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Oral microbiota and elderly population: A bibliometric review

Microbiota oral e população idosa: Uma revisão bibliométrica

Microbiota oral y población anciana: Una revisión bibliométrica

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Abstract
Bibliometrics has become a fundamental quantitative tool for mapping the research output of scholars, leading journals, academic institutions, and countries. The oral microbiota is a recently studied concept that plays an important role in the process of health and disease, especially concerning the aging process. The present study aimed to conduct a bibliometric review to analyze the evolution of publications on the terms of "oral microbiota" and "elderly population. The data was extracted from Scopus. Data on authors, countries, most cited journals, co-authorship between countries and authors, co-occurrence of keywords, co-occurrence of keywords based on the year of publication and co-citation of references were analyzed using the VOSviewer software. A total of 619 documents (1970–2024) were retrieved, with a significant rise in publications from 2018 and a peak in 2021. Ghannoum MA, the United States, and PLOS ONE were the most cited author, country, and journal, respectively. The most recurrent keywords included “oral microbiota” (n=173), “microbiota” (n=53), “oral microbiome” (n=51), “saliva” (n=45), and “periodontitis” (n=44). Findings highlight the increasing research interest in the relationship between oral microbiota and aging, particularly in oral health and diet, emphasizing its relevance in elderly care.
Keywords: Bibliometrics; Aging; Oral Cavity; Health of the Elderly; Oral Healthcare.

Resumo
A bibliometria tornou-se uma ferramenta quantitativa essencial para mapear a produção científica de pesquisadores, periódicos de destaque, instituições acadêmicas e países. A microbiota oral é um conceito recentemente explorado, que desempenha papel relevante nos processos de saúde e doença, especialmente no que diz respeito ao envelhecimento. O presente estudo teve como objetivo realizar uma revisão bibliométrica para analisar a evolução das publicações sobre os termos “microbiota oral” e "população idosa”. Os dados foram extraídos da base Scopus. As informações analisadas incluíram autores, países, periódicos mais citados, coautorias entre países e autores, coocorrência de palavras-chave, coocorrência de palavras-chave com base no ano de publicação e cocitação de referências, por meio do software VOSviewer. Foram recuperados 619 documentos no período de 1970 a 2024, observando-se um aumento expressivo nas publicações a partir de 2018, com pico em 2021. Ghannoum MA, os Estados Unidos e o periódico *PLOS ONE* foram, respectivamente, o autor, país e periódico mais citados. As palavras-chave mais recorrentes foram “oral microbiota” (n=173), “microbiota” (n=53), “oral microbiome” (n=51), “saliva” (n=45) e “periodontitis” (n=44). Os achados destacam o crescente interesse científico na relação entre microbiota oral e envelhecimento, sobretudo no contexto da saúde bucal e da alimentação, evidenciando sua importância nos cuidados com a população idosa.
Palavras-chave: Bibliometria; Envelhecimento; Cavidade Oral; Saúde do Idoso; Cuidados de Saúde Bucal.

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Resumen
La bibliometría se ha convertido en una herramienta cuantitativa fundamental para mapear la producción científica de investigadores, revistas de alto impacto, instituciones académicas y países. La microbiota oral es un concepto recientemente estudiado que desempeña un papel relevante en los procesos de salud y enfermedad, especialmente en lo que respecta al envejecimiento. El presente estudio tuvo como objetivo realizar una revisión bibliométrica para analizar la evolución de las publicaciones sobre los términos "microbiota oral" y "población anciana". Los datos fueron extraídos de la base Scopus. Se analizaron datos sobre autores, países, revistas más citadas, coautorías entre países y autores, coocurrencia de palabras clave, coocurrencia de palabras clave según el año de publicación y cocitación de referencias, mediante el software VOSviewer. Se recuperaron un total de 619 documentos en el período de 1970 a 2024, con un aumento significativo en las publicaciones a partir de 2018 y un pico en 2021. Ghannoum MA, Estados Unidos y la revista *PLOS ONE* fueron el autor, país y revista más citados, respectivamente. Las palabras clave más recurrentes fueron "microbiota oral" (n=173), "microbiota" (n=53), "microbioma oral" (n=51), "saliva" (n=45) y "periodontitis" (n=44). Los hallazgos destacan el creciente interés científico en la relación entre microbiota oral y envejecimiento, particularmente en el contexto de la salud bucal y la dieta, lo que subraya su relevancia en el cuidado de la población mayor.
Palabras clave: Bibliometría; Envejecimiento; Cavidad Oral; Salud del Anciano; Salud Bucal.

1. Introduction

The global population is undergoing a rapid demographic transition. Projections suggest that by 2050, the number of individuals aged 60 years and older will double, while those aged 80 years and older will triple (Bautmans et al., 2022; Dogra et al., 2022). However, this demographic shift is accompanied by a rising incidence of non-communicable chronic diseases (NCDs), including cardiovascular, neurodegenerative, and atherosclerotic diseases, metabolic syndromes, cancer, and diabetes (Dominguez et al., 2022; Liu et al., 2023).

For a long time, aging was perceived as a negative process; however, over the years, theories of positive aging have been increasingly explored (Behr et al., 2023). The World Health Organization (WHO) defines healthy aging as the process of developing and maintaining functional capacity that enables well-being in older age (Rudnicka et al., 2020). The living environment is closely linked to quality of life and healthy aging. Thus, the optimal approach to ensuring successful aging is not characterized by treating diseases but by adopting a healthy lifestyle, where prevention takes precedence over treatment (Mazza et al., 2021).

