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Bibliometric insights into molecular and bioinformatic research trends on ameloblastoma

Yoithapprabhunath Thuckanaickenpalayam Ragunathan[1], Ramdas Madhavan Nirmal[2], Supriya Kheur[3], Kumar Chandan Srivastava[4,5], Swetha Pasupuleti[6], Srichinthu Kenniyan Kumar[7*], Armen A. Muradyan[8] and Artak Heboyan[9,10*]

*Correspondence:
Srichinthu Kenniyan Kumar
drchinthu@ksridsr.edu.in
Artak Heboyan
a_heboyan@farabi.tums.ac.ir

Full list of author information is available at the end of the article

Abstract

Objectives The study aimed to evaluate the significant trends of advancement in the body of literature of specialty journals on molecular biological investigations of ameloblastoma (AB). Additionally, this bibliometric study sought to identify the authors, organizations, journals, and countries from emerging regions that have exerted the most significant influence on molecular biological and bioinformatics studies on AB.

Novelty of study The novelty of this study lies in its comprehensive bibliometric integration of bioinformatics and molecular perspectives, offering a structured roadmap for future ameloblastoma research.

Materials and methods A complete list of AB molecular biological research citations was found in Scopus. The search was restricted to papers published between 2014 and 2024, but there were no restrictions on the language or type of research studies. The study examined total citations, citation density, journal name, impact factor, journal category, quartile, published year, authors, affiliations, and study type.

Results The analysis included collecting 112 publications published between 2014 and 2024. There were 95 original research papers, 6 systematic reviews, 5 case reports, 3 brief communications, and 6 systematic reviews and meta-analyses. Our analysis identifies noteworthy authors and nations that have contributed, with Brazil emerging as a leading figure in this field of study.

Conclusions The research on AB, especially its biological profile, has changed significantly across the years, as can be observed by perusing the contents of the papers included here. The data from this study would help the researchers target specific objectives for future research in more relevant avenues.

Keywords Ameloblastoma, Bibliometric analysis, BRAF V600E protein, Citation density, Immunohistochemistry

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1 Introduction

Ameloblastoma (AB) is a type of benign tumour that is usually found in the maxilla and mandible. This tumour may be caused by the residual dental lamina cells, the cell rests of Malassez or the basal cells of the epithelium [1]. AB has aggressive characteristics, and the likelihood of recurrence is increased in cases when surgical resection is insufficient [2]. The extensive resection of the jaw is a successful method for managing relapse; however, it is accompanied by notable challenges in terms of both appearance and functionality [3]. In recent decades, numerous research organizations have conducted molecular biological investigations on ameloblastoma, resulting in significant advancements in our comprehension of this tumour. Hence, there is a need to devise an innovative non-invasive intervention that incorporates molecular targeted therapy, aiming to minimize the decline in patients' quality of life following surgery. The present analysis highlights the significance of molecular targeted therapy utilizing inhibitors targeting mutant BRAF, as indicated by multiple publications. Furthermore, there have been reports of possible contenders for therapeutically relevant variables, in addition to BRAF [1].

Assessing the proliferative potential of AB can yield valuable insights into the optimal therapeutic approach. The assessment of proliferative cells in various tumour types can be accomplished by a range of methodologies, such as the examination of the mitotic index, the use of flow cytometry, silver staining, and immunohistochemical procedures. The aforementioned procedures are extensively employed in the investigation of AB. It is crucial to emphasise that there exist more precise and sensitive methodologies for ascertaining the existence of certain proliferative markers, such as proteomics techniques that enable us to ascertain the presence or absence of certain proteins within these tumours. The real-time polymerase chain reaction is a quantitative, sensitive, and highly specific approach employed to ascertain the degree of gene expression in AB. The immunohistochemistry method is less sensitive and specific than the other two, but it has the advantage of being able to show the existence of proteins "in situ," which provides crucial information on how the tumour progresses. However, it is also more costly and time-consuming [4].

A bibliometric study of published papers identifies the most active research areas in a specific domain and illustrates the patterns of publication, influential authors, main topics, and emerging research areas within a given area [5]. Additionally, the scholarly influence of the works that have been published can be assessed using citation analysis, an increasingly popular bibliometric approach [6]. Numerous investigations have been conducted in diverse domains, including forensic odontology [7]dental stem cells [8] oral submucous fibrosis [9]pemphigoid disorders [10]ameloblastoma [11]odontogenic keratocyst [12]carcinoma of the mouth [5]and similar domains. Despite the substantial contributions of several academic papers to the comprehension of different facets of AB, these articles have not yet been graded and subjected to descriptive analysis. Furthermore, there has been a consistent increase in the interest of researchers in molecular biological investigations on AB. This is mostly due to its intrusive clinical behaviour, diverse morphological and histological patterns, and a high incidence of recurrence [11]. As far as we know, there has not been a bibliometric analysis conducted on the published studies regarding the molecular features of AB. To develop a valuable resource for clinical, and future academic endeavours, the present investigation was conducted to determine significant trends of advancement in the body of literature of specialty journals on

molecular biological investigations of AB. Additionally, this bibliometric study sought to identify the authors, organizations, journals, and countries from emerging regions that have exerted the most significant influence on molecular biological and bioinformatics studies on AB.

