ORIGINAL RESEARCH

A Bibliometric Study of Trends, Indicators, and Characteristics in the Global Scientific Production on Fluorosis

Justiniano Sotomayor Camayo[1], Margot Gutierrez-Ilave[2], William Cardenas-Silva[3], Adrian Mallma-Medina[4], Katia Luz Medina Calderon[5], Fran Espinoza-Carhuancho[6], Frank Mayta-Tovalino[7]

Abstract

Aim: To perform an analysis of the trends, indicators, and characteristics of the world scientific production on fluorosis, and to evaluate its impact on scientific research in this field.

Materials and methods: A descriptive, cross-sectional study was conducted with a bibliometric approach of the worldwide scientific production on fluorosis published during the years 2018–2023. All metadata were extracted from the Scopus database. The articles were exported in .csv format to SciVal (Elsevier). Of the collected articles, 69 were original, 17 were reviews, 2 were conference papers, 6 were book chapters, among others.

Results: It was found that among the journals with the highest number of articles were Biological Trace Element, Caries Research, Children, Fluoride, and Indian Journal of Forensics. In addition, the highest percentage of authors have published between 1 and 2 articles, with a smaller proportion having 3–4 publications. Among the journals with the highest number of articles are Biological Trace Element, Caries Research, Children, Fluoride, and Indian Journal of Forensics. The Universidade de São Paulo has the most publications, although it is also one of those with the lowest citation-weighted impact in relation to the global average (FWCI: 0.9).

Conclusion: The collaboration map shows a wide international cooperation network, with an active participation of Brazil among Latin American countries. Scientific production in fluorosis has a negative trend from 2018 to 2023 and is mainly concentrated in high-impact scientific journals.

Clinical significance: The study shows a wide network of international cooperation on fluorosis, so the results provide important information to guide future clinically focused research on fluorosis and its impact on public health.

Keywords: Bibliometrics, Children, Fluorosis.

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Introduction

Dental fluorosis is a condition that affects tooth enamel, occurring in a small percentage of individuals as a result of exposure to fluoride during dental development in early childhood.[1,2] Fluorosis is an alteration that can be considered chronic, in which the development of enamel is interrupted and results in hypomineralization.[3] In recent years, there has been an increase in the prevalence of enamel fluorosis.[4,5] This can be attributed to an excess of fluoride intake from preventive measures such as varnishes, which is incorporated into the enamel during tooth development.[6] Globally, its prevalence is not entirely clear. However, it is estimated that excessive fluoride concentrations have caused cases of dental fluorosis worldwide. For example, in Mexico, the reported prevalence of dental fluorosis was 30–100% in areas where the water was naturally fluoridated, while in the United States, the prevalence of fluorosis in the 1980s was 22.3%.[7,8]

The brown discoloration characteristic of fluorosis was instrumental in discovering the relationship between excessive fluoride intake and the development of hypoplastic dentition, which would later become known as fluorosis.[7] This condition, which affects the esthetic function of teeth, is found mainly in populations living in areas with high fluoride levels.[8–11] Fluorosis is caused by excessive fluoride intake, is more common in areas with high levels of fluoride in the water.[4] During tooth development, a high concentration of fluoride can affect ameloblasts, the cells responsible for enamel formation. This can lead to developmental changes and other characteristic features of fluorosis.[12]

This esthetic damage reduces the quality of life of affected patients, especially with regard to their sociocultural integration, which requires appropriate treatment.[13] Water and protein retention delays the growth of enamel crystals, which subsequently modifies the degree of subsurface porosities.[14] The main clinical characteristic of dental fluorosis is the alteration of the appearance of the color of the teeth, it is diagnosed by the analysis of symptoms and radiographs, its treatment can range from teeth whitening to the placement of veneers.[3–7]

[1–5]Department of Academic, Faculty of Dentistry, Universidad Nacional Mayor de San Marcos, Lima, Peru

[6]Grupo de Bibliometría, Evaluación de evidencia y Revisiones Sistemáticas (BEERS), Human Medicine Career, Universidad Cientifica del Sur, Lima, Peru

[7]Department of Academic, Faculty of Dentistry, Universidad Nacional Mayor de San Marcos, Lima, Peru; Grupo de Bibliometría, Evaluación de evidencia y Revisiones Sistemáticas (BEERS), Human Medicine Career, Universidad Cientifica del Sur, Lima, Peru