The gut microbiota plays a crucial role in metabolic adaptation, immune system regulation, and the functioning of the gut-brain axis (Sun et al., 2023). Its influence is increasingly associated with both the development of diseases and the promotion of health, with evidence showing that metabolites produced by the microbiota can directly regulate host metabolism (Yang et al., 2023). When an imbalance occurs between commensal and pathogenic microbiomes, disrupting homeostasis, the organism may face severe consequences, such as inflammatory bowel diseases, obesity, and diabetes mellitus. This imbalance is often triggered by factors such as unhealthy lifestyle habits or adverse environmental conditions (Sun et al., 2023). Furthermore, the gut microbiota is implicated in the onset of neuropsychiatric disorders, including Alzheimer's disease, Parkinson's disease, and depression (Wang et al., 2022).

The oral microbiota is the second largest and most diverse microbial community in the human body, adapting to the various surfaces within the oral cavity. Its composition can vary depending on factors such as temperature, pH, humidity, saliva volume, oxygen levels, as well as behavioral and environmental conditions (Li et al., 2021; Schamarek et al., 2023; Shaalan et al., 2022). These microorganisms play essential roles in maintaining oral and systemic health by contributing to the synthesis and metabolism of vitamins, proteins, and lipids, nutrient processing, energy supply, immune modulation, and the regulation of metabolic processes (Li et al., 2021; Yang et al., 2019). Alterations in the composition of the oral microbiota are observed in the presence of oral diseases, periodontal disease, and systemic conditions such as obesity and diabetes (Shaalan et al., 2022). Additionally, the oral microbiota has been linked to certain types of cancers, including pancreatic, colorectal, and

head and neck squamous cell carcinoma (Yang et al., 2019).

In older adults, studies suggest that the composition of the oral microbiome is also associated with an increased risk of ischemic stroke (IS), as demonstrated in a study by Wang et al. (2023) conducted with elderly Chinese women. Additionally, older individuals with elevated fasting glucose levels exhibit oral microbiome dysbiosis, suggesting this may be a typical characteristic of hyperglycemia that contributes to disease progression (Wang et al., 2019). Dysbiosis has also been linked to the pathogenesis of Alzheimer's disease (AD), with the microbial profile potentially serving as a biomarker for the disease's diagnosis (Wu et al., 2021). Thus, oral cavity bacteria can be considered indicators of health in older adults (Guo et al., 2024), underscoring the importance of further research to understand their influence on systemic health in this population. Therefore, the present study aimed to conduct a bibliometric review to analyze the evolution of publications on the terms of "oral microbiota" and "elderly population."

2. Methodology

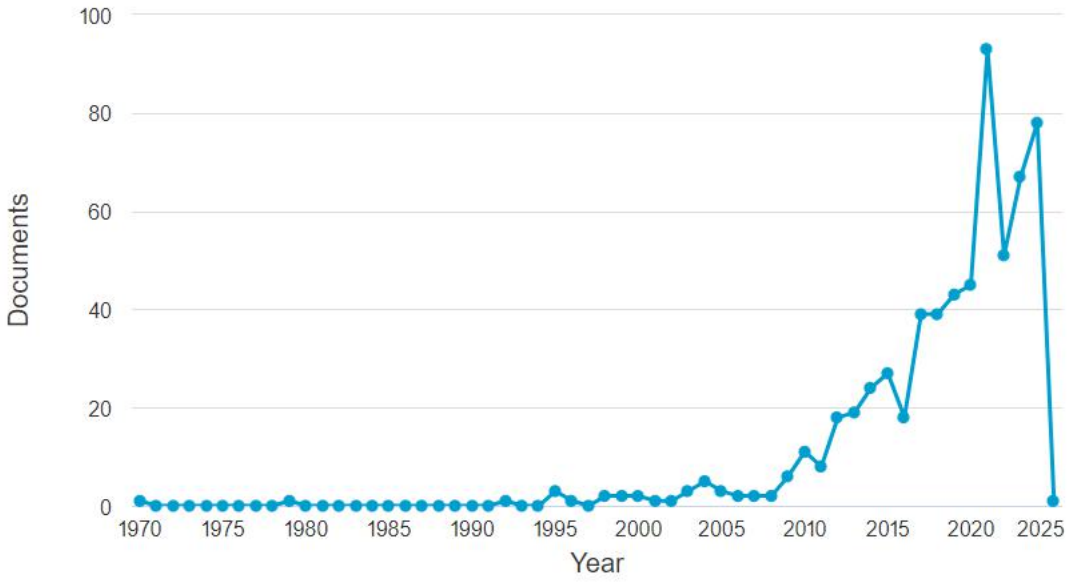
A quantitative research was carried out (Pereira et al., 2018) and the specific type of bibliometric review (Luz, 2025; Jerez-Roig et al., 2014). This research focused on the identification of bibliometric descriptors, using the Scopus database with the descriptors "oral microbiota" AND "elderly" OR "ageing'' OR "aged'' in English. The research was conducted on October 1, 2024 by JLPO, BAS and MLAF, the preliminary search required consensus among the researchers to proceed. Thus, a file in CSV format "full record and cited references" was exported and imported to the VOSviewer software version 1.6.18 (Van Eck & Waltman, 2010; Van Eck & Waltman, 2023). The analyses were carried out in two phases: data on years of publication and the 10 most cited articles were analyzed using the data available on Scopus. Data on authors, countries, most cited journals, co-authorship between countries and authors, keywords cited by authors, co-occurrence of words by authors, co-authorship by countries, citation by journals and countries and co-citation by authors were analyzed using VOSviewer software version 1.6.18.

