



Analisis Bibliometrik Konsumsi Makanan dan Minuman Manis : Faktor Risiko dan Dampaknya Terhadap Kesehatan Anak

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ABSTRAK

Pendahuluan : Konsumsi makanan dan minuman manis merupakan masalah kesehatan masyarakat yang signifikan, terutama bagi anak-anak, yang berkontribusi pada obesitas, karies gigi, dan masalah kesehatan lainnya. Analisis bibliometrik ini meneliti tren penelitian dan kontribusi terkait dampak konsumsi makanan dan minuman manis terhadap kesehatan anak-anak dari tahun 2019 hingga 2023. Keterbaruan studi ini yaitu pendekatan yang komprehensif dalam menganalisis penelitian. Dengan mengungkap tren penelitian dan isu kesehatan yang saling terkait, analisis ini memberikan wawasan penting serta mengidentifikasi area penelitian yang perlu dieksplorasi lebih lanjut.

Metode: Menggunakan *database* Scopus, kami menganalisis artikel yang diterbitkan antara 2019 dan 2023 dengan kata kunci “*sweet AND foods OR sugary AND beverages AND children's AND health*” Kriteria inklusi mencakup artikel asli, berbahasa Inggris, dan akses terbuka. VOSviewer digunakan untuk visualisasi.

Hasil: Kami mengidentifikasi 113 artikel yang relevan, dengan puncak publikasi pada tahun 2021 dan 2022 yang dipengaruhi oleh meningkatnya dampak pandemi covid-19, sementara penurunan publikasi artikel pada tahun 2023 disebabkan karena pergeseran tren topik penelitian. Analisis menunjukkan Amerika memiliki publikasi terbanyak selama 5 tahun terakhir. Kata kunci berfokus pada perilaku diet, hasil kesehatan, dan faktor resiko pada lima tahun terakhir.

Kesimpulan: Analisis ini menyoroti peningkatan penelitian tentang dampak kesehatan dari makanan manis pada anak-anak, yang didominasi oleh negara-negara berpenghasilan tinggi dengan kontribusi yang signifikan dari negara lain. Pendekatan multidisipliner sangat penting untuk mengatasi dampak diet yang kompleks pada kesehatan anak-anak, dengan menekankan kolaborasi penelitian global dan intervensi kebijakan.

Kata Kunci: makanan manis; kesehatan anak-anak; analisis bibliometrik, VOSviewer

ABSTRACT

Introduction: The consumption of sugary foods and drinks is a significant public health concern, especially for children, contributing to obesity, dental caries, and other health issues. This bibliometric analysis examines research trends and contributions on the impact of sugary food and drink consumption on children's health from 2019 to 2023. The novelty of this study lies in its comprehensive approach to analyzing existing research. By uncovering research trends and interconnected health issues, this analysis provides valuable insights and identifies areas that require further exploration.

Method: Using the Scopus database, we analyzed articles published between 2019 and 2023 with keywords “*sweet AND foods OR sugary AND beverages AND children's AND health*”. Inclusion criteria were original, English-language, open-access articles. VOSviewer was used for visualization.

Results: We identified 113 relevant articles, with a peak in publications in 2021 and 2022, influenced by the increasing impact of the Covid-19 pandemic. While the decline in publications in 2023 was attributed to a shift in research topic trends. The analysis shows that the United States had the highest number of publications over the past five years. Keywords focused on dietary behavior, health outcomes, and risk factors during the past five years.

Conclusion: The analysis highlights increasing research on the health impacts of sugary foods on children, led by high-income countries with notable contributions from others. A multidisciplinary approach is essential to address the complex dietary impacts on children's health, emphasizing global research collaboration and policy interventions.

Keywords: *sugary foods; children's health; bibliometric analysis; VOSviewer.*

INTRODUCTION

Consumption of sugary foods has become an important concern in public health research because it is associated with a number of significant health problems, especially among children. Among children aged 3-4 years, consumption of sugar-sweetened foods including packaged fruit juices is very high, with 71.4% consuming one or more sugar-sweetened drinks daily. Consumption of sweet foods is also high, with 59.6% of children consuming them once or more per day (UNICEF, 2019). Research showed that 81.6% of children consumed one commercial snack the day before the interview and 40% consumed sugar-sweetened drinks, while 60% of children aged 24-35 months consumed 3 or more snacks per day (Green et al., 2019).