1.1 Contributions

The novel contributions of this study are:

1) We analyze bibliometric trends in molecular and bioinformatic research on ameloblastoma to identify influential authors, institutions, and journals.
2) We provide citation density and impact factor comparisons across leading dentistry and oral pathology journals from 2014 to 2024.
3) We highlight key molecular biomarkers and bioinformatics approaches in ameloblastoma research, offering insights for future investigations.
4) We identify regional contributions to ameloblastoma research, with Brazil emerging as a leading contributor in molecular biological studies.

2 Materials and methods

2.1 Data source

AB article citation data was retrieved from Scopus on March 30, 2024. The following medical phrases were used to search Scopus for titles, keywords, and text: "Molecular studies on Ameloblastoma" OR "Bioinformatic studies on Ameloblastoma." The two reviewers separately searched for titles in the Science Citation Index Expanded part of the Scopus repository, particularly for the following seven specialty journals of Dentistry/Oral Surgery: the Journal of Oral Diseases (Oral Dis), the Journal of Dental Research (J Dent Res), the Journal of Oral Oncology (Oral Oncol), the Journal of Oral Pathology and Medicine (J Oral Pathol Med), the Journal of Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology (Oral Surg Oral Med Oral Pathol Oral Radiol), the Journal of Oral and Maxillofacial Pathology (J Oral Maxillofac Pathol), and the Indian Journal of Dental Research (Indian J Dent Res). The publications on the molecular characteristics of AB that came up in the search were then sorted by descending citation counts. In instances where papers got an identical amount of citations, citation density was also computed by dividing the overall count of citations by the number of years following the publication. Titles and abstracts were examined to determine how relevant these papers were to AB. The search was restricted to papers published between 2014 and 2024, but there were no restrictions on the language or type of research studies.

2.2 Data extraction

Online Supplementary file 1 shows the list of articles that were obtained from the search. The following details were also taken from the paper: study type, affiliation, first author's country of origin, quartile (2022 Journal of Citation Reports (JCR): Science Edition), name of the publisher, journal impact factor (JIF), journal categories, cite score, SCImago Journal Rank, Source Normalized Impact per Paper, and H-index. The data was imported into Microsoft Excel 2016. A third author intervened when the two reviewers disagreed until they concurred.

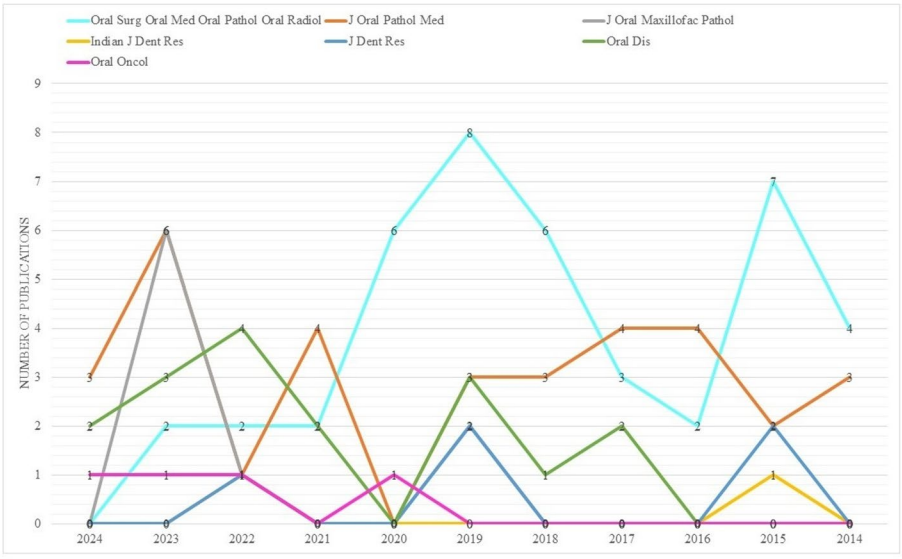


Fig. 1 Total number of year-wise publications in the selected journals over a past decade