Corresponding Author: Frank Mayta-Tovalino, Department of Academic, Faculty of Dentistry, Universidad Nacional Mayor de San Marcos, Lima, Peru; Grupo de Bibliometría, Evaluación de evidencia y Revisiones Sistemáticas (BEERS), Human Medicine Career, Universidad Cientifica del Sur, Lima, Peru, Phone: +511214-2500, e-mail: fmaytat@unmsm.edu.pe

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Table 1: Top 10 Scopus sources

Scopus source	*Scholarly output*	*Citations per publication*	*Field-weighted views impact*	*Citation count*
Biological Trace Element Research	3	0.3	0.79	1
Caries Research	3	5.7	1.47	17
Children	3	1	1.56	3
Fluoride – Quarterly Reports	3	0.3	2.81	1
Indian Journal of Forensic Medicine and Toxicology	3	0	0.95	0
Pesquisa Brasileira em Odontopediatria e Clinica Integrada	3	0.3	0.86	1
Community Dentistry and Oral Epidemiology	2	5.5	1.3	11
Environmental Geochemistry and Health	2	13.5	0.86	27
European Archives of Pediatric Dentistry: Official Journal of the European Academy of Pediatric Dentistry	2	2.5	1.85	5
International Journal of Pharmaceutical Research	2	130	1.34	260

This condition goes beyond esthetics. Some dental experts argue that tooth discoloration may also have a risk to the quality of life, as fluorosis involves a constant deterioration of the tooth enamel surface, which increases the prevalence of various dental diseases.[15] Fluoride is a substance that accumulates in the human body, primarily in the teeth and bones. However, both inadequate and excessive intake of fluoride can disrupt the normal physiological function of the body, causing harm not only to the skeletal system but also to other systems. As a result, reducing fluoride levels in drinking water is crucial for preventing dental diseases.[16]

Finally, a bibliometric study can provide the dental community with an up-to-date perspective. This is important given that the factors associated with the development of fluorosis are not yet fully understood. In addition, this bibliometric analysis allows mapping of sub-areas in need of further research. Therefore, the aim of this research was to perform a bibliometric study of trends, indicators, and characteristics in the global scientific production on fluorosis.

Materials and Methods

Study Design

A descriptive, cross-sectional study with bibliometric approach[17] was conducted on the worldwide scientific production on fluorosis published during the years 2018–2023. All metadata for this study were obtained from the Scopus database.

Search Strategy

Metadata extraction was performed using the keywords "Fluorosis" and all its variants appearing in the Emtree terms and MeSH of Embase and PubMed, respectively. The Boolean operators "AND" and OR" were used and the following search strategy was established: TITLE-ABS-KEY ("Fluoroses, Dental" OR "Fluoroses Dental" OR "Dental Fluoroses" OR "Dental Fluorosis" OR "Mottled Enamel" OR "Enamel Mottled" OR "Enamels Mottled" OR "Mottled Enamels" OR "dental mottling" OR "enamel fluorosis" OR "enamel mottling" OR "fluorosis dental" OR "mottled enamel" OR "mottled teeth" OR "mottling enamel" OR "mottling tooth" OR "tooth fluorosis" OR "tooth mottling") AND ("Deciduous Tooth" OR "Dentition Deciduous" OR "Deciduous Dentition*" OR "Dentition Primary" OR "Primary Dentition" OR "Milk Tooth" OR "Tooth Milk" OR "Primary Teeth" OR "Teeth Deciduous" OR "Deciduous Teeth" OR "Teeth Primary" OR "Tooth Primary" OR "Milk Teeth" OR "Teeth Milk" OR "Baby Teeth" OR "Teeth Baby" OR "Baby Tooth" OR "Tooth Baby" OR "Primary Tooth") AND PUBYEAR >2017 AND PUBYEAR <2024.

Data Collection

The collection of 93 articles from Scopus was carried out on July 26, 2023, and these correspond to the period between the years 2018 and 2023. The articles were exported in .csv format to SciVal software (Elsevier). Of the collected articles, 69 were original, 17 were reviews, 2 were conference papers, 6 were book chapters, among others. The database used in this study included variables such as the year of publication, the author, the journal in which the manuscript was published, the h-index of the author, the CiteScore of the journal, and the Field-Weighted Citation Impact (FWCI) of the manuscript.