Excessive consumption of sugary foods and drinks has been linked to unhealthy weight gain and various chronic diseases. Obesity is mostly caused by excessive calorie consumption over time. Apart from that, excessive consumption of sweet drinks increases the risk of obesity in children (Castetbon et al., 2023). The higher a child's propensity for consuming sweet foods, the higher the incidence of dental caries. High consumption of sweet foods increases the risk of dental caries in school-aged children. Poor dental health in children can impact their quality of life and general well-being (Mahboobi et al., 2021). A diet high in sugar can reduce sleep quality and cause headaches (Bleich & Vercammen, 2018).

By understanding the negative consequences of consuming sugary foods and drinks on children's health, research on the risk factors associated with these diets is critical for devising effective intervention strategies and appropriate public health policies to improve the health of future generations. Therefore, this bibliometric analysis aims to provide a better understanding of research trends and the contributions of researchers in understanding the impact of sugary food and drink consumption on children's health, as well as to identify areas of research that still need to be explored. The novelty of this bibliometric analysis lies in its comprehensive analysis of existing research on the impact of sugary food and drink consumption on children's health. By using advanced bibliometric tools, this study identifies research trends, uncovers interconnected health issues, and providing valuable insights for future research and the development of targeted public health interventions.

METHOD

This research uses a bibliometric study that involves metadata analysis of articles published from 2019-2023 or the last 5 years. The data search process was carried out using the Scopus database using predetermined keywords, namely "*sweet AND foods OR sugary AND beverages AND children's AND health*". Inclusion criteria for compiling a bibliography include original articles relating the consumption of sweet foods and drinks to children's health, in English, and open-access documents.

The study applied exclusion criteria to ensure the quality and relevance of the included articles. The types of documents excluded from the analysis were editorials, notes, letters, errata, conference papers, short surveys, retracted papers, notes, letters, data papers, and undefined documents. Additionally, articles that were in press in sources such as conference proceedings, books, book series, and trade journals were also excluded from the study. Initial search results using the Scopus database produced a total of 144 articles with 113 of them meeting the predetermined inclusion criteria. The data search results are then saved in CSV format.

The next stage is to observe the completeness of the data, including checking the article title, author's name, author's country of origin, keywords used, publisher, and year of publication. After ensuring the completeness of the data, bibliometric analysis was carried out based on several

characteristics, namely year of publication, source, articles most cited, names of the most productive authors, affiliations or institutions that actively publish regarding consumption of sweet foods and drinks and children's health, country of origin of the author, type of article, subjects that most frequently collaborate with related topics, institutions or institutions that sponsor publications, and keywords that are often used by authors. To assist in bibliometric analysis, VOSviewer is one *software* that can be used to visualize and analyze bibliometrics.

