

# Status of Research on Dental Caries during Pregnancy: A Biometric Exploration

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## ABSTRACT

**Aim:** To describe the bibliometric characteristics of the state of scientific production on dental caries during pregnancy.

**Materials and methods:** A bibliometric study with a sample of 408 publications indexed in the Scopus database, which were selected based on a search strategy that included logical operators and the term MESH. The Scival tool was used to analyze the metadata.

**Results:** Jamieson Lisa Marie is positioned as the author with the most publications, and Schroth Robert as the one with the best-weighted impact (FWCI: 37.7). High-impact journals such as BMC Oral Health, Journal of Dental Research, and BMC Public Health stand out for their productivity and an average number of citations. The United States has a large number of publications and evidence of networks of scientific activity with Australia, Canada, and Brazil. The University of Adelaide leads the production and the work of two Latin American institutions (Universidade de São Paulo and Universidade Federal do Maranhão) stands out. International collaboration has improved during the study period.

**Conclusion:** Scientific production on dental caries during pregnancy is increasingly published in high-impact journals, with growing international collaboration. The United States leads in publications, while Australian institutions are the most productive in this field.

**Clinical significance:** Caries during pregnancy is a problem that has an important impact on maternal and perinatal health; thus, its timely management and prevention are important areas of research in the field of oral health.

**Keywords:** Bibliometric analyses, Dental caries, Pregnancy, Pregnant women.

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## INTRODUCTION

During pregnancy, women experience a number of transient physiological changes that are evidenced by hormonal, metabolic, immunological, and physical modifications, which may affect oral health.<sup>1,2</sup> These changes are related to increased levels of hormones such as estrogen and progesterone, which can lead to an increased risk of gum inflammation or periodontal disease.<sup>3</sup> Also, during this stage, there is a change in the oral microbiota, which, in addition to morning sickness and frequent vomiting, especially during the first trimester, can increase the risk of tooth enamel erosion and, eventually, the development of caries.<sup>4,5</sup>

Maintaining optimal oral health during the gestational period is a fundamental element that affects both maternal health and the proper development of the fetus; conversely, poor hygiene can lead to periodontal problems or dental caries; the latter is identified as a pathology derived from a process in which the hard tissues of the teeth go through a cycle of demineralization and remineralization, which is influenced by several factors, including the consumption of sugars and is made more likely by increased acidity in the oral cavity, sugar consumption, lack of or inadequate dental care or untimely treatment.<sup>6-10</sup>

Globally, the prevalence of caries is approximately 50% and its lack of treatment constitutes a major public health problem.<sup>11</sup> A review reported that this oral manifestation in pregnancy is the most frequent, followed by periodontitis and gingivitis.<sup>12</sup> Previous studies in Colombia and the United States have shown that the prevalence of caries is around 90% in pregnant women, making this problem one of the most relevant in the fields of oral and maternal health.<sup>13,14</sup>

In pregnancy, dental caries is a complex problem that has an impact on maternal and perinatal health. Evidence suggests an

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association between dental caries and the risk of fetal macrosomia in relation to gestational age, although not with preterm birth.<sup>15,16</sup> On the other hand, children of mothers who received dental care during pregnancy had a lower risk of childhood caries compared to those whose mothers did not receive such care.<sup>17</sup> This demonstrates that proper oral hygiene, regular dental visits, and timely treatment of any dental problems during pregnancy not only benefits the mother, but also contributes to the wellbeing of her child.<sup>18</sup>

The approach to these problems by prenatal care and dental service providers encompasses assessment, counseling, referral, and working in coordination with each other; therefore, scientific production should be oriented towards strengthening these processes and broadening horizons from new perspectives of analysis. In this sense, bibliometrics makes it possible to identify trends in research, discover emerging areas of study, evaluate the dissemination of knowledge, and make informed decisions in the management of scientific resources and policies, the impact of which is reflected in greater transparency, efficiency, and quality in scientific production.<sup>19,20</sup>