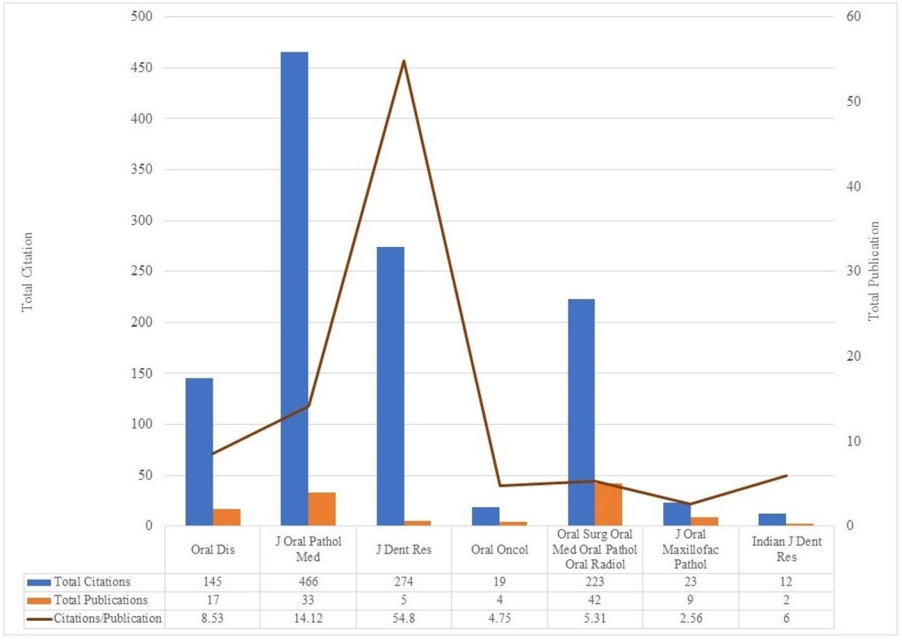


Fig. 2 Total number of publications and citations based on the selected journals

3 Results

3.1 General data

The analysis included collecting 112 publications published between 2014 and 2024. Supplementary file 1 shows trends in the quantity of papers published. Figure 1 shows that 2023 and 2019 had the most published papers ($n = 18$ each). The J Oral Pathol Med had the highest number of citations ($n = 466$) over the past ten years. The J Dent Res had an average of 54.8 citations per publication. The Oral Med Oral Surg Oral Pathol Oral Radiol had the most publications ($n = 42$) (Fig. 2).

Table 1 Most frequently cited journals chosen for the study

Source Title	Categories	Cite Score	SNIP	SJR	Publisher	Impact factor	H-index	Quartile
Oral Dis	Dentistry, Medicine	7.4	1.39	0.849	Wiley-Blackwell	3.8	98	Q1
J Dent Res	Dentistry, Oral Surgery and Medicine	13.4	2.303	1.872	SAGE	7.6	202	Q1
Oral Oncol	Dentistry, Oral Surgery Oncology	8.6	1.497	1.271	Elsevier	4.8	128	Q1
J Oral Pathol Med	Dentistry, Oral Surgery and Medicine, Pathology	7.3	1.213	0.682	Wiley-Blackwell	3.3	91	Q2
Oral Surg Oral Med Oral Pathol Oral Radiol	Dentistry, Oral Surgery and Medicine	3.7	1.045	0.561	Elsevier	2.9	133	Q2
J Oral Maxillofac Pathol	Dentistry, Medicine	2	0.886	0.329	Wolters Kluwer Health	1.22	35	Q3
Indian J Dent Res	Dentistry	2.1	0.568	0.264	Wolters Kluwer Health	1.088	50	Q3

Metrics based on Scopus data as of April 2023; SJR - SCImago Journal Rank; SNIP– Source Normalized Impact per Paper

Table 2 Type of publications based on study design

Type of publications	Number of publications
Original research	95
Systematic review and meta-analysis	3
Systematic review	6
Brief communications	3
Case report	5
Total	112

Based on SCImago journal rankings, four of the seven journals: The Journal of Dental Research, Oral Diseases, and Oral Oncology were ranked in the first quartile. While two were (28.57%) in the second quartile (Q2: The J Oral Pathol Med and the Oral Med Oral Surg Oral Pathol Oral Radiol), two (28.57%) were in the third quartile (Q3: The J Oral Maxillofac Pathol and Indian J Dent Res). The journals that published the chosen papers have impact factors ranging from 7.6 to 1.088. H-index values ranged from 35 for the J Oral Maxillofac Pathol to 202 for the J Dent Res (Table 1). With just five publications, the J Dent Res had the greatest impact factor. Table 2 shows an overview of document types: there were 95 original research papers, 6 systematic reviews, 5 case reports, 3 brief communications, and 6 systematic reviews and meta-analyses. Compared to the Journal of Dental Research, which had 5 articles and the highest cite score (13.4), the Oral Med Oral Surg Oral Pathol Oral Radiol published 42 articles and had a citation score of 3.7. Figure 3 shows Journals' Impact Factor vs. Number of Publications graph, comparing journal impact factors with publication counts.

3.2 Analysis of the institutions, and author contributions

The list of prolific authors is shown in Table 3, where the authors with the most publications ($n = 7$) were Amaral-Silva GK (in 6 papers as first author and 1 as sixth author) and Rocha AC (in 5 papers as first author and 1 each as second and third author). As the first author, Martins-de-Barros contributed to four publications. The university with the most publications ($n = 12$) was the Universidade Federal de Minas Gerais, located in Belo Horizonte, Brazil (Table 4). The top 10 papers [13–22] of AB molecular biology research