3. Results

Our search strategy in the Scopus database initially identified a total of 677 records. After setting as screening filters original articles, another 58 were excluded (review articles, book chapters, letters from editors, conference abstracts), leaving 619 for analysis.

The first publication was made in 1970, consisting of a single document. In 2021, there was an increase in publications, with 93 documents published. In 2022, there was a decline in the number of published documents (51 articles), followed by a progressive increase in the years 2023 (67 articles) and 2024 (78 articles) to date (Figure 1).

Figure 1 - Number of published papers per year.



Sorce: Scopus (2024).

In Table 1, we can observe a ranking of the ten most cited articles. In first place is the article by Ghannoum, published in 2010, with 813 citations. Following that is the article by Fan, published in 2018, which has accumulated 535 citations. In ninth and tenth place, the articles by Zhao and Peters, both published in 2017, were the least cited in this ranking, obtaining 276 and 275 citations, respectively.

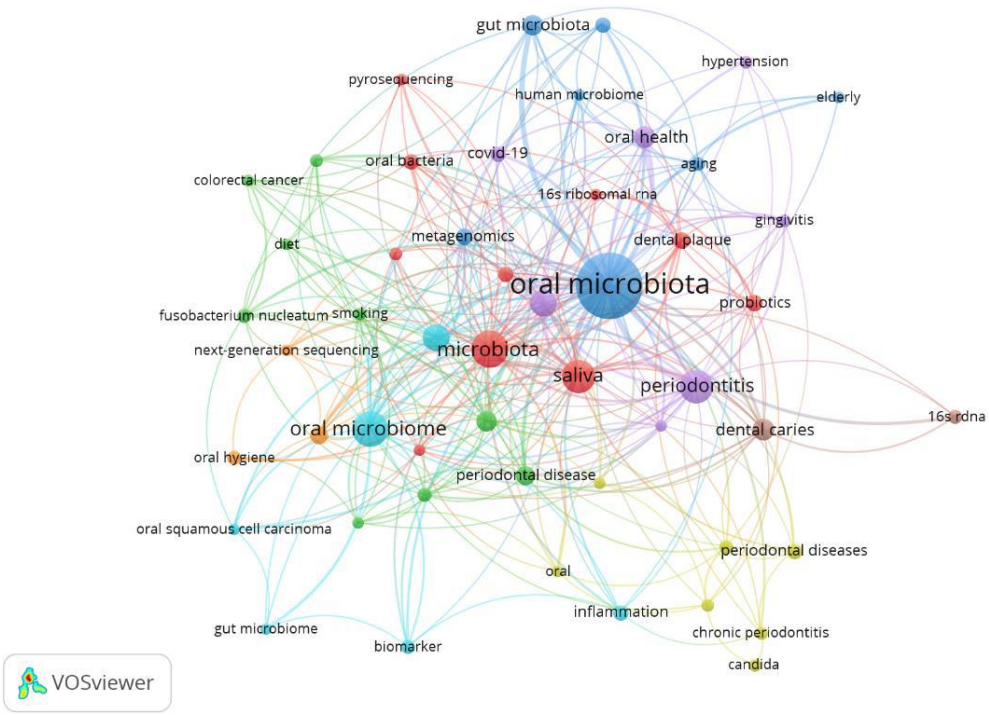
Table 1 - Top 10 Most Cited Articles.

Title	Authors	Journal	Year of publication	Citations
Characterization of the oral fungal microbiome (mycobiome) in healthy individuals	Ghannoum et al. (2010)	PLos Pathogens	2010	813
Human oral microbiome and prospective risk for pancreatic cancer: A population-based nested case-control study	Fan et al. (2018)	Gut	2018	535
Bacterial diversity in the oral cavity of 10 healthy individuals	Bik et al. (2010)	ISME Journal	2010	500
Variations of oral microbiota are associated with pancreatic diseases including pancreatic câncer	Farrell et al. (2012)	Gut	2012	495
The oral microbiota in colorectal cancer is distinctive and predictive	Flemer et al. (2018)	Gut	2018	406
Periodontal disease and the oral microbiota in new-onset rheumatoid arthritis	Scher et al. (2012)	Arthritis and Rheumatism	2012	380
Dysbiosis of salivary microbiota in inflammatory bowel disease and its association with oral immunological biomarkers	Said et al. (2014)	DNA research	2014	296
Changes in abundance of oral microbiota associated with oral câncer	Schmidt et al. (2014)	PLoS ONE	2014	287
Variations in oral microbiota associated with oral câncer	Zhao et al. (2017)	Scientific Reports	2017	276
Oral microbiome composition reflects prospective risk for esophageal cancers	Peters et al. (2017)	Cancer Research	2017	275

Source: Own authorship (2024).

The analysis of word co-occurrence by the authors used the criterion that each keyword should have been mentioned in search engines at least six times. Consequently, we observed the formation of eight clusters, with the most frequently occurring words being oral microbiota (n=173), microbiota (n=53), oral microbiome (n=51), saliva (n=45), and periodontitis (n=44) (Figure 2). The cluster with the highest number of connections was the red cluster, with interconnected words such as microbiota, saliva, and probiotics. In the dark blue cluster, the occurrence of the main keywords related to the theme of the present study is evident, where the term oral microbiota shows strong connections with the words aging, elderly, gut microbiota, among others (Figure 2).