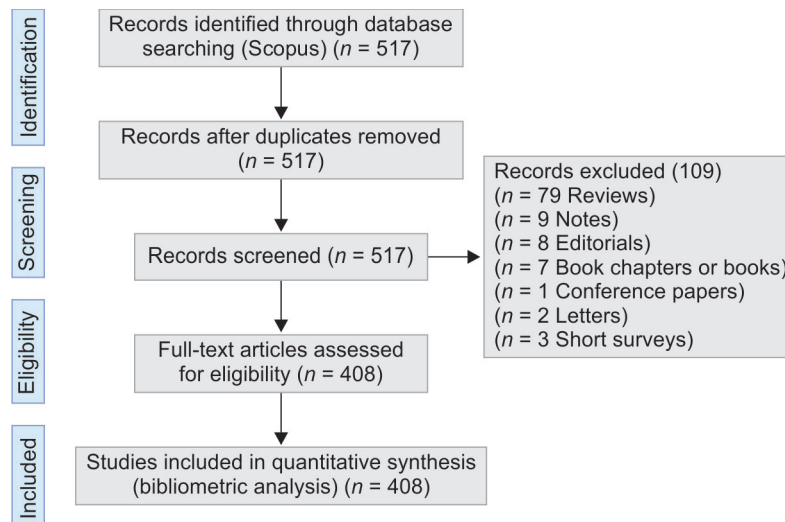


Fig. 1: Figure for the selection of scientific publications

This topic, positioned between the fields of oral health and maternal health, requires an in-depth analysis and evaluation of existing research following the bibliometric approach, as this facilitates knowledge of research trends and their collaboration networks, as well as the gaps in knowledge present in this area. On the other hand, it would allow the exploration and recognition of the scientific evidence that favors clinical decision-making by the health team, as well. Therefore, the aim of the study is to describe the bibliometric characteristics of the state of scientific production of dental caries during pregnancy.

## MATERIALS AND METHODS

A descriptive and cross-sectional study was carried out, in accordance with bibliometric methodology, which consisted of the analysis of scientific publications on dental caries during gestation, which have been indexed in the Scopus database.

The Scopus search was carried out on 26 February 2024, for which a strategy was created using logical operators (AND and OR) and MESH terms, and was defined as follows: TITLE-ABS-KEY [("Dental Caries" OR "Dental Caries" OR "Dental Cavity" OR "Dental Decay" OR "Dental Cavities" OR "Carious Lesions" OR "Carious Lesions" OR "Carious Lesion" OR "Lesions Carious" OR "Carious Lesions" OR "Dental Decay" OR "Carious Dentin" OR "Carious Dentins" OR "Dentin Carious" OR "Dentins Carious") AND ("Pregnancy" OR "Pregnancies" OR "Gestation" OR "Pregnant Woman" OR "Woman Pregnant" OR "Women Pregnant" OR "Women Pregnant" OR "Pregnant Women")] AND PUBYEAR > 2012 AND PUBYEAR < 2023. The advanced search module offered by the Scopus database was used for the execution of this strategy. The result of the search was 517 articles, and then an author (JBO) evaluated the presence of duplicated publications to eliminate them if necessary.

Inclusion criteria were established as follows: Original articles dealing with the topic of gestational caries, articles published in scientific journals indexed in Scopus, published from 2013 to 2022, and in any language. On the other hand, review articles (79), notes (9), editorials (8), book chapters (7), conference papers (1), letters (2), and short surveys (3) were excluded in the selection process. In accordance with these characteristics, the study included a sample of 408 research articles (Fig. 1).

The SciVal tool belongs to the Elsevier corporation, which allows to generation a view of research performance or activity in a thematic field, from Scopus data.<sup>21</sup> This tool was used to export the metadata of the selected publications; bibliometric indicators such as the number of publications, number of citations, average number of citations per publication, affiliation, field-weighted citation impact (FWCI), h-index, SCLImago Journal Rank (SJR); source-normalized impact per paper (SNIP) and quartile of the journal were also estimated with this tool; in addition, using the MS Excel 2019 program, trend graphs were made for the percentage of internal collaboration. The VOSviewer version 1.6.20 tool was used to visualize the co-authorship network by country.

Given that the study analyses the metadata of scientific publications indexed in Scopus, review by a Research Ethics Committee was not considered necessary.

## RESULTS

The author with the highest scientific output on gestational dental caries was Jamieson Lisa Marie from the Adelaide Dental School in Australia (11 publications). On the other hand, Lawrence Herenia P., Broughton John R. and Schroth Robert J. had the highest citation impact with 19.3, 21.7, and 37.7 citations per publication respectively. The one with the highest citation impact with respect to the world average was Schroth Robert J. (FWCI: 2.07) and the one with the highest h-index was Demarco, Flavio Fernando from the Universidade Federal de Pelotas (Table 1).