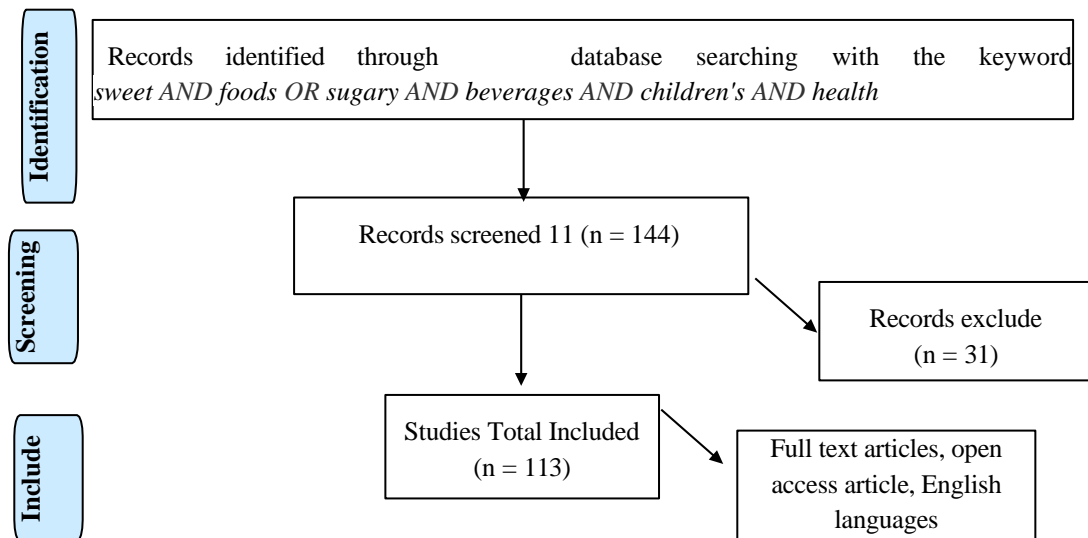


Diagram 1. Article selection process

RESULT

Article Publication Trends per Year

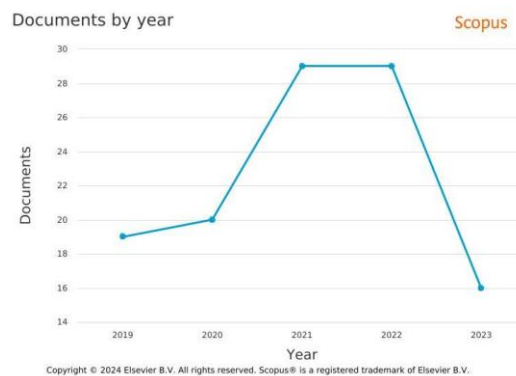


Figure 1. Article Publication Trends per Year

Source: <https://bit.ly/AnalisisScopus>

Figure 1 shows the growth trend from 2019 to 2022, followed by a decline in 2023. The number of publications increased from 19 in 2019 to 29 in 2021 and 2022, before falling to 16 in 2023.

Documents Based on Source

Table 1. Most Cited Articles

No	Writer	Article Title	Year of Publication	Number of Citations	Journal Name	References
1.	Wang, L., Martínez Steele, E., You, M., ...Mozaffarian, D., Zhang, F.F.	Trends in Consumption of Ultra-processed Foods among US Youths Aged 2-19 Years, 1999-2018	2021	148	JAMA Journal of the American Medical Association	(Wang et al., 2021)
2.	Martini, D., Godos, J., Bonaccio, M., Vitaglione, P., Grosso, G.	Ultra-processed foods and nutritional dietary profile: A meta-analysis of nationally representative samples	2021	126	Nutrients	(Martini et al., 2021)
3.	Pujia, R., Ferro, Y., Maurotti, S., ...Montalcini, T., Mazza, E.	The effects of covid-19 on the eating habits of children and adolescents in italy: A pilot survey study	2021	58	Nutrients	(Pujia et al., 2021)
4.	Hunter, S.R., Reister, E.J., Cheon, E., Mattes, R.D.	Low calorie sweeteners differ in their physiological effects in humans	2019	52	Nutrients	(Hunter et al., 2019)
5.	Wang, L., Van Grieken, A., Van Der Velde, LA, ...Boere-Boonekamp, M.M., Raat, H.	Factors associated with early introduction of complementary feeding and consumption of non-recommended foods among Dutch infants: The BeeBOFT study	2019	50	BMC Public Health	(Wang et al., 2019)
6.	Noll, P.R.S., Noll, M., de Abreu, L.C., ...Silveira, E.A., Surprised, I.C.E.	Ultra-processed food consumption by Brazilian adolescents in cafeterias and school meals	2019	49	Scientific Reports	(Noll et al., 2019)
7.	Williams, J., Buoncristiano, M., Nardone, P., ...Weber, M., Breda, J.	A snapshot of european children's eating habits: Results from the fourth round of the who european childhood obesity surveillance initiative (cosi)	2020	43	Nutrients	(Williams et al., 2020)
8.	Magriplis, E., Michas, Mr., Petridi, E., ...Panagiotakos, D. (1999)., Zampelas, A.	Dietary sugar intake and its association with obesity in children and adolescents	2021	40	Children	(Magriplis et al., 2021)
9.	Pfinder, M., Heise, T.L., Hilton Boon, M., ...Katikireddi, S.V., Lhachimi, S.K.	Taxation of unprocessed sugar or sugar-added foods for reducing their consumption and preventing obesity or other adverse health outcomes	2020	32	Cochrane Database of Systemic Reviews	(Pfinder et al., 2020)
10.	Rodrigues, R.M., Souza, A.D.M., Bezerra, I.N., ...Yokoo, E.M., Sichieri, R.	Most consumed foods in Brazil: evolution between 2008-2009 and 2017-2018	2021	32	Public Health Magazine	(Rodrigues et al., 2021)