Selection Criteria

We included original articles and reviews that were published in English. However, preprints, letters to the editor, and conference papers were excluded from the study.

Statistical Analysis

The database used in this study included variables, such as the year of publication, the author, the journal in which the manuscript was published, the h-index of the author, the CiteScore of the journal, and the Field-Weighted Citation Impact (FWCI) of the manuscript.

Results

The journals Environmental Geochemistry and Health and International Journal of Pharmaceutical Research have the highest average number of citations per publication, although only two publications were identified in both journals. On the other hand, Fluoride – Quarterly Reports and European archives of pediatric dentistry have a better average number of citations per field, with an index of 2.81 and 1.85, respectively (Table 1).

The Universidade de São Paulo (Brazil) has the most publications (6 publications), although it is also one of those with the lowest citation-weighted impact relative to the global average (FWCI: 0.9). In contrast, Saveetha Institute of Medical and Technical Sciences (Deemed to be University) has a higher number of citations per publication (86.7), better weighted impact (FWCI: 4.21) and more citation count (260) (Table 2).

Among the most productive authors, Levy Steven Marc (University of Iowa) and Zohoori Fatemeh Vida (Teesside University) have the most publications, both with four articles; however, Maguire Anne from Newcastle University in the United Kingdom has the highest average number of citations per publication.

Table 2: Top 10 most productive institutions

Institution	*Country*	*Scholarly output*	*Citations per publication*	*Field-weighted citation impact*	*Citation count*
Universidade de São Paulo		6	9.5	0.9	57
Newcastle University		4	9.5	1.02	38
Teesside University		4	9.5	1.02	38
Universidade Estadual de Campinas		4	3	0.94	12
University of Iowa		4	6	0.68	24
Saveetha Institute of Medical and Technical Sciences (Deemed to be University)		3	86.7	4.21	260
Sichuan University		3	8.3	0.44	25
Universidad Autonoma de San Luis Potosi		3	5	1.42	15
Universidade Estadual Paulista Júlio de Mesquita Filho		3	3	0.69	9
Institute of Technical Education and Research of Siksha O Anusandhan University		2	0	0	0