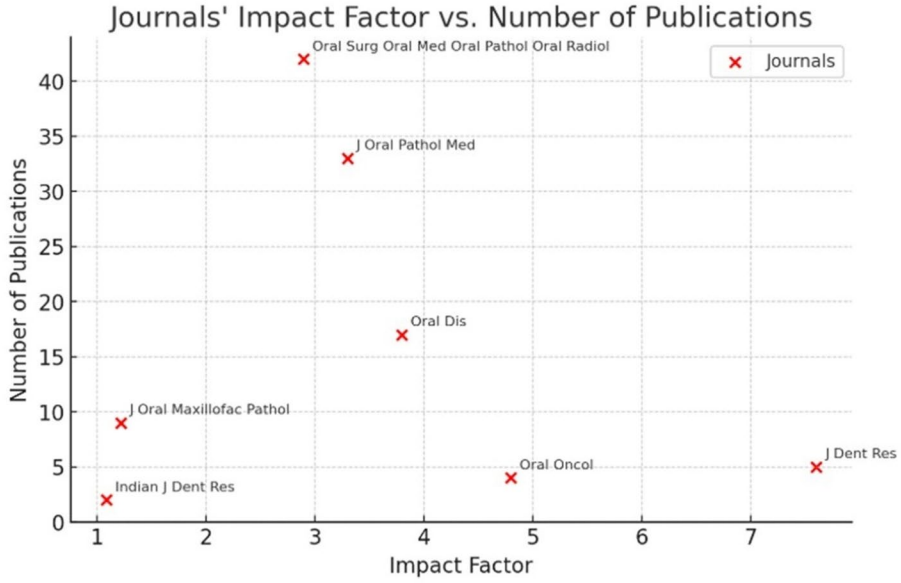


Fig. 3 Journals' Impact Factor vs. Number of Publications graph, comparing journal impact factors with publication counts

Table 3 Authors who had contributed a minimum of two publications

Author	Country	Authorship						
		1st	2nd	3rd	4th	5th	6th	Total
do Amaral-Silva GK	Brazil	6	0	0	0	1	0	7
Rocha AC	Brazil	0	1	1	0	5	0	7
Gomez RS	Brazil	0	0	0	0	1	5	6
Fonseca FP	Brazil	1	1	2	0	0	2	6
Sanchez-Romero C	Brazil	3	2	0	0	0	0	5
Martins-de-Barros	Brazil	4	0	0	0	0	0	4
Kataoka MSS	Brazil	0	0	0	0	3	1	4
Siar CH	Malaysia	3	0	0	1	0	0	4
Urs	India	1	1	0	1	0	0	3
Heikinheimo K	Finland	3	0	0	0	0	0	3
Gomes CC	Brazil	0	0	0	0	1	2	3
Pollack	USA	0	1	0	0	0	1	2
Martins MD	Brazil	0	1	1	0	0	0	2

Table 4 Affiliations with three or more publications

Universities	Number of publications
Universidade Federal de Minas Gerais, Belo Horizonte, Brazil	12
University of Pernambuco, Pernambuco, Brazil	4
Federal University of Mato Grosso do Sul, Brazil	4
University of Campinas, Piracicaba, Sao Paulo	8
Sun Yat-sen University, Guangzhou, China	3
Federal University of Pará, Brazil	3
University of Turku, Finland	3
University of Malaya, Kuala Lumpur, Malaysia	3
Stanford University School of Medicine, Stanford, CA	3
Maulana Azad Institute of Dental Sciences, New Delhi, India	3

are displayed in Table 5. Figure 4 shows Institutional Contributions Graph showing the number of publications by universities. Figure 5 shows Geographical Distribution of Publications, showing country-wise research contributions.

3.3 Analysis of document citations

The citation density of the top 10 articles is displayed in Table 3, along with the total citations. The most often cited paper was "Early Dental Epithelial Transcription Factors Distinguish Ameloblastoma from Keratocystic Odontogenic Tumour," which was published in 2015 and had 111 citations, authored by Heikinheimo K. from the University of Turku, Finland [15]. Ten articles that made up the top 10 list had citation counts that ranged from 15 to 111. These publications were ranked in the list based on citation densities that varied from 5.3 to 15. The original research work "Identification of key biomarkers related to epithelial-mesenchymal transition and immune infiltration in ameloblastoma using integrated bioinformatics analysis" by Zhang et al. had the highest citation density. "Biological profile of ameloblastoma and its location in the jaw in 1246 Nigerians" by Olubanwo et al., published in the Oral Surg Oral Med Oral Pathol Oral Radiol in 2018, was with the lowest citation density among the top 10 publications [22].