Analysis based on the most cited article, namely Wang, L., et al. (2021). Trends in Consumption of Ultraprocessed Foods among US Youths Aged 2-19 Years, 1999-2018 (JAMA - Journal of the American Medical Association) with 148 citations. Furthermore, Martini, D., et al. (2021). Ultra-processed foods and nutritional dietary profile: A meta-analysis of nationally representative samples is in second place with 126 citations. The 10th position was written by Rodrigues, R.M., et al. (2021). Most consumed foods in Brazil: evolution between 2008-2009 and 2017-2018 with 32 citations.

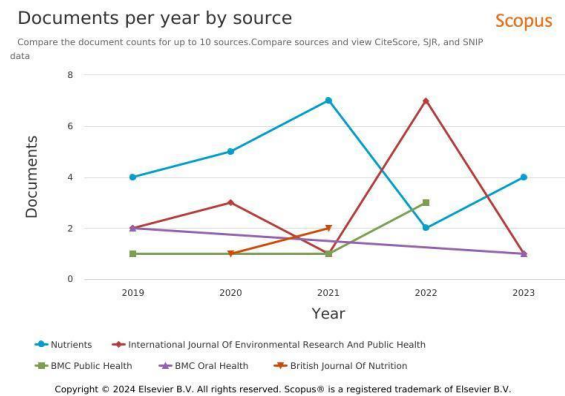


Figure 2. Documents by Source
Source: <https://bit.ly/AnalisisScopus>

Figure 2 shows the 5 journals that have published the most articles in 2019-2023. The five journals are Nutrients, International Journal of Environmental Research and Public Health, BMC Public Health, Pediatric Obesity, Appetit.

Author's Country of Origin

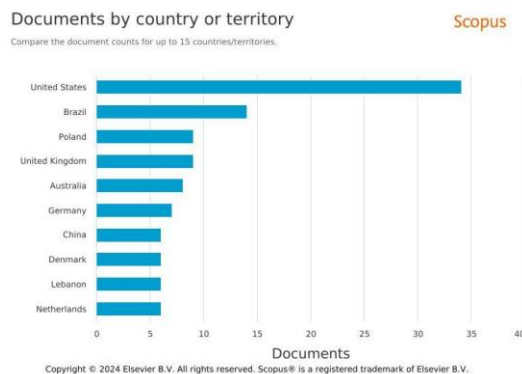


Figure 3. Author's Country of Origin
Source: <https://bit.ly/AnalisisScopus>

Most countries shown in Figure 3 are High-Income Countries (HIC), except for China, Brazil, and Iran. The United States occupies the top position with the highest number of publications, namely 44 publications. Brazil is in second place with 14 publications. Poland and China show almost equal publications with 11 and 10 publications respectively. Australia and Canada occupy fifth and sixth positions with 9 publications each. Germany, Iran, Canada, and Denmark are also included in the top 10 countries that contribute to children's health publications related to the consumption of sweet foods with smaller contributions than the countries above.

10 Most Prolific Writers

Matthiesen, J. stands out in publishing articles in the last 5 years. This indicates Matthiesen, J.'s active and ongoing research efforts in this area. The remaining 9 authors have contributed the same number of publications, indicating that they have all made significant contributions to this field of research publication.