Among the most productive scientific journals, the best positioned was BMC Oral Health (Q1) with 26 publications; however, the Journal of Dental Research has the highest normalized impact per article (SNIP: 2.303), and BMC Public Health had the highest average number of citations per publication (33). Of the 10 journals with the highest production, 90% are high impact, belonging to the first and second quartiles. The journal Pesquisa Brasileira em Odontopediatria e Clinica Integrada had the lowest CiteScore 2022 (1.8) and SCLImago Journal Rank (0.212) (Table 2).

The University of Adelaide had the highest scientific output on dental caries during pregnancy, while the Universidade de São Paulo and the Universidade Federal do Maranhão had the lowest number of publications. Among the 10 institutions, 20% are from New Zealand

**Table 1:** Top 10 authors with the highest scientific production on dental caries during pregnancy

Name	Filiation	Scholarly output	Citations per publication	FWCI	h-index
Jamieson, Lisa Marie	Adelaide Dental School, Adelaide, Australia	11	15.7	0.92	32
Lawrence, Herenia P	University of Toronto, Toronto, Canada	9	19.3	1.12	39
Broughton, John R	Otago Medical School, Dunedin, New Zealand	7	21.7	1.08	15
Ribeiro, CCC	Universidade Federal do Maranhão, Sao Luis, Brazil	7	5.9	0.45	20
Alves, Cláudia Maria Coêlho	Universidade Federal do Maranhão, Sao Luis, Brazil	6	6.2	0.24	16
Correa, MB	Universidade Federal de Pelotas, Pelotas, Brazil	6	9.7	1.1	31
Demarco, Flavio Fernando	Universidade Federal de Pelotas, Pelotas, Brazil	6	9.7	1.1	53
Schroth, Robert J	Rady Faculty of Health Sciences, Winnipeg, Canada	6	37.7	2.07	29
Milgrom, Peter M	University of Washington, Seattle, United States	6	9.5	0.82	39
Thomson, W Murray	University of Otago, Dunedin, New Zealand	6	14.7	0.87	67

FWCI, field-weighted citation impact

**Table 2:** Top 10 scientific journals indexed in Scopus with the highest scientific production on dental caries during pregnancy

Scopus source	Publications	Citations	Citations per publication	SNIP	Citescore 2022	SJR	Quartile
BMC Oral Health	26	362	13.9	1.368	4.1	0.741	Q1
International Journal of Environmental Research and Public Health	11	81	7.4	1.28	5.4	0.828	Q2
Caries Research	10	203	20.3	1.706	7.7	0.961	Q1
Journal of Public Health Dentistry	8	82	10.3	0.765	3	0.421	Q2
Oral Health and Preventive Dentistry	7	29	4.1	0.739	2.3	0.356	Q2
Journal of Dental Research	7	222	31.7	2.303	13.4	1.872	Q1
PLoS ONE	7	99	14.1	1.253	6	0.885	Q1
European Archives of Pediatric Dentistry: Official journal of the European Academy of Pediatric Dentistry	6	63	10.5	1.157	3.7	0.593	Q2
Pesquisa Brasileira em Odontopediatria e Clinica Integrada	6	23	3.8	0.401	1.8	0.212	Q3
BMC Public Health	5	165	33	1.661	6.1	1.307	Q1

SJR, SCImago Journal Rank; SNIP, source-normalized impact per paper

and 20% are from Brazil, and of the latter group, the Universidade Federal do Maranhão had the lowest impact (5.4 citations per publication) and lowest weighted citation average (FWCI: 0.42). King's College London in the UK (FWCI: 52.94) and Karolinska Institute in Sweden (FWCI: 52.67) have the best weighted impact with reference to the overall average number of citations (Table 3).

In the co-authorship network by country, 7 clusters are shown, with the United States, India, Brazil, the United Kingdom, and Australia leading their respective groupings; in addition, the United States is the country with the highest concentration of publications and the broadest network of collaboration, with the strongest links

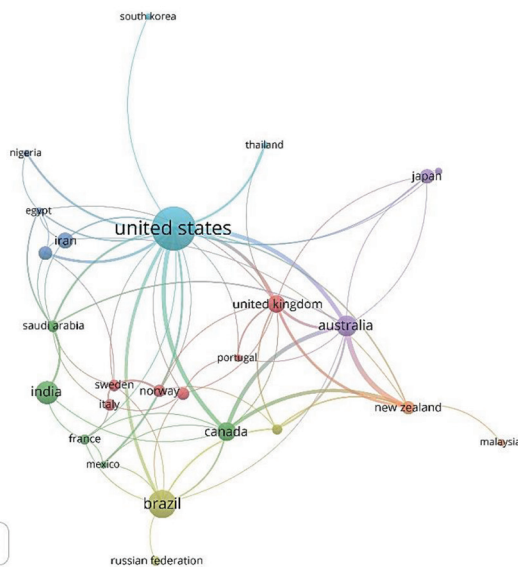
to Australia and Canada. In the yellow cluster, there is collaboration, albeit weak, between South American countries such as Brazil and Mexico. The countries with the least scientific activity are Mexico, Portugal, Malaysia, and Nigeria (Fig. 2).