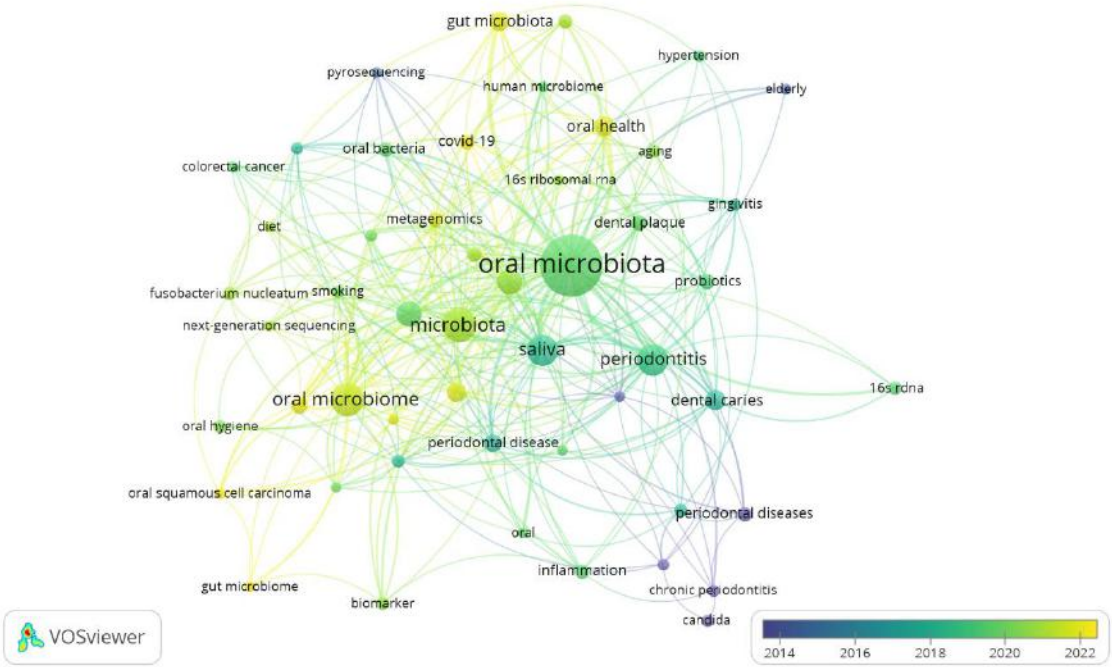
Figure 2 - Co-occurrence of keywords proposed by the authors of the documents.



Source: VOSviewer (2024).

When evaluating the co-occurrence of keywords by authors with an emphasis on the year, research on the topic began in 2014. However, exploratory studies related to oral microbiota, aging, elderly, among others, started to gain momentum between mid-2018 and 2020 (Figure 4). It is important to note that from 2020 onwards, the documents published on oral microbiota began to be associated with keywords such as oral health, diet, oral microbiome, dysbiosis, gut microbiota, among others, becoming more consolidated in 2022 (Figure 3).

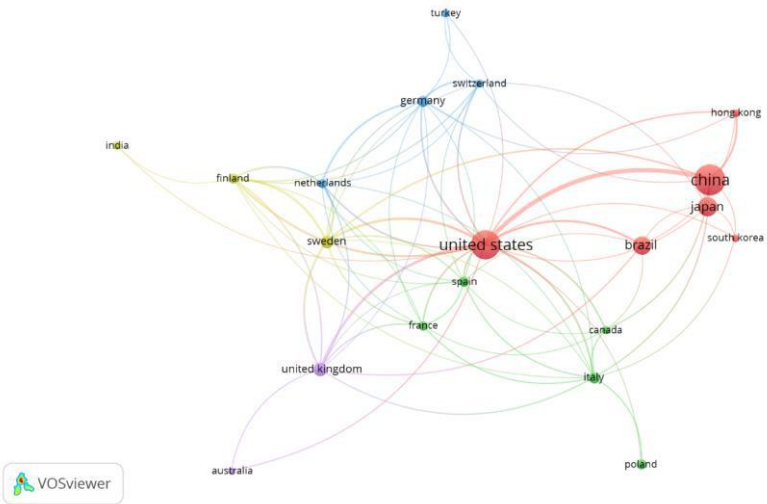
Figure 3 - Co-occurrence of keywords by authors by year.



Source: VOSviewer (2024).

Regarding the partnerships between countries for the publication of documents on the topic, we can observe the formation of five clusters. The criterion used was that the minimum number of documents per country was set at ten. Thus, we observe the formation of five clusters and note that the countries with the highest number of co-authored published documents are represented by the red cluster, which includes collaborations among countries such as the United States, China, Japan, Brazil, South Korea, and Hong Kong (Figure 4).

Figure 4 - Co-authorship of published documents between countries.



Source: VOSviewer (2024).

The number of citations was analyzed through journals and countries (Table 2). Regarding the most cited journals on the topic, Plos One (n = 1676) and Scientific Reports (n = 1419) were the ones that received the most citations for their published documents. Among this list of the top 10 most cited journals, the Journal of Clinical Periodontology (n=319) and Archives of Oral Biology (n=303) received the fewest citations (Table 2). As for the countries, the United States (n = 9045) and China (n = 4578) received the most citations in this ranking, while Germany (n = 689) and Finland (n = 605) were the countries that received the fewest citations on the topic (Table 2).