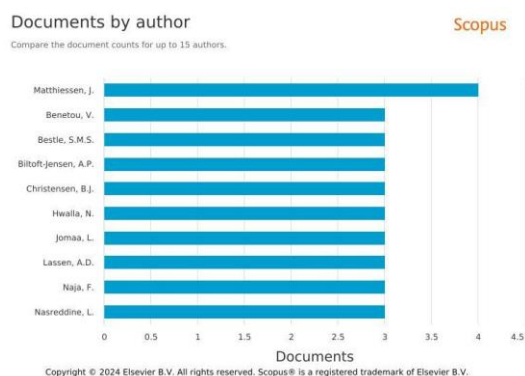


Figure 4. 10 Most Productive Writers
Source: <https://bit.ly/AnalisisScopus>

Documents Based on Affiliation

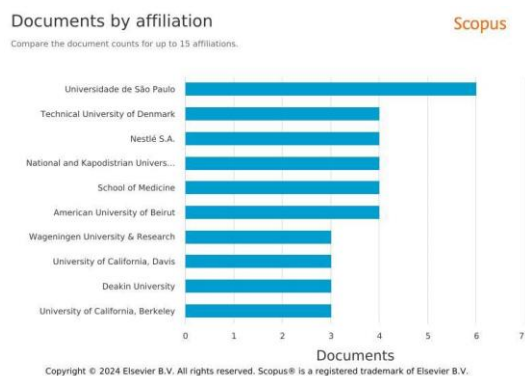


Figure 5. Documents Based on Affiliation
Source: <https://bit.ly/AnalisisScopus>

Figure 5 provides an overview of the research productivity of the institutions involved. Universidade de Sao Paulo occupies the top position with 6 publications. Tehran University of Medical Sciences and Nestle S.A. each contributed with 5 publications. The other seven authors have almost equal numbers of publications with the countries above, namely the Technical University of Denmark, Isfahan University of Medical Sciences, The University of North Carolina at Chapel Hill, Endocrinology and Metabolism Research Institute TUMS, National and Kapodistrian University of Athens, School of Medicine, and the American University of Beirut with 4 publications each.

Document Based on Type

Articles based on type show that 91.3% of publications regarding consumption of sweet foods and children's health are in the form of articles and the other 6.9% are in the form of reviews.

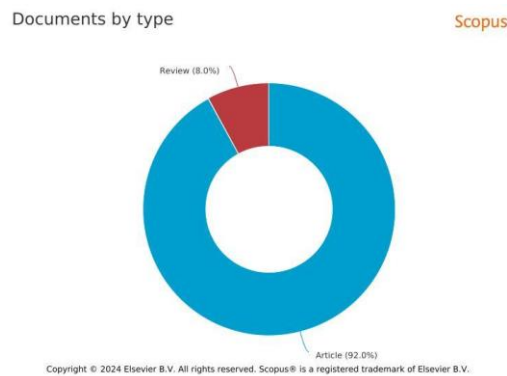


Figure 6. Document Based on Type
Source: <https://bit.ly/AnalisisScopus>

Subject Based Documents

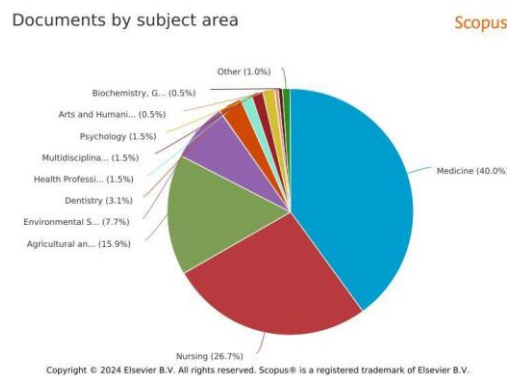


Figure 7. Document Based on Subject
Source: <https://bit.ly/AnalisisScopus>

The medical and nursing professions are the most dominant in the literature regarding the consumption of sweet foods on children's health. Other health professions, namely psychology, health professions, and dentists, highlight the importance of dental and oral health in relation to the consumption of sweet foods in children. This reflects the importance of this topic in medical practice and health research. Apart from that, there are subjects in non-health fields including *Agricultural dan Biological Science, Environmental Science, Multidisciplinary, Social Sciences, Arts and Humanities*, and others.

Document Based on Sponsor Source

Figure 8 highlights support from various institutions and research bodies. The National Institutes of Health contributed the top number of documents at 9 documents. Second place is the Robert Wood Johnson Foundation which shows their interest in this topic with 7 papers. The Conselho Nacional de Desenvolvimento Cientifico e Tecnologico and the National Heart, Lung, and Blood Institute demonstrated global interest in this research with 5 papers. Followed by the American University of Beirut, Coordenacao de Aperfeicoamento de Pessoal de Nivel Superior, National Center for Advancing Translational Sciences, and National Health and Medical Research 4 documents each and the Conseil National de la Recherche Scientifique and the National Institute of Child Health and 3 papers each.