The number of articles published in Q1 quartile journals increased from 8 to 23; and in the Q2 quartile, from 4 to 15 papers. For lower-impact journals, the number of articles was lower and remained constant over the study period. On the other hand, international collaboration in scientific publications increased from 9.7 to 43.2% from 2013 to 2016; thereafter, it decreased and there was not much variation, with 25.5% in 2022 (Fig. 3).

**Table 3:** Top 10 institutions with the highest scientific production on dental caries during pregnancy

Institution	Country	Scholarly output	Citations per publication	FWCI
University of Adelaide		16	428.6	26.5
University of Washington		15	463.9	28.69
University of Otago		14	490.1	30.37
University of Toronto		12	567.8	35.05
University of Melbourne		9	750.8	46.74
University of Bergen		9	744.4	46.34
King's College London		8	845.9	52.94
Karolinska Institutet		8	850.1	52.67
Universidade de São Paulo		8	833.3	51.65
Universidade Federal do Maranhão		8	5.4	0.42

FWCI, field-weighted citation impact



**Fig. 2:** Co-authorship by country

## DISCUSSION

The various hormonal and physical changes that occur during pregnancy can increase susceptibility to caries development, positioning it as an oral health problem that has had a significant impact on maternal and child health.<sup>22</sup> Although the topic of dental caries represents a relevant and increasingly addressed field in dental research, studies of this oral health problem in pregnancy should be understood as an opportunity for authors and institutions involved in the provision of maternal and dental services.<sup>23</sup>

Research in the field of dentistry is increasing and, in accordance with this, the study of oral health problems, such as caries in special stages such as pregnancy, is becoming more and more widely reported, especially in high impact journals.<sup>23</sup> In this regard, Suiter and Sarli, find the publication of their research in these journals more interesting, given their scope, prestige, and visibility in the academic and scientific world.<sup>24</sup>

In the study carried out by Melo et al.<sup>25</sup> the Journals Caries Research and Journal of Dental Research were identified as emerging journals in the field of dental caries during pregnancy. They also stood out as two of the most cited journals in the context

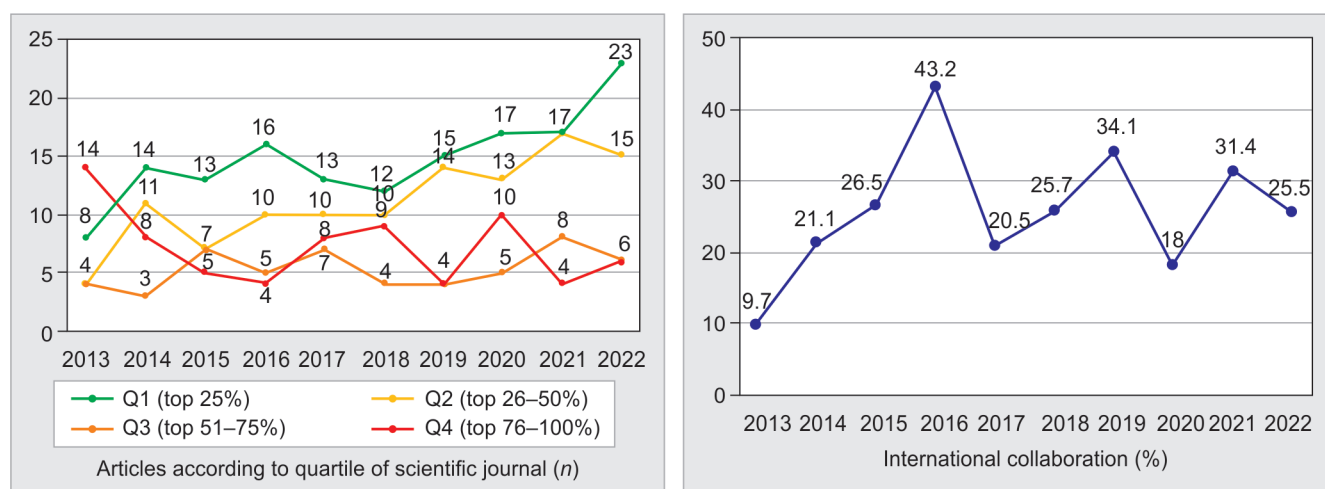


Fig. 3: Trend in publications by scientific journal quartile and international collaboration