Table 5 Top ten most frequently cited publications among the selected journals included in the study

Authors	Title of the publication	Publication Year	Journal	Total citations	Citation density
Zhang et al.,[13]	Identification of key biomarkers related to epithelial-mesenchymal transition and immune infiltration in ameloblastoma using integrated bioinformatics analysis	2023	Oral Dis	15	15
Heikinheimo et al. [14])	The Mutational Profile of Unicystic Ameloblastoma	2019	J Dent Res	70	14
Heikinheimo et al. [15)]	Early Dental Epithelial Transcription Factors Distinguish Ameloblastoma from Keratocystic Odontogenic Tumor	2015	J Dent Res	111	12.3
You et al. [16)]	Advancements in MAPK signaling pathways and MAPK-targeted therapies for ameloblastoma: A review	2019	J Oral Pathol Med	57	11.4
Tan et al. [17]	BRAF inhibitor treatment of primary BRAF-mutant ameloblastoma with pathologic assessment of response	2015	Oral Surg Oral Med Oral Pathol Oral Radiol	88	8.6
Heikinheimo et al. [18)]	Novel Targets for the Treatment of Ameloblastoma	2015	J Dent Res	74	8.2
Pereira et al. [19]	BRAFV600E mutation in the diagnosis of unicystic ameloblastoma	2016	J Oral Pathol Med	61	7.6
Yang et al. [20]	Elevated hydrostatic pressure promotes ameloblastoma cell invasion through upregulation of MMP-2 and MMP-9 expression via Wnt/β-catenin signalling	2018	J Oral Pathol Med	45	7.5
Oh et al. [21]	High prevalence of BRAF V600E mutations in Korean patients with ameloblastoma: Clinicopathological significance and correlation with epithelial-mesenchymal transition	2019	J Oral Pathol Med	32	6.4
Olubanwo et al. [22]	Biological profile of ameloblastoma and its location in the jaw in 1246 Nigerians	2018	Oral Surg Oral Med Oral Pathol Oral Radiol	32	5.3

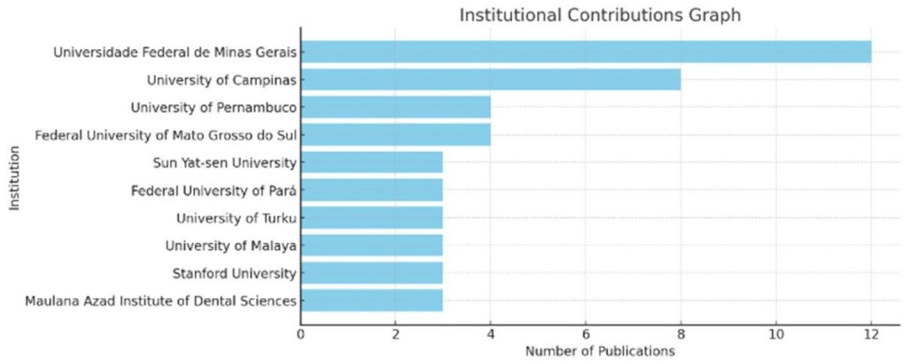


Fig. 4 Institutional Contributions Graph showing the number of publications by universities

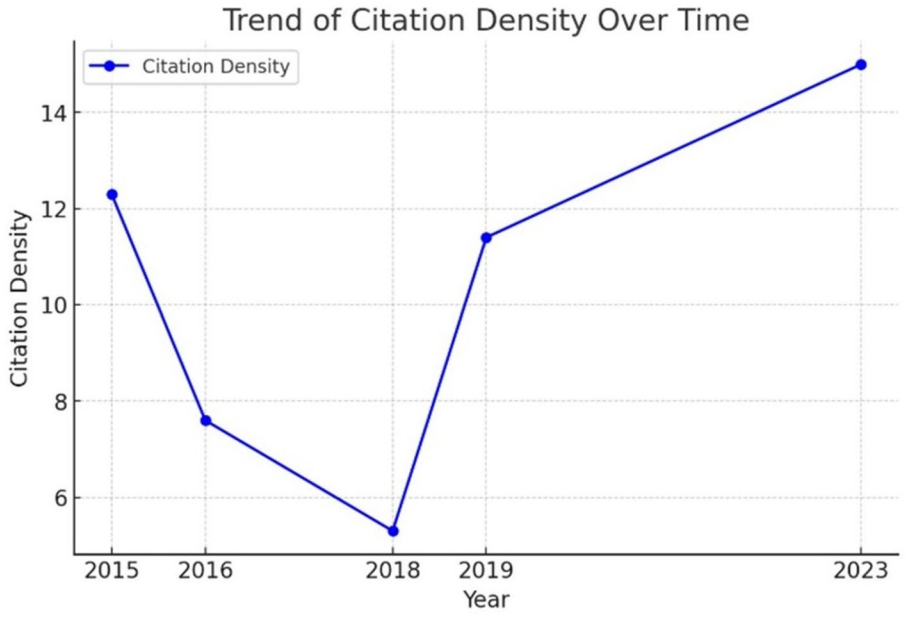


Fig. 5 Trend of Citation Density Over Time showing how citation density has changed over the years

Figure 6 shows trend of Citation Density Over Time showing how citation density has changed over the years.

3.4 Analysis of the country of origin of the publications

The first author of each publication was sought, and their nationality was noted. This search revealed that the 112 publications had been contributed to by researchers from 21 different nations. Following Brazil, which had 43 articles cited in 241 papers, India had contributed to 15 papers with only 4 citations and China had 11 articles cited in 145 citations (Fig. 7).