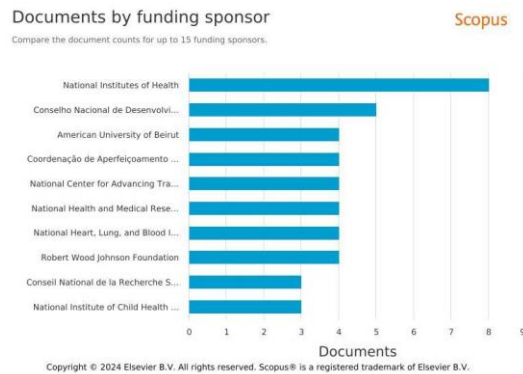


Figure 8. Documents Based on Sponsor Source
 Source: <https://bit.ly/AnalisisScopus>

Author Keywords

Analysis of the author's keywords was carried out with the help of VOSviewer software, a total of 186 author keywords were created that were highly connected. Author keywords are separated into 6 clusters with different colors. Cluster 1 consists of 48 items with the top keywords viz *candy, food intake, caloric intake, fruit, and vegetable*. Cluster 2 consists of 40 items consisting of the *article, child, sugar intake, and risk factor* as the top keywords. Cluster 3 consists of 39 items consisting of *child, cross-sectional, diet, female, and nutrition*. Cluster 4 with 34 items among them *adolescent, body mass, childhood obesity, fast food, and feeding behavior* as the top keywords. Cluster 5 comprises 13 items with top keywords *beverage, food, snacks, and soft drink*. Cluster 6 consists of 12 items with top keywords *sugar-sweetened beverage, adolescent, human experiment, dan major clinical study*.