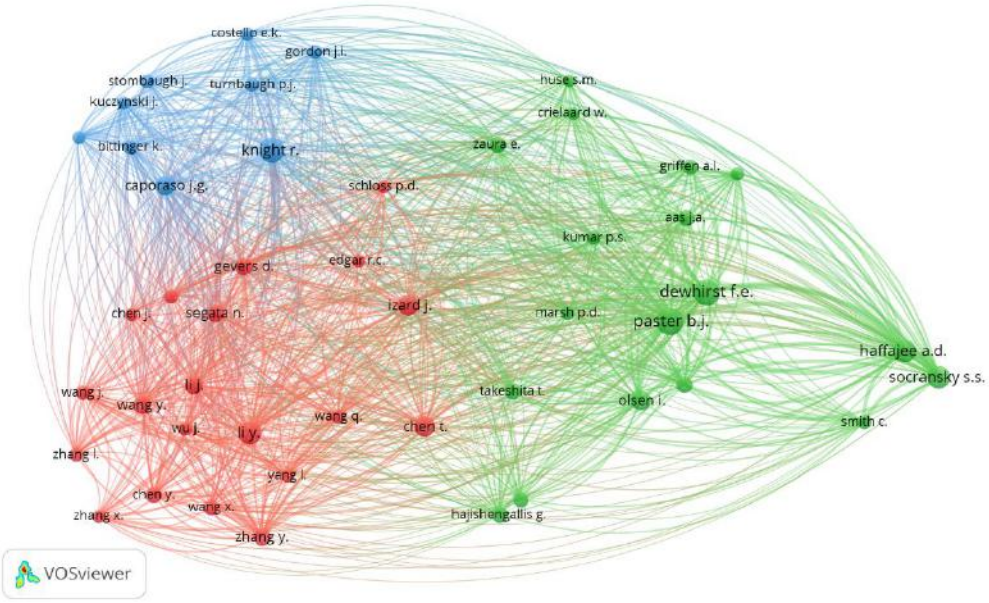
Table 2 - Top 10 Most Cited Documents among Journals and Countries.

Journals	**Number of documents**	**Number of citations**
Plos One	29	1676
Scientific Reports	32	1419
Frontiers in Cellular and Infection Microbiology	31	747
Microbiome	8	554
Frontiers in Microbiology	15	416
BMC Microbiology	10	367
Journal of Dental Research	8	341
Microbial Pathogenesis	6	330
Journal of Clinical Periodontology	8	319
Archives of Oral Biology	7	303
Countries	**Number of documents**	**Number of citations**
United States	142	9045
China	158	4578
Japan	63	1693
Brazil	54	1628
Sweden	28	1361
United Kingdom	32	1095
Spain	17	739
Netherlands	14	726
Germany	21	689
Finland	18	605

Source: Own authorship (2024).

The data related to author co-citation are represented in Figure 5. The criterion used for the formation of the network map was set at a minimum of 80 times an author was cited. Thus, we can observe the formation of three clusters. In the green cluster, the authors with the strongest connections among others are Paster, B. J., Dewhirst, F. E., Haffajee, A. D., and Socransky, S. S. (Figure 5). In the blue cluster, the notable authors are Knight, R., and Caporaso, J. G. (Figure 5). In the red cluster, the strong connections are represented by Li, Y., Izard, J., Chen, T., and Gevers, D. (Figure 5).

Figure 5 - Co-citation by authors.



Source: VOSviewer (2024).

4. Discussion

Bibliometric analysis is an effective numerical assessment tool for evaluating publications across various fields and specific time periods, as well as the relationships between these publications (Stelmach et al., 2022). Bibliometrics constitutes a branch of library and information science, used to study the size, growth, and distribution of scientific documents in an effort to assess their impact on the academic community (García-Villar & García-Santos, 2021).To the best of our knowledge, this is the first bibliometric analysis to present the dynamics of article production within a specific category in this field and population. We analyzed publications on oral microbiota in the elderly population, with the particularity of selecting only original articles since the emergence of publications in this area, aiming to map the trend of the oral microbiota concept in older adults.

In the present bibliometric analysis, 619 articles were examined, primarily reflecting the increase in publications since 2021. This surge in research may be a consequence of the growing attention given to the role of oral microbiota in the development and prevention of chronic diseases such as diabetes, cancer, cardiovascular diseases, inflammatory bowel disease, and Alzheimer's disease (Peng et al., 2022). Furthermore, these chronic conditions are of significant relevance to healthcare systems, particularly due to their impact on a large proportion of the elderly population (Da Silva e Silva et al., 2024; Nilson et al., 2020).

The possible explanation for the relationship between oral microbiota and the development of chronic diseases stems from the fact that the composition of oral microbiota can be disseminated to other tissues and cause inflammatory complications that worsen or contribute to the onset of pathologies (Hajishengallis & Chavakis, 2021). Among the top 10 most cited articles, the first-ranked study evaluated oral microbiota in healthy individuals (Ghannoum et al., 2010), as did the study in the third position of the top 10 (Bik et al., 2010). However, in the other articles comprising the most cited group, the predominant subject was the development of gastrointestinal cancers such as pancreatic cancer (Fan et al., 2018; Farrell et al., 2012), colorectal cancer (Flemer et al., 2018), oral cancer (Schmidt et al., 2014; Zhao et al., 2017), and esophageal cancer

(Peters et al., 2017). In addition, inflammatory bowel disease (Said et al., 2014) and rheumatoid arthritis (Scher et al., 2012) were also topics associated with oral microbiota mentioned in this group.

The most frequently occurring terms were oral microbiota (n=173), microbiota (n=53), oral microbiome (n=51), saliva (n=45), and periodontitis (n=44) (Figure 2), reflecting the association between the terms microbiota and periodontitis, given that bacterial growth in the oral region can be the initial cause of periodontitis (Hussein et al., 2022). When analyzing the interconnection of terms, microbiota, saliva, and probiotics exhibited the highest number of linkages. This is because probiotics are live microorganisms with significant potential to modify the composition of the oral microbiota, thereby contributing to the reduction of major periodontal pathogens (Di Stefano et al., 2022).