3.5 Intellectual structure of the keywords

The keywords considered for the current bibliometric analysis appeared in at least two selected papers in the present bibliometric study (Fig. 8). Only 26 of the 637 total keywords satisfied the criterion. Among the chosen publications, ameloblastoma appeared

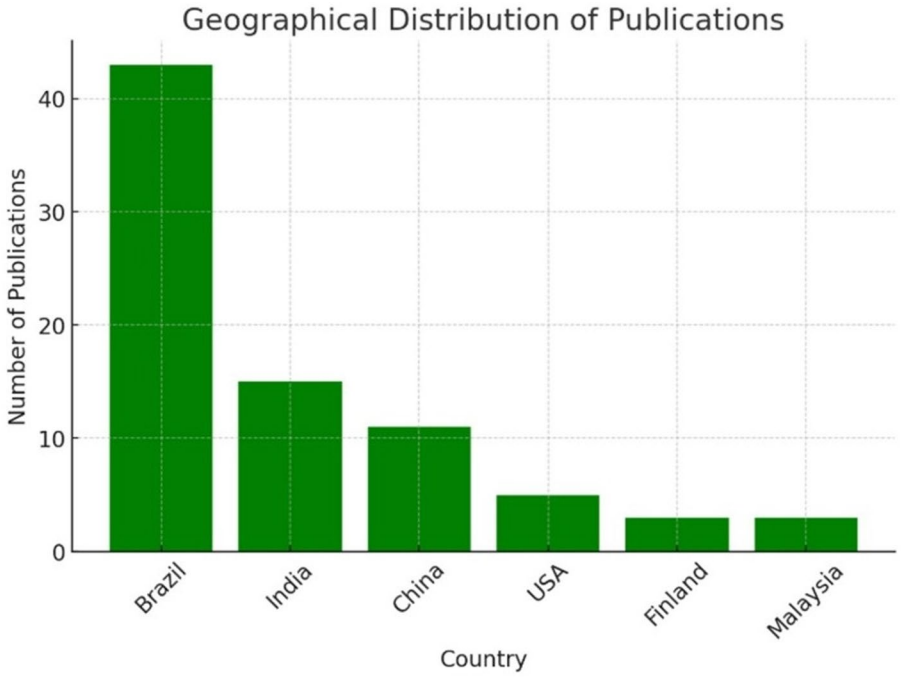


Fig. 6 Geographical Distribution of Publications, showing country-wise research contributions

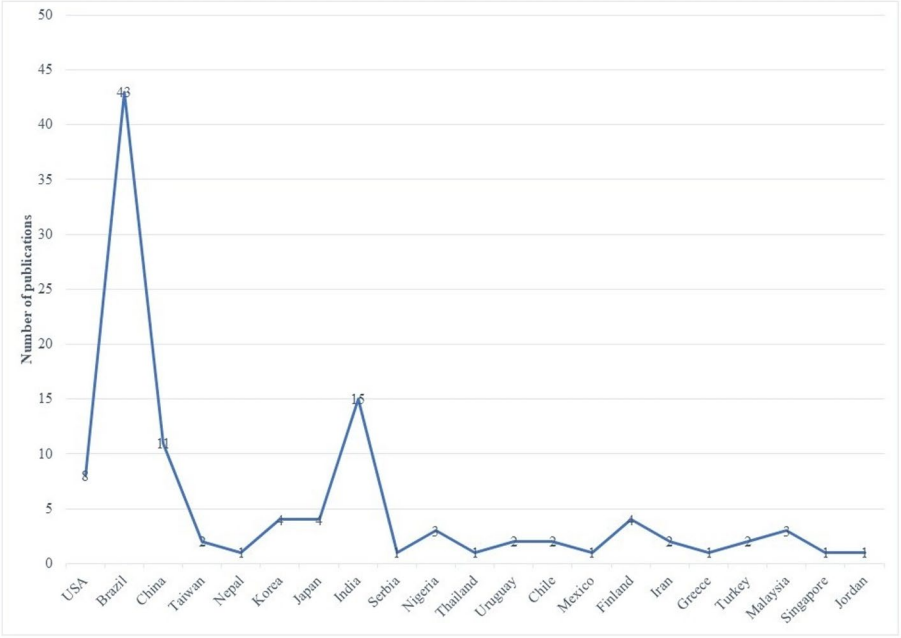


Fig. 7 Country of origin and the number of publications included during the study period