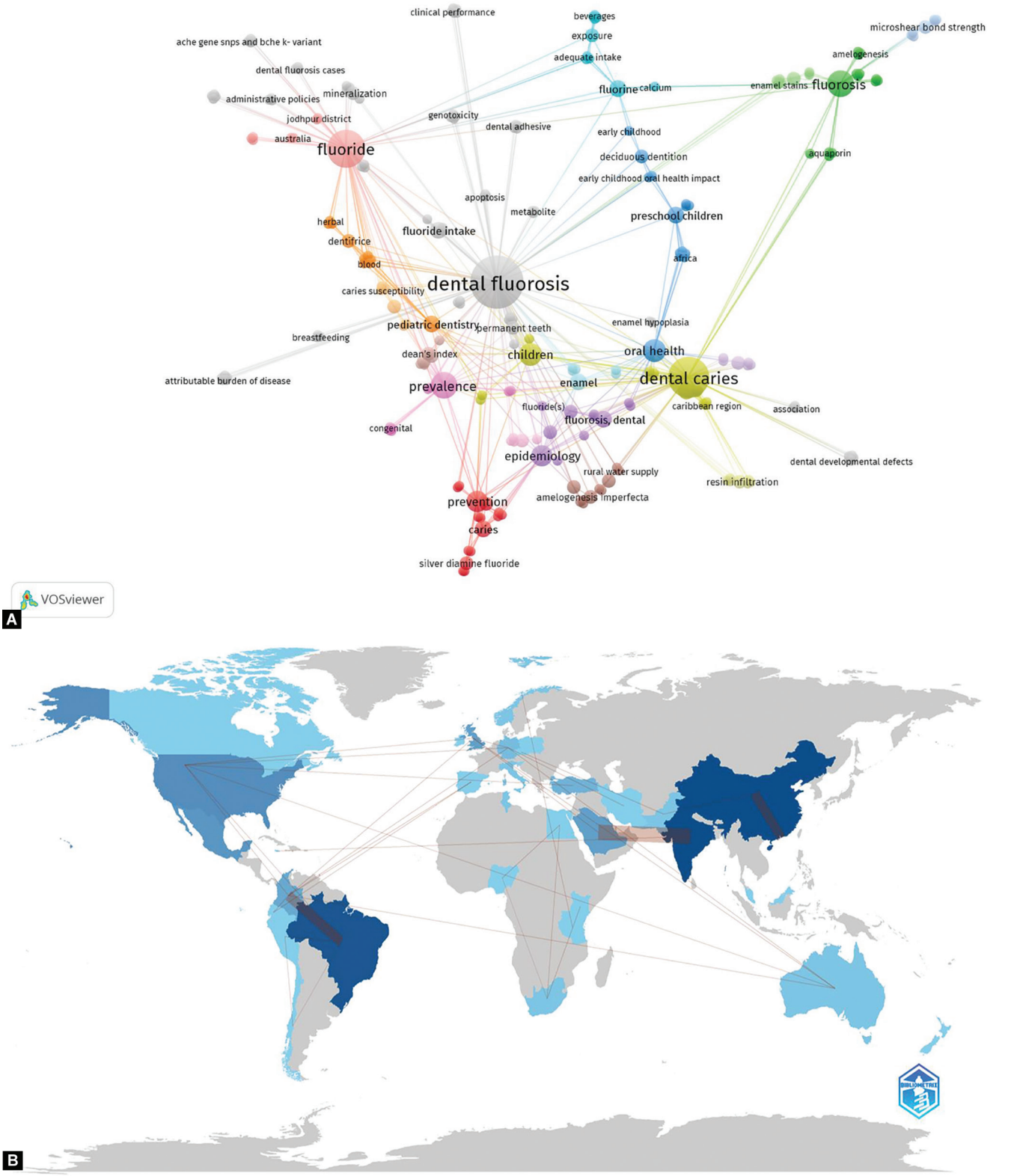
Table 3: Top 10 authors

Author	*Affiliation*	*Country*	*Scholarly output*	*Citations per publication*	*h-index*	*Citation count*
Levy, Steven Marc	University of Iowa		4	6	52	24
Zohoori, Fatemeh Vida	Teesside University		4	9.5	18	38
Buzalaf, Marilia Afonso Rabelo	Universidade de São Paulo		3	15	47	45
Cury, JA	Universidade Estadual de Campinas		3	3.7	56	11
Guo, Ling	Southwest Medical University		3	4.3	7	13
Jeremias, Fabiano	Universidade Estadual Paulista Júlio de Mesquita Filho		3	3	19	9
Maguire, Anne	Newcastle University		3	11.7	25	35
Warren, John Joseph	University of Iowa		3	6.3	45	19
Carvalho, Thamyris Souza	Universidade de São Paulo		2	4	5	8
Curtis, Alexandra M	University of Iowa		2	9.5	6	19