Regarding publication venues, the journals PLOS ONE, Scientific Reports, and Frontiers in Cellular and Infection Microbiology rank among the top three in terms of the number of published documents and citations. These journals have impact factors of 2.9, 3.8, and 4.6, respectively, according to Clarivate (2023), and are indexed in major databases such as PubMed, Web of Science, and Scopus. This indexing highlights the credibility and scientific relevance of the studies published in these journals.

The countries with the highest number of co-authored publications were the United States, China, Japan, Brazil, South Korea, and Hong Kong. The United States (n = 9,045) and China (n = 4,578) received the highest number of citations in this ranking, whereas Germany (n = 689) and Finland (n = 605) had the lowest citation counts on the studied topic. Brazil ranks fourth in both the number of publications and citations but still has significant progress to make in this field.

The present bibliometric analysis has some potential limitations: only the Scopus database was used; however, it is a commonly utilized and reliable source for bibliometric studies, covering a broad range of journals (Falagas et al., 2008). Additionally, it is well recognized that bibliometric analysis does not allow for the direct assessment of the scientific rigor of all studies, nor does it automatically confirm that every review written by an established scientific author is of high quality. Nevertheless, this is not the primary objective of a bibliometric review, which aims to assess publication trends and research impact within a given field.

5. Conclusion

The highest number of published papers on the topic of oral microbiota and elderly individuals was observed in the year 2021. From 2018 onward, the areas of oral health and diet became increasingly prominent concerning this subject. The United States stands out as the country with the highest number of citations, while China leads in terms of the highest number of documents published on the proposed topic. Thus, there is a notable increase in research in the field of oral microbiota and aging, highlighting it as a promising area for investment in promoting health and well-being in aging populations.

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References

Bautmans, I., Knoop, V., Amuthavalli Thiyagarajan, J., Maier, A. B., Beard, J. R., Freiberger, E., Belsky, D., Aubertin-Leheudre, M., Mikton, C., Cesari, M., Sumi, Y., Diaz, T., & Banerjee, A. (2022). WHO working definition of vitality capacity for healthy longevity monitoring. *The Lancet Healthy Longevity*, *3*(11), e789–e796. https://doi.org/10.1016/S2666-7568(22)00200-8

Behr, L. C., Simm, A., Kluttig, A., & Grosskopf (Großkopf), A. (2023). 60 years of healthy aging: On definitions, biomarkers, scores and challenges. *Ageing Research Reviews*, *88*, 101934. https://doi.org/10.1016/j.arr.2023.101934

Bik, E. M., Long, C. D., Armitage, G. C., Loomer, P., Emerson, J., Mongodin, E. F., Nelson, K. E., Gill, S. R., Fraser-Liggett, C. M., & Relman, D. A. (2010). Bacterial diversity in the oral cavity of 10 healthy individuals. *The ISME Journal 2010 4:8*, *4*(8), 962–974. https://doi.org/10.1038/ismej.2010.30

Da Silva e Silva, T., Da Silva Avelar, L., Simon R Martinez, B., Abdon Razoni, F., De Souza Alves Santos, E., Carneiro Borges, A., Coelho Fernando, S. M., Barros de Oliveira, I., Santos Lima Filho, S., Ribeiro Morais, P., Albuquerque Gadelha, A. J. D., Souza pesqueira da Cunha, T. O., Souza Melo, V. M., Silva Cunha Guimarães, A. L., Cardoso Oliveira Silva, J. A., Cabral Miranda Saraiva, C. M., & Santos, M. P. dos. (2024). Aspectos da doença de alzheimer no Brasil: um estudo epidemiológico. *Brazilian Journal of Implantology and Health Sciences*, *6*(11), 1559–1572. https://doi.org/10.36557/2674-8169.2024v6n11p1559-1572

Di Stefano, M., Polizzi, A., Santonocito, S., Romano, A., Lombardi, T., & Isola, G. (2022). Impact of Oral Microbiome in Periodontal Health and Periodontitis: A Critical Review on Prevention and Treatment. *International Journal of Molecular Sciences*, *23*(9), 5142. https://doi.org/10.3390/ijms23095142

Dogra, S., Dunstan, D. W., Sugiyama, T., Stathi, A., Gardiner, P. A., & Owen, N. (2022). Active Aging and Public Health: Evidence, Implications, and Opportunities. *Annual Review of Public Health*, *43*(1), 439–459. https://doi.org/10.1146/annurev-publhealth-052620-091107

Dominguez, L. J., Veronese, N., Baiamonte, E., Guarrera, M., Parisi, A., Ruffolo, C., Tagliaferri, F., & Barbagallo, M. (2022). Healthy Aging and Dietary Patterns. *Nutrients*, *14*(4), 889. https://doi.org/10.3390/nu14040889

Falagas, M. E., Pitsouni, E. I., Malietzis, G. A., & Pappas, G. (2008). Comparison of PubMed, Scopus, Web of Science, and Google Scholar: strengths and weaknesses. *The FASEB Journal*, *22*(2), 338–342. https://doi.org/10.1096/fj.07-9492LSF

Fan, X., Alekseyenko, A. V., Wu, J., Peters, B. A., Jacobs, E. J., Gapstur, S. M., Purdue, M. P., Abnet, C. C., Stolzenberg-Solomon, R., Miller, G., Ravel, J., Hayes, R. B., & Ahn, J. (2018). Human oral microbiome and prospective risk for pancreatic cancer: a population-based nested case-control study. *Gut*, *67*(1), 120–127. https://doi.org/10.1136/GUTJNL-2016-312580