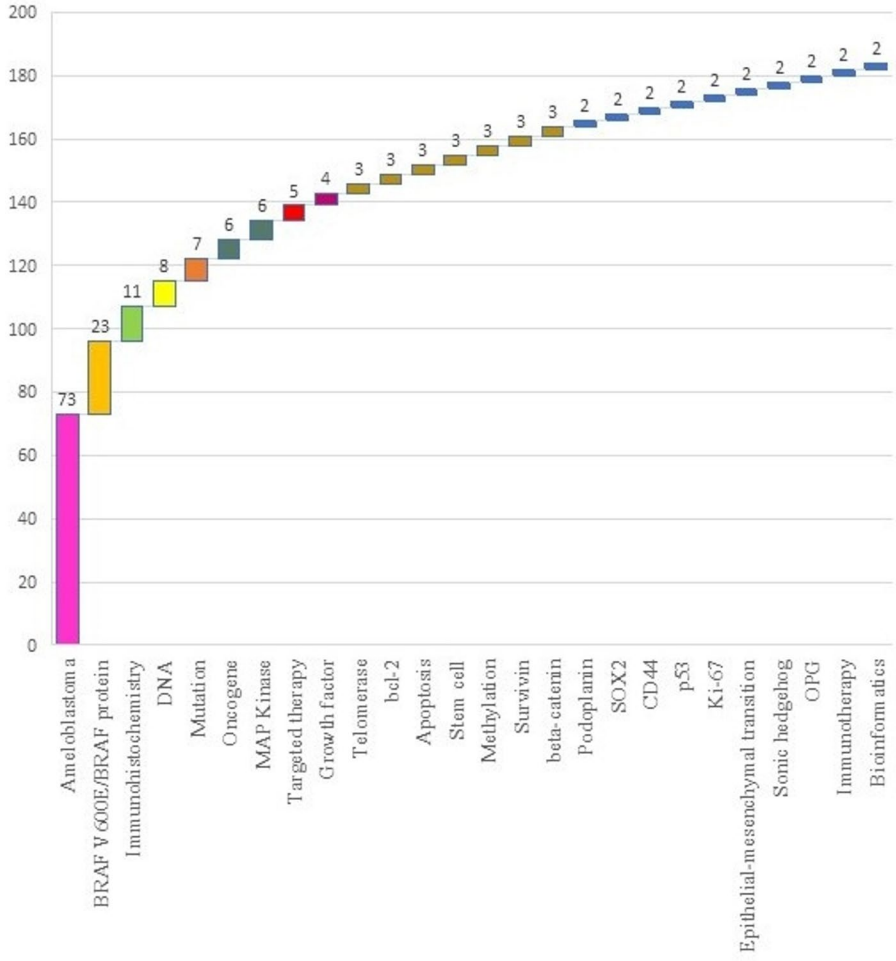


Fig. 8 Keywords cited at least two or more times in the selected molecular biological studies on ameloblastoma

73 times followed by BRAF V600E or BRAF protein, the second most often used keyword, appearing 23 times.

4 Discussion

Articles published in the seven speciality journals throughout the previous 10 years were included in the present bibliometric analysis. One paper in particular attracted a lot of citations, indicating its substantial impact on the molecular field of AB. Our analysis identifies noteworthy authors and nations that have contributed, with Brazil emerging as a leading figure in this field of study. This result coincided with another bibliometric study that provided information on important avenues for further investigation into oral mucosal lesions in COVID-19 [6]. Citation analysis is a useful method in medical literature that helps identify the most important papers within a particular topic. Many academicians employ bibliometric methods to investigate the influence of a group of researchers, or in the identification of individual influential papers within a certain field of study [7].

Heldwein et al., [23] stated that studies that receive 100 citations or more are considered classic studies. The current analysis found just one paper that has received over 100 citations and is therefore regarded as classic. Understanding and being familiar with

these historic publications clinicians, and young researchers remain up to date on traditional knowledge. We determined each article's citation density, which represented its scientific effect, yearly to correct for time bias [7]. Based on where a journal falls within the JIF distribution of a given subject category, quartile rankings are determined for every journal within that category. Public research funding that is based on performance might benefit greatly from the total publications and/or the fraction of total publications in a specified quartile, typically the first quartile [24]. Nevertheless, in the present study, very few papers were assigned to the selected first quartile (J Dent Res [$n = 5$], Oral Dis [$n = 17$], Oral Oncol [$n = 4$]), and third quartile (J Oral Maxillofac Pathol [$n = 9$], Indian J Dent Res [$n = 2$]) journals. In contrast, the maximum number of papers were in the chosen second quartile (J Oral Pathol Med [$n = 33$], and Oral Surg Oral Med Oral Pathol Oral Radiol [$n = 42$]) journals.

When it comes to publishing their research, authors typically choose high-impact journals, to publish outstanding work [9, 11]. Previous bibliometric studies that have shown a favourable association between citation frequency and JIFs provide evidence for this claim [25, 26]. Nevertheless, no such relationship was found in the current study, which was in conjunction with an earlier bibliometric investigation [7]. Regardless of the impact factors, authors today are more concerned with the journal's readership and hence favour publishing their top-notch work in specialised journals. Despite having an impact factor of less than five, the Oral Surg Med Pathol Oral Radiol, and J Oral Pathol Med, have published 42 and 33 articles, respectively. This indicates that more frequently than not, investigators submit work on AB to these two journals for publication. Furthermore, because the outcomes of some research that have evolved into landmark studies are so well acknowledged, their original investigators or collaborators are frequently forgotten, and these studies may eventually receive fewer citations. This phenomenon is called the "obliteration by incorporation" effect [27].