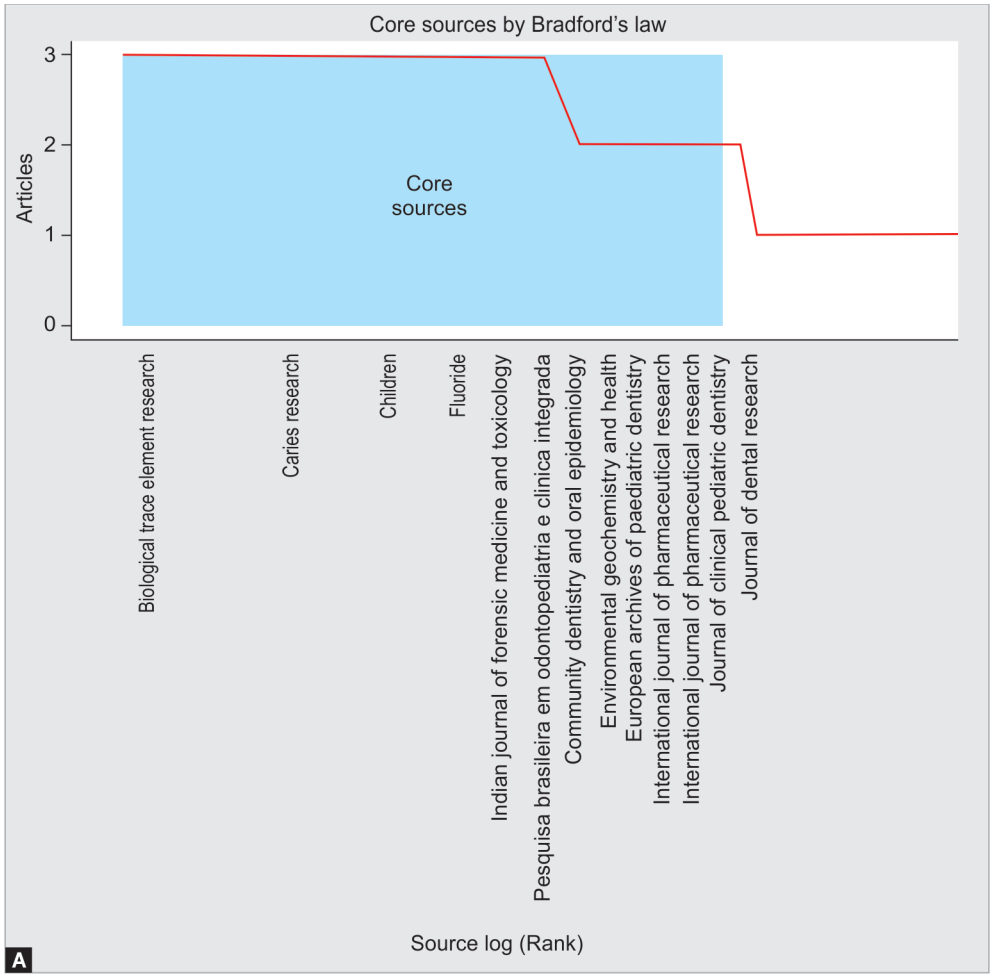
The authors with the best h-index are Cury, JA from Brazil (56) and Levy, Steven Marc from United States (52) (Table 3).

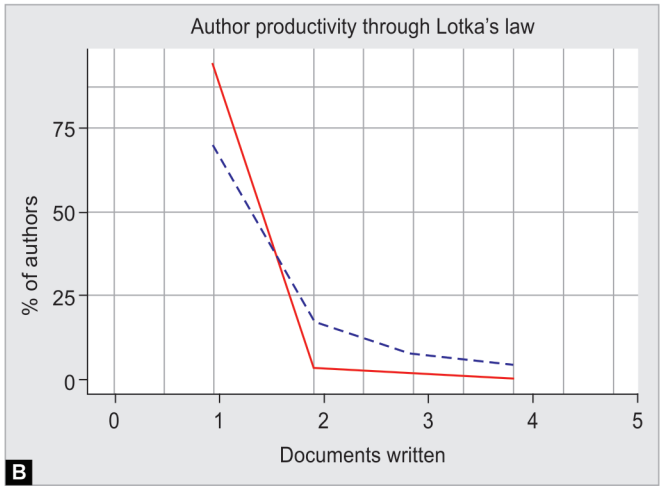
In the keyword visualization network, several clusters are observed, the highest co-occurrence is observed in the lead, red and yellow clusters, highlighting the terms "dental fluorosis," "fluoride" and "dental caries," respectively. On the other hand, the terms "Epidemiology" and "Oral Health" stand out in the purple and blue clusters, respectively (Fig. 1A).

The collaboration map shows a broad international network of international cooperation, with the current participation of Brazil among the Latin American countries. In addition, the United States and China showed a large concentration of manuscripts with



Figs 1A and B: (A) Co-occurrence per keyword; (B) Country collaboration map





Figs 2A and B: (A) Bradford; (B) Lotka's Law

not only national but also international participation. In Africa, it is shown that the countries of this continent maintain an active collaboration network among themselves (Fig. 1B).

Among the journals with the highest number of articles are Biological Trace Element, Caries Research, Children, Fluoride, and Indian Journal of Forensics. In addition, the highest percentage of authors have published between 1 and 2 articles, with a smaller proportion having 3–4 publications (Fig. 2).

The scientific production in fluorosis from year 2018 (19 publications) to 2023 (12 publications) has a negative trend.