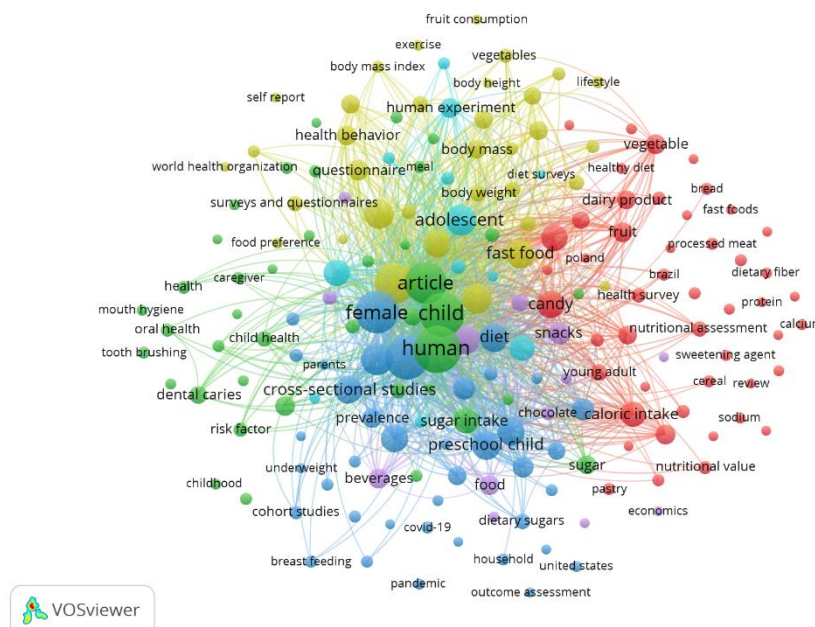


Figure 9. Author Keywords
 Source: VOSviewer software

Density Display Mode

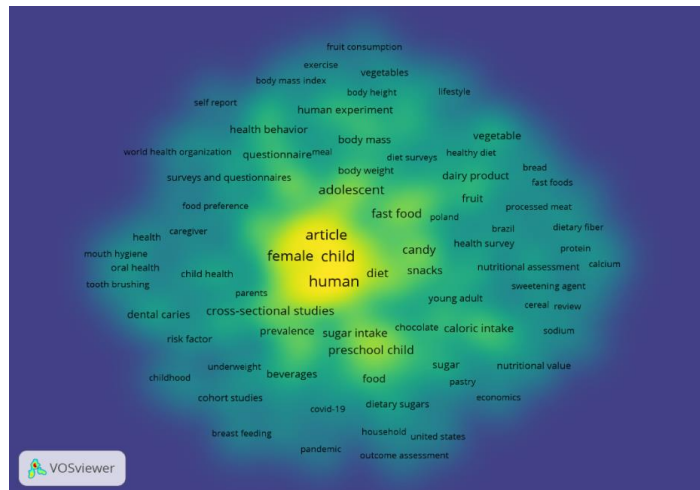


Figure 9. Density Display Mode

Source: VOSviewer software

The density display mode highlights that most research relates the consumption of sugary foods and drinks to children's health. The brighter yellow color indicates a higher frequency of this study, among others, in articles, female, child, human, diet, candy, adolescent, fast food, and cross-sectional studies. Research on topics such as caregiver, pandemic, economics, and *nutritional value* shows a fainter color.

DISCUSSION

Article Publication Trends per Year

Fluctuations in the number of publications from 2019 to 2023 reflect the dynamics of research regarding exclusive breastfeeding and the nutritional status of toddlers. The increase in the number of publications in 2021 and 2022 is likely to be triggered by increasing global awareness regarding the importance of exclusive breastfeeding and toddler nutrition, as well as the impact of the COVID-19 pandemic which may affect diet and access to good nutrition. The decline in the number of publications in 2023 could be caused by several factors, including a shift in research focus to other topics, changes in research funding, or the long-term impact of the pandemic on research activities.

In 2023, there was a significant shift in research trends regarding children's health. Research related to the pandemic, COVID-19, and mental health saw a sharp increase and became the focus of attention among scientists. Data from Scopus shows that keywords such as "COVID-19," "Coronavirus Disease 2019," and "Pandemic" became increasingly dominant. Researchers began shifting their focus to understand the impact of the pandemic on various aspects of health, including children's health. Additionally, mental health emerged as an increasingly important research area, with significant increases in the use of keywords like "Mental Health," "Depression," and "Anxiety." Researchers highlighted the psychological impacts of the pandemic on children, adolescents, and the general population.

Research on the consumption of sweet foods and sweet drinks is still a relevant topic in the context of toddler nutrition. Toddlers are at a critical stage of development where their dietary habits and preferences are being established, laying the foundation for their future eating behaviors and health outcomes (Mahajan et al., 2021). Given its significant impact on children's health, more research is needed to develop effective strategies to reduce sugar consumption in children. A multidisciplinary

approach involving aspects of education, policy and community intervention is needed to address this problem holistically.

Most Cited Articles

These articles show a significant increase in the consumption of ultra-processed foods across countries and age groups. This trend has major implications for the nutritional status and health of society, especially in the context of children and adolescents. Ultra-processed foods are often high in sugar, fat and salt, but low in important nutrients such as fiber, vitamins and minerals, which can contribute to obesity, type 2 diabetes and cardiovascular disease (Juil et al., 2022).

The increase in consumption of ultra-processed foods is also linked to changes in lifestyle and eating habits that rely more on fast and easy-to-prepare foods, which are often less healthy. Factors such as time constraints, busy schedules, and the perception of convenience associated with ultra-processed foods contribute to their popularity. These foods are designed to be easily accessible, affordable, and require minimal preparation, making them a convenient choice for individuals with hectic lifestyles (Mattar et al., 2022). The article by Wang et al (2021) and Martini et al (2021) reinforces the need for a more holistic and evidence-based approach to reducing consumption of ultra-processed foods and improving diet quality. This research also highlights the importance of effective policy interventions, such as better nutrition labeling, reducing advertising of unhealthy foods to children, and promoting balanced diets rich in whole, minimally processed foods. Public education and awareness efforts are also critical to changing eating behavior and improving long-term health.

Author's Country of Origin

Figure 3 highlights the leading role of the United States in this research area, along with strong contributions from a mix of high-income and upper-middle-income countries. The presence of Brazil, China, and Iran underscores the global interest in children's health related to sweet food consumption, transcending economic classifications.

