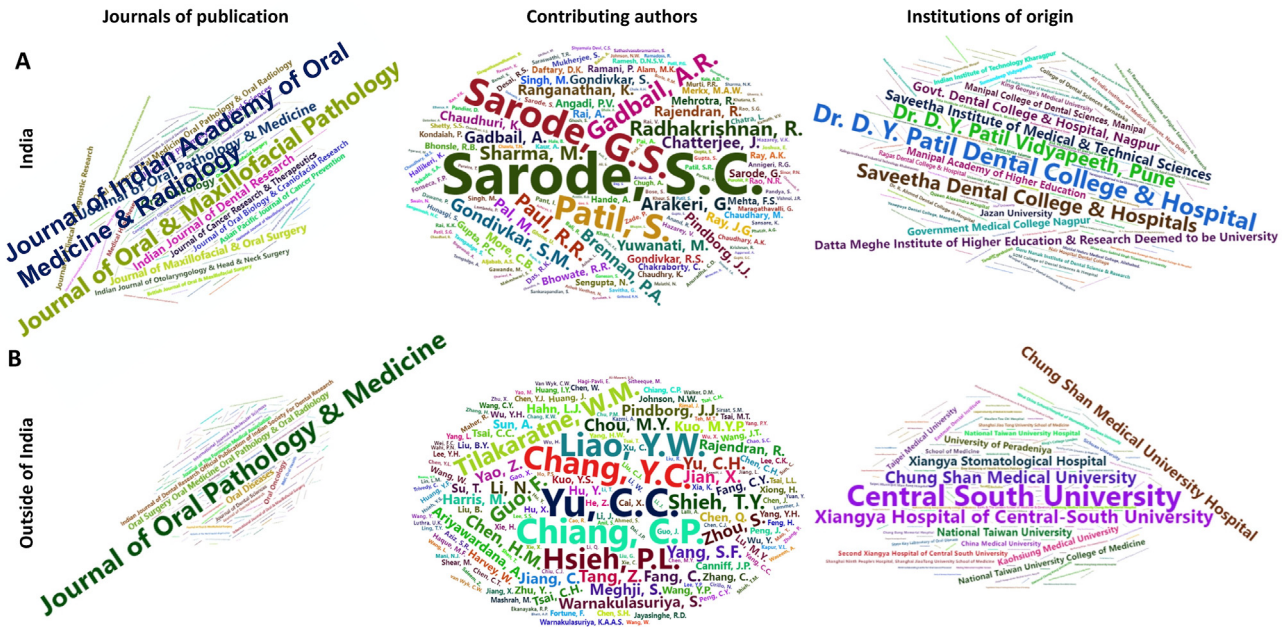


Figure 2 Cloud graphs of journal of publication, contributing authors, and institutions of origin regarding oral cancer research in (A) India and (B) out of India. The journal of publication, contributing authors, and institutions of origin with largest number of papers (rank, 1–10) are presented in [supplementary Table S1](#). In India, the journal of publication, contributing author, institution of origin with largest number of articles was *Journal of Indian Academy of Oral Medicine & Radiology* (n = 64), Sarode, S.C. (n = 54), and Dr. D. Y. Patil Dental College & Hospital (n = 80), respectively. In outside of India, the journal of publication, contributing author, institution of origin with maximum number was *Journal of Oral Pathology & Medicine* (n = 55), Yu, C.C. (n = 23), and Central South University (n = 68), respectively.