Farrell, J. J., Zhang, L., Zhou, H., Chia, D., Elashoff, D., Akin, D., Paster, B. J., Joshipura, K., & Wong, D. T. W. (2012). Variations of oral microbiota are associated with pancreatic diseases including pancreatic cancer. *Gut*, *61*(4), 582–588. https://doi.org/10.1136/GUTJNL-2011-300784

Flemer, B., Warren, R. D., Barrett, M. P., Cisek, K., Das, A., Jeffery, I. B., Hurley, E., O'Riordain, M., Shanahan, F., & O'Toole, P. W. (2018). The oral microbiota in colorectal cancer is distinctive and predictive. *Gut*, *67*(8), 1454–1463. https://doi.org/10.1136/GUTJNL-2017-314814

García-Villar, C., & García-Santos, J. M. (2021). Indicadores bibliométricos para evaluar la actividad científica. *Radiología*, *63*(3), 228–235. https://doi.org/10.1016/j.rx.2021.01.002

Ghannoum, M. A., Jurevic, R. J., Mukherjee, P. K., Cui, F., Sikaroodi, M., Naqvi, A., & Gillevet, P. M. (2010). Characterization of the oral fungal microbiome (mycobiome) in healthy individuals. *PLoS pathogens*, *6*(1). https://doi.org/10.1371/JOURNAL.PPAT.1000713

Guo, L., Zhou, J., Xie, F., Lang, Q., Xu, Y., Chen, L., Xue, Z., Mao, Y., & Wang, R. (2024). The profile of oral microbiome in Chinese elderly population associated with aging and systemic health status. *BMC Oral Health*, *24*(1), 895. https://doi.org/10.1186/s12903-024-04676-x

Hajishengallis, G., & Chavakis, T. (2021). Local and systemic mechanisms linking periodontal disease and inflammatory comorbidities. *Nature Reviews Immunology*, *21*(7), 426–440. https://doi.org/10.1038/s41577-020-00488-6

Hussein, N. A., Soliman, Z. S., & Edrees, M. F. (2022). Oral microbiota associated with gingiva of healthy, gingivitis and periodontitis cases. *Microbial Pathogenesis*, *171*, 105724. https://doi.org/10.1016/j.micpath.2022.105724

Liu, W., You, J., Ge, Y., Wu, B., Zhang, Y., Chen, S., Zhang, Y., Huang, S., Ma, L., Feng, J., Cheng, W., & Yu, J. (2023). Association of biological age with health outcomes and its modifiable factors. *Aging Cell*, *22*(12). https://doi.org/10.1111/acel.13995

Li, Y., Cui, J., Liu, Y., Chen, K., Huang, L., & Liu, Y. (2021). Oral, Tongue-Coating Microbiota, and Metabolic Disorders: A Novel Area of Interactive Research. *Frontiers in cardiovascular medicine*, *8*. https://doi.org/10.3389/FCVM.2021.730203

Jerez-Roig, J., Guedes, M. B. O., Silva, J. M. D., & Lima, K. C. (2014). (2014). Análise da produção científica da Revista Brasileira de Geriatria e Gerontologia: uma revisão bibliométrica. *Revista Brasileira de Geriatria e Gerontologia*, 17(3). https://doi.org/10.1590/1809-9823.2014.14116

Luz, M. L. (2025). *Entenda o que é uma revisão bibliométrica, seus objetivos, aplicações na academia e no mercado e as etapas essenciais para realizá-la.* PISAC/UnB. https://pisac.unb.br/blog/revisao-bibliometrica-o-que-e-para-que-serve-e-como-fazer/

Mazza, E., Ferro, Y., Pujia, R., Mare, R., Maurotti, S., Montalcini, T., & Pujia, A. (2021). Mediterranean Diet In Healthy Aging. *The Journal of nutrition, health and aging*, *25*(9), 1076–1083. https://doi.org/10.1007/s12603-021-1675-6

Nilson, E. A. F., Andrade, R. da C. S., Brito, D. A. de, & Michele Lessa de, O. (2020). Custos atribuíveis a obesidade, hipertensão e diabetes no Sistema Único de Saúde, Brasil, 2018. *Revista Panamericana de Salud Pública*, *44*, 1. https://doi.org/10.26633/RPSP.2020.32

Peng, X., Cheng, L., You, Y., Tang, C., Ren, B., Li, Y., Xu, X., & Zhou, X. (2022). Oral microbiota in human systematic diseases. *International Journal of Oral Science*, *14*(1), 14. https://doi.org/10.1038/s41368-022-00163-7

Pereira, A. S., Shitsuka, D. M., Parreira, F. J., & Shitsuka, R. (2018). *Metodologia da pesquisa científica.* (1ª ed.). Santa Maria, RS: Universidade Federal de Santa Maria – UFSM, Núcleo de Tecnologia Educacional (NTE).

Peters, B. A., Wu, J., Pei, Z., Yang, L., Purdue, M. P., Freedman, N. D., Jacobs, E. J., Gapstur, S. M., Hayes, R. B., & Ahn, J. (2017). Oral Microbiome Composition Reflects Prospective Risk for Esophageal Cancers. *Cancer research*, *77*(23), 6777–6787. https://doi.org/10.1158/0008-5472.CAN-17-1296

Rudnicka, E., Napierała, P., Podfigurna, A., Męczekalski, B., Smolarczyk, R., & Grymowicz, M. (2020). The World Health Organization (WHO) approach to healthy ageing. *Maturitas*, *139*, 6–11. https://doi.org/10.1016/j.maturitas.2020.05.018