Despite having strong scientific content, recent novel works could not have as many citations. It was proposed that an article needs to be published for at least six to fifteen years to receive enough citations to be considered a citation classic [28]. It is noticeable that 112 of the papers ascribed here have varying numbers of citations; fewer publications have garnered more attention and have ruled the literature on AB, adhering to Bradford's law [29]. The other bibliometric evaluations concur with the result of our investigation [9, 30, 31].

There are some intrinsic limitations to the present bibliometric analysis. Information about the citation analysis was obtained only from the Scopus repository. Therefore, there is a chance that genuine "classic" publications that are accessible in other databases such as Web of Science (WoS) and PubMed, Google Scholar could have dropped out. Furthermore, the hierarchy for cited publications on AB may differ in other databases [11]. Citation counts are typically greater in Google Scholar and Scopus than in WoS [32]. Nonetheless, Scopus is frequently utilized in the literature and is regarded as the most reliable database for citation analysis [7]. A bibliometric analysis typically does not represent the quality of an article; rather, it measures the publication's recognition within a particular field. Researchers frequently have a tendency to mention earlier highly cited works, regardless of their content or quality, due to the phenomenon of the snowball effect [9, 11, 33]. Regardless of their profound scientific merit, older publications have a higher edge than more recent ones when it comes to citation analysis [7, 11]. Despite

many limitations, the information presented in this study offers some understanding of the primary domains of research for molecular studies on AB.

5 Conclusion

The research on AB, especially its biological profile, has changed significantly across the years, as can be observed by perusing the contents of the papers included here. The data from this study would help the researchers target specific objectives for future research in more relevant avenues. In general, and especially in the past ten years, there has been a notable upsurge in molecular investigations on AB. This might be a result of the growing number of AB cases in the general population as well as the possibility of tumour resistance to treatment. The bibliometric analysis of 112 publications from 2014 to 2024 revealed that the *Journal of Oral Pathology and Medicine* had the highest number of citations ($n = 466$), while *Journal of Oral Medicine*, *Oral Surgery*, *Oral Pathology*, *and Oral Radiology* published the most articles ($n = 42$), highlighting key publication trends in molecular and bioinformatics studies on ameloblastoma. Further advancements in evidence-based medicine are anticipated, including a rise in top-quality evidence studies on the molecular traits associated with AB.

6 Future work

Future research should expand the bibliometric analysis by incorporating emerging AI-driven citation analysis tools to predict trends in ameloblastoma research.

7 Limitation

The study is limited to Scopus-indexed journals, which may exclude relevant contributions from other databases and regional publications.

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Data Availability.
The data will be available on reasonable request from the corresponding author.

Data availability
The data will be available on reasonable request from the corresponding author.

Declarations

Ethical approval Consent to participate
Not Applicable, as the current study is a bibliometric analysis based which is entirely based on previously published literature from publicly accessible databases. It does not involve human participants, animals, or identifiable personal data. Hence, the study is exempted from the ethical approval. Not Applicable, as there is no involvement of human participants, personal data, or clinical samples in this bibliometric analysis.

Consent for publication
Not Applicable, as the study is based entirely on analysis of published literature from publicly available databases (e.g., Scopus, Web of Science, PubMed), and does not include any identifiable personal data or unpublished material. All authors have reviewed and approved the final manuscript and gave consent to its publication in Discover Oncology.

Competing interests
The authors declare no competing interests.

Author details
[1]Present address: Department of Oral & Maxillofacial Pathology & Microbiology, Vivekanandha Dental College for Women, Affiliated to The TN Dr. MGR Medical University, Elaiyampalayam 637205, Tamil Nadu, India
[2]Department of Oral & Maxillofacial Pathology, Cuddalore Government Dental College & Hospital, Affiliated to The TN Dr. MGR Medical University, Cuddalore, Tamil Nadu, India
[3]Department of Oral and Maxillofacial pathology and Oral Microbiology, Incharge- Regenerative Medivine Laboratory, Dr. D.Y.Patil dental college and Hospital, Pimpri, Maharashtra, India
[4]Department of Oral and Maxillofacial Surgery & Diagnostic Sciences, College of Dentistry, Jouf University, Sakaka 72345, Saudi Arabia
[5]Department of Oral Medicine & Radiology, Saveetha Institute of Medical and Technical Sciences, SIMATS, Saveetha Dental College and Hospital, Saveetha University, Chennai, Tamil Nadu, India
[6]Department of Oral and Maxillofacial Pathology, Vishnu Dental College, Kovvada, Andhra Pradesh, India
[7]Department of Oral & Maxillofacial Pathology & Microbiology, KSR Institute of Dental Science and Research, Affiliated to The TN Dr. MGR Medical University, Tiruchengode, Tamil Nadu 637215, India
[8]Administrative Department, Yerevan State Medical University after Mkhitar Heratsi, Str. Koryun 2, Yerevan 0025, Armenia
[9]Department of Prosthodontics, Faculty of Stomatology, Yerevan State Medical University after Mkhitar Heratsi, Str. Koryun 2, Yerevan 0025, Armenia
[10]Department of Prosthodontics, School of Dentistry, Tehran University of Medical Sciences, North Karegar St, Tehran, Iran

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