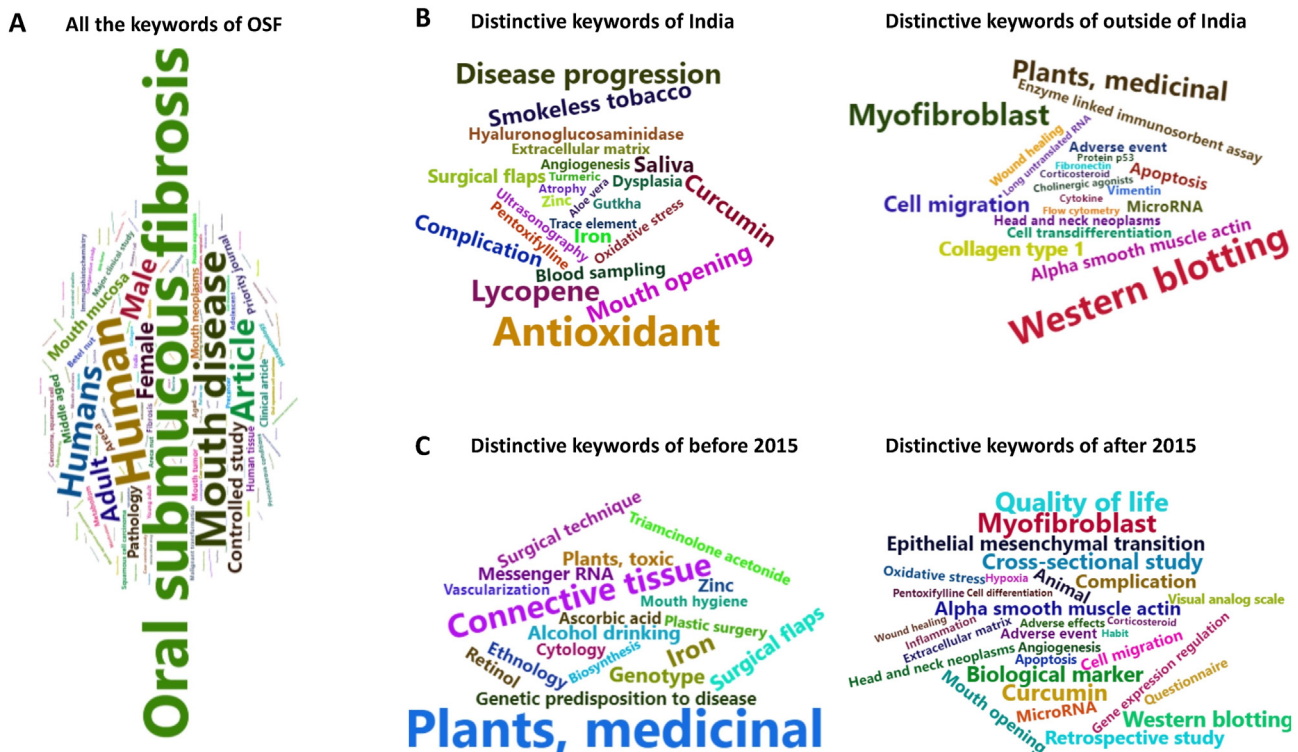


Figure 3 Research characteristics of the papers on oral submucous fibrosis. Cloud graphs of (A) all the keywords, (B) distinctive keywords of papers from India and outside of India, and (C) distinctive keywords of papers published before 2015 and after 2015.

protein expression. The more common keywords in different years can basically reflect research trends (Fig. 3C). Before 2015, biology research on connective tissue, genotype, genetic predisposition to disease, messenger RNA, cytology, and biosynthesis were more frequent keywords. Drug research on medicinal plants, toxic plants, retinol, ascorbic acid, triamcinolone acetonide, iron, and zinc were more common. Clinical aspects of surgical technique, surgical flaps, plastic surgery, mouth hygiene, and alcohol drinking were more frequent keywords. After 2015, biology research on myofibroblast, biological marker, alpha smooth muscle actin, microRNA, epithelial mesenchymal transition, extracellular matrix, gene expression regulation, hypoxia, and oxidative stress were more frequent keywords. Drug research on adverse event/effects, corticosteroid, curcumin, and pentoxifylline were more common. Experiment methods such as animal experiment, apoptosis, cell differentiation, cell migration, wound healing, and western blotting were more frequent. The aspects of complication, head and neck neoplasms, quality of life, questionnaire, and visual analog scale were also more frequent keywords after 2015.

Discussion

Scientometric analysis is a useful tool that utilizes bibliometric data to measure scientific output of a disease or region in a particular field. OSF is a common and prevalent oral mucosal disease in South/Southeast Asian regions, especially in India. Indian scholars previously analyzed the bibliometric characteristics of top-100 most-cited articles on OSF.^{11,12} In this scientometric study, we provided a more comprehensive analysis of bibliometric characteristics of all the papers on OSF. This scientometric analysis helps in evaluating the historical citation and research characteristics in the field of OSF that has undergone scientific evolution over the past decades. India accounted for over two-third (68.5%) of the total number of papers on OSF, mainly because it is the most populous country with highest population density and high prevalence of areca nut chewing. Although the number of OSF cases is most frequently reported in India, the number ($n = 354$) of papers on areca nut/betel quid in India was less than that ($n = 457$) in Chinese Taiwan.⁸ In a way, the number of OSF cases in India might still be underestimated,⁷ because it does not correspond to scientific output of study on areca nut/betel quid.

The research keywords can reflect the directions and concerned topics of research. The keywords antioxidant, oxidative stress, angiogenesis, and extracellular matrix were more frequently researched by Indian scholars. The keywords myofibroblast, alpha smooth muscle actin, microRNA, long untranslated RNA, and protein p53 were more common researched by other scholars.^{13–16} Risk factors of smokeless tobacco and gutkha were more frequently mentioned by Indian scholars, the Indian population consumes the areca nut, mainly in a form of betel quid with or without tobacco and commercial products e.g. gutkha since long time. Besides, Indian scholars could pay more attention to study on saliva and blood sampling of OSF patients, while other scholars could perform more experiment

methods to research biology of this disease. On the other side, the more common keywords in different years can basically reflect research trends. The trend of biology research on connective tissue, genotype, genetic predisposition, messenger RNA, and cytology before 2015 has changed to research on myofibroblast, biological marker, microRNA, epithelial mesenchymal transition, extracellular matrix, and oxidative stress after 2015. The trend of clinical aspects of surgery and mouth hygiene before 2015 has changed to the aspects of adverse event/effects, complication, and quality of life after 2015.^{17–19}

In summary, this scientometric study on OSF elucidated the current scenario and research trends in the field of this disease. Finding the scientometrics will not only help in further improving policies in relation to areca nut production and related product control but also in reciprocal collaboration and communication for OSF field in South/Southeast Asian regions.

Declaration of competing interest

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

Acknowledgments

This work was supported by National Construction Project of Clinical Key Specialized Department (No. [2013]544) and the Research Discipline fund No. KQYJXK2020 from Ninth People's Hospital, Shanghai Jiao Tong University School of Medicine and College of Stomatology, Shanghai Jiao Tong University.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jds.2024.05.006>.

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