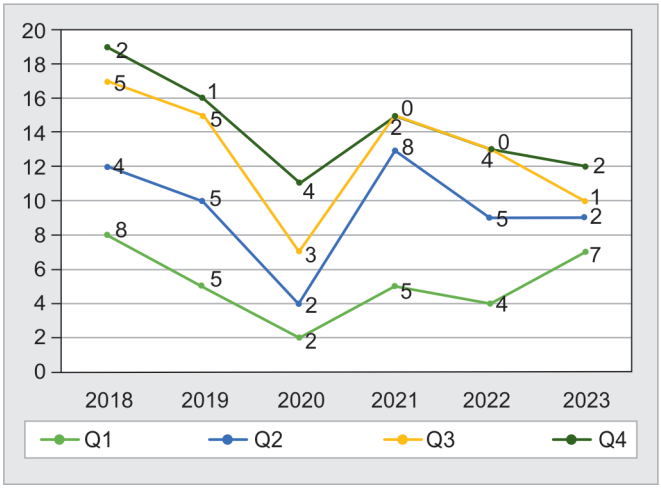


Fig 3: Scientific production by quartile of the journal

The articles are mainly concentrated in high-impact scientific journals, 36% in Q1 quartile journals and 30.2% in Q2 quartile journals (Fig. 3).

Discussion

Enamel fluorosis develops due to excessive and prolonged intake of fluoride from various sources.[17] Fluoride can come from a variety of sources, including fluoridated milk and salt, and fluoride products, etc.[18] Research has identified diet and dental treatments as the primary causes of fluorosis.[19] It is important to determine the prevalence of fluorosis and to identify the current sources of fluoride intake and their relative contributions. Besides, the management of dental fluorosis will depend on its severity,[20] associated risks, and the patient's perception of esthetics. While mild cases may not require treatment, more severe forms of fluorosis may necessitate interventions such as preventive care or surgery.[21]

It is crucial to be informed about the causes of dental fluorosis and how to prevent it, as this condition can only develop during the formation of tooth enamel.[22] To prevent dental fluorosis, it is recommended to supervise children's toothbrushing, teach them not to consume toothpaste, and limit the use of fluoride supplements.[23] In addition, it is essential to control fluoride levels in drinking water, which may require defluoridation techniques, this balances the benefits of fluoride to prevent and avoids complications associated with its excessive consumption.[24] Dental fluorosis has a restricted period of development, which starts from birth and ends around the age of 8 years, this means that it is important to adopt preventive measures during this period to avoid the appearance of this pathology.[9]

Preventive measures to treat fluorosis include various strategies, which serve to ensure safe fluoride concentrations in drinking water. In addition, it is important to raise public awareness of the benefits and risks of fluoride.[25] For this reason, dentists should be alert to the proper management of patients with dental fluorosis.[26] In cases of severe dental fluorosis, a specialist should be consulted for multidisciplinary treatment.[27]

According to studies, resin infiltration is the best option for improving esthetics in cases of dental fluorosis.[28] In addition, resin infiltration using an additional infiltrant has been demonstrated to yield superior esthetic outcomes compared with bleaching, and to effectively address the issue of fluorosis.[29–31] However, it is important to keep in mind that fluorosis staining may stimulate inactive lesions. Some research has shown that patients may experience tooth sensitivity and irritation of the gums after treatment, particularly in the case of microabrasion.[32,33] This may be due to a reduction in the thickness of the enamel. Nonetheless, this issue should not be a major concern as it will diminish over time.[32,33]

This bibliometric study focused on the analysis of the effects of fluorosis. By identifying relevant scientific journals, analyzing the impact of research worldwide, and exploring collaborative networks, it is hoped to contribute to the advancement of knowledge in this field and promote a better understanding of the effects of dental fluorosis.

Finally, the limitations of this study are that information was only obtained from the Scopus database. This means that it was not possible to detail all the scientific productions related to the topic, since other databases, such as Embase, PubMed, or Web of Science should be examined to obtain a broader and more detailed view of the scientific publications related to the topic in question. Although Scopus is one of the largest content databases, the results should be taken with caution as they do not necessarily reflect worldwide research. In addition, since bibliometric software has some accessibility weaknesses, there may be an underrepresentation of available content.

Conclusion

Within the limitations of this bibliometric study, it is concluded that the terms "dental fluorosis," "fluoride" and "dental caries" stand out in the keyword visualization network. International collaboration is broad, with a notable participation of Brazil among the Latin American countries. The journals with the highest number of articles are Biological Trace Element and Caries Research. However, scientific production in fluorosis has shown a negative trend from 2018 to 2023, although articles are mainly concentrated in high-impact scientific journals.

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