Said, H. S., Suda, W., Nakagome, S., Chinen, H., Oshima, K., Kim, S., Kimura, R., Iraha, A., Ishida, H., Fujita, J., Mano, S., Morita, H., Dohi, T., Oota, H., & Hattori, M. (2014). Dysbiosis of salivary microbiota in inflammatory bowel disease and its association with oral immunological biomarkers. *DNA research : an international journal for rapid publication of reports on genes and genomes*, *21*(1), 15–25. https://doi.org/10.1093/DNARES/DST037

Schamarek, I., Anders, L., Chakaroun, R. M., Kovacs, P., & Rohde-Zimmermann, K. (2023). The role of the oral microbiome in obesity and metabolic disease: potential systemic implications and effects on taste perception. *Nutrition journal*, *22*(1). https://doi.org/10.1186/S12937-023-00856-7

Scher, J. U., Ubeda, C., Equinda, M., Khanin, R., Buischi, Y., Viale, A., Lipuma, L., Attur, M., Pillinger, M. H., Weissmann, G., Littman, D. R., Pamer, E. G., Bretz, W. A., & Abramson, S. B. (2012). Periodontal disease and the oral microbiota in new-onset rheumatoid arthritis. *Arthritis and rheumatism*, *64*(10), 3083–3094. https://doi.org/10.1002/ART.34539

Schmidt, B. L., Kuczynski, J., Bhattacharya, A., Huey, B., Corby, P. M., Queiroz, E. L. S., Nightingale, K., Kerr, A. R., DeLacure, M. D., Veeramachaneni, R., Olshen, A. B., & Albertson, D. G. (2014). Changes in abundance of oral microbiota associated with oral cancer. *PloS one*, *9*(6). https://doi.org/10.1371/JOURNAL.PONE.0098741

Shaalan, A., Lee, S., Feart, C., Garcia-Esquinas, E., Gomez-Cabrero, D., Lopez-Garcia, E., Morzel, M., Neyraud, E., Rodriguez-Artalejo, F., Streich, R., & Proctor, G. (2022). Alterations in the Oral Microbiome Associated With Diabetes, Overweight, and Dietary Components. *Frontiers in Nutrition*, *9*, 914715. https://doi.org/10.3389/FNUT.2022.914715/BIBTEX

Stelmach, V., Semertzidou, E., Efstathiou, A., Tzikos, G., Papakostas, P., Panidis, S., Gkarmiri, S., Fyntanidou, B., Shrewsbury, A., Grosomanidis, V., Stavrou, G., & Kotzampassi, K. (2022). Mapping of Intragastric Balloon Use: a Guide to the Activity of Institutions Through Bibliometry. *Obesity Surgery*, *32*(7), 2373–2385. https://doi.org/10.1007/s11695-022-06089-7

Sun, J., Fang, D., Wang, Z., & Liu, Y. (2023). Sleep Deprivation and Gut Microbiota Dysbiosis: Current Understandings and Implications. *International Journal of Molecular Sciences*, *24*(11), 9603. https://doi.org/10.3390/ijms24119603

Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, *84*(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3

Van Eck, N. J., & Waltman, L. (2023). *Manual for VOSviewer version 1 .6.19*. Universiteit Leiden.

Wang, C., Yang, Y., Cai, Q., Gao, Y., Cai, H., Wu, J., Zheng, W., Long, J., & Shu, X.-O. (2023). Oral microbiome and ischemic stroke risk among elderly Chinese women. *Journal of Oral Microbiology*, *15*(1). https://doi.org/10.1080/20002297.2023.2266655

Wang, R.-R., Xu, Y.-S., Ji, M.-M., Zhang, L., Li, D., Lang, Q., Zhang, L., Ji, G., & Liu, B.-C. (2019). Association of the oral microbiome with the progression of impaired fasting glucose in a Chinese elderly population. *Journal of Oral Microbiology*, *11*(1), 1605789. https://doi.org/10.1080/20002297.2019.1605789

Wang, Z., Wang, Z., Lu, T., Chen, W., Yan, W., Yuan, K., Shi, L., Liu, X., Zhou, X., Shi, J., Vitiello, M. V., Han, Y., & Lu, L. (2022). The microbiota-gut-brain axis in sleep disorders. *Sleep Medicine Reviews*, *65*, 101691. https://doi.org/10.1016/j.smrv.2022.101691

Wu, Y.-F., Lee, W.-F., Salamanca, E., Yao, W.-L., Su, J.-N., Wang, S.-Y., Hu, C.-J., & Chang, W.-J. (2021). Oral Microbiota Changes in Elderly Patients, an Indicator of Alzheimer's Disease. *International Journal of Environmental Research and Public Health*, *18*(8), 4211. https://doi.org/10.3390/ijerph18084211

Yang, D.-F., Huang, W.-C., Wu, C. W., Huang, C.-Y., Yang, Y.-C. S. H., & Tung, Y.-T. (2023). Acute sleep deprivation exacerbates systemic inflammation and psychiatry disorders through gut microbiota dysbiosis and disruption of circadian rhythms. *Microbiological Research*, *268*, 127292. https://doi.org/10.1016/j.micres.2022.127292

Yang, Y., Cai, Q., Zheng, W., Steinwandel, M., Blot, W. J., Shu, X.-O., & Long, J. (2019). Oral microbiome and obesity in a large study of low-income and African-American populations. *Journal of Oral Microbiology*, *11*(1), 1650597. https://doi.org/10.1080/20002297.2019.1650597

Zhao, H., Chu, M., Huang, Z., Yang, X., Ran, S., Hu, B., Zhang, C., & Liang, J. (2017). Variations in oral microbiota associated with oral cancer. *Scientific reports*, *7*(1). https://doi.org/10.1038/S41598-017-11779-9