10 Most Prolific Writers

The authors' contributions to the literature related to children's health and sweet food consumption highlight several researchers who have made a significant impact in this field. This equal contribution suggests a robust and collaborative effort among these researchers to advance the understanding of the implications of sweet food consumption on children's health. Matthiesen, J. leads with a prolific recent contribution, while the other nine authors demonstrate consistent and significant contributions, highlighting a strong collaborative network within this research domain.

Documents Based on Affiliation

These institutions have shown nearly equal research productivity, highlighting their collective effort and interest in advancing knowledge on children's health and the impacts of sweet food consumption. The data suggests a diverse and international collaboration among academic and research institutions in this field.

Document Based on Type

This distribution suggests that while original research articles dominate the field, there is also a recognition of the importance of synthesizing existing knowledge through review articles to provide comprehensive insights and guide future research directions.

Subject Based Documents

The literature on the consumption of sweet foods and children's health is predominantly dominated by the medical and nursing professions. This dominance underscores the critical focus on

this topic within medical practice and health research, highlighting the significant impact of sweet food consumption on children's overall health. In addition to the medical and nursing fields, other health professions such as psychology and dentistry also play crucial roles. These professions emphasize the importance of dental and oral health, which are directly affected by the consumption of sweet foods. This indicates a multi-faceted approach within health-related fields, recognizing the broader implications of sweet food consumption beyond general health to include psychological well-being and dental health.

Moreover, this topic also spans several non-health disciplines, demonstrating its interdisciplinary nature. Fields such as Agricultural and Biological Sciences, Environmental Science, Multidisciplinary Studies, Social Sciences, and Arts and Humanities are involved in this research area. This broad involvement from various disciplines reflects the extensive interest and the multifaceted impacts of sweet food consumption on children's health, encompassing environmental, social, and cultural dimensions. This diverse range of disciplines highlights the multifaceted nature of research on sweet food consumption and children's health, reflecting its broad relevance across various fields of study.

Document Based on Sponsor Source

This diverse support from various prominent institutions underscores the wide-ranging interest and recognition of the importance of studying the impact of sweet food consumption on children's health. The involvement of these institutions highlights a collaborative and multidisciplinary approach, emphasizing the significance of this research topic in both national and international contexts.

Author Keyword

The keyword analysis using VOSviewer revealed six clusters, highlighting key research areas in toddler nutrition and eating habits. Cluster 1 focuses on diet components like candy and caloric intake, while Cluster 2 addresses sugar consumption and health risks in children. Cluster 3 emphasizes nutrition studies, particularly cross-sectional studies and gender differences. Cluster 4 explores childhood obesity and fast food consumption. Cluster 5 centers on beverage and snack intake, with a specific focus on sugary drinks. Lastly, Cluster 6 involves experimental studies on sugar-sweetened beverages. This analysis underscores the critical focus on reducing sugary food and drink intake to combat obesity and improve children's health, necessitating continued multidisciplinary research and policy interventions.

Density Display Mode

The density display underscores a robust body of research linking sugary food and drink consumption to adverse health outcomes in children. The high frequency of related studies highlights the public health priority given to this issue. However, the fainter areas suggest opportunities for future research. By focusing more on the roles of caregivers, the economic dimensions of diet, the effects of the pandemic, and a deeper understanding of nutritional value, researchers can provide a more comprehensive view of the factors influencing children's dietary habits and health outcomes.

Future research could delve into several key areas, such as the role of caregivers and lifestyle factors in children's eating patterns. This is supported by findings in figure 9, which indicate that keywords like "lifestyle", "dietary sugars", "fast food", "caregiver", and "fruit consumption" are still underexplored. Subsequent studies could investigate how caregivers and home environments influence children's consumption of sugary foods, including the impact of family habits and access to healthy food.

Additionally, the fading prominence of the "economics" keyword highlights an opportunity to examine economic factors, such as family income and the cost of health foods. The presence of

keywords like “Covid-19” and “pandemics” also presents a chance to explore the long term effects of the covid-19 pandemic on children’s eating patterns and changes in dietary habits during and after lockdown periods.

This study has some limitations, including its inability to fully capture the rapid changes in trends related to sugary food and drink