of this research, although it should be noted that the leading journals are BMC Oral Health (Q1) and the International Journal of Environmental Research and Public Health (Q2), both of which have a high impact. The contrast of these data allows us to understand that there is a commitment on the part of researchers and their institutional groups to publish in prestigious journals recognized in the scientific community, which exert a notable influence in the academic field. It is important to highlight the role and editorial activity of the journal *Pesquisa Brasileira em Odontopediatria e Clínica Integrada* from Brazil, which is one of the ten journals with the most publications on caries during pregnancy.

In the analysis of the featured institutions, the University of Adelaide and the University of Melbourne in Australia are among the most productive. This finding may highlight related problems in dental care, such as communication challenges between obstetricians and pregnant women regarding oral health, which may increase the risk of dental caries.<sup>26</sup> On the other hand, Brazil has two more participatory institutions, including the Universidade Federal do Maranhão and the Universidade de São Paulo. According to these results, a previous study positions the latter higher education institution as the one with the highest number of publications.<sup>27</sup> This evidence points to the importance and, above all, the need to promote international collaboration in oral health research, according to the needs and problems present in pregnant women. This area of research needs to promote collaborative research not only for the different perspectives it generates but also for better capacity to solve complex problems, greater access to resources and support for the implementation of interventions, improved reach of findings, and their impact at the societal level.<sup>28</sup> To this end, the results of this study show that the United States, Brazil, and Canada should maintain leadership in this field and engage new countries, especially where this problem is highly prevalent.

In the co-authorship network, it was found that the United States is positioned as the country with the highest concentration of publications and the greatest links with other countries; it also shows Brazil as a country that is achieving greater visibility and international positioning. In the same trend, research in the field of oral health during pregnancy highlights the leading role in productivity and citation of scientific activity in both countries.<sup>29</sup> Similarly, Ganesh et al.<sup>27</sup> also identified that both Brazil and the

United States managed to position themselves as one of the most productive in the thematic field of dental caries. This shows Brazil as the main Latin American country in terms of scientific production in these topics, which makes it the country that should take on the role of leader in the region and encourage the sustained participation of other countries through the formation and consolidation of multidisciplinary research groups. This requires the active and permanent participation over time of the leaders in this field, such as Ribeiro and Alves Cláudia Maria Coêlho, from the Universidade Federal do Maranhão, as well as Correa and Demarco Flavio Fernando, from the Universidade Federal de Pelotas, who are visible among those with the greatest scientific activity in the thematic field of this study.

Research in oral health during pregnancy requires an approach from different approaches, based on the integration of knowledge and perspectives from different professions and social contexts, which allow different aspects to be understood and contribute to enriching the understanding of this area.<sup>30,31</sup> In this sense, it is recognized that international collaboration improves the quality and relevance of the research by facilitating the diversity of the different aspects in which a problem is analyzed.<sup>32</sup> The results of this study highlight the improvement in this type of collaboration, which suggests broader global integration of research groups, inter-institutional participation, agreements, and greater openness to the integration of global perspectives, allowing the quality and diversity of the studies conducted to be enriched.

Research in dental caries during pregnancy is dynamic and needs to adapt to the technological changes that develop over time. New research directions in this field are oriented towards the implementation of artificial intelligence, big data, or machine learning for the prevention or treatment of this problem, as well as personalized preventive interventions based on digital tools and those based on the community are areas that have yet to be explored.

The research has limitations that include possible errors in the indexing of the metadata of the documents published in the scientific journals; in addition, the estimates of the bibliometric parameters did not exclude self-citations, which may vary the real impact of the studies. Finally, only studies in Scopus were searched, although this cannot represent all scientific knowledge, it is recognized that this database is one of the most important

globally. A strength was that, according to the review carried out by the authors, this study would be the first bibliometric exploration of dental caries in pregnancy, positioning this research as a starting point for a thematic field relevant to maternal health and oral health.

In conclusion, the greatest scientific production on dental caries in pregnancy is published in high-impact journals, with an evident growth in the study period, together with the proportion of articles that have international cooperation. Collaborative networks position the United States as the one with the highest concentration of publications, in addition, Australian institutions are positioned as the most productive. Research in this area is expanding into new perspectives, in line with global trends, but active promotion of international and interdisciplinary networking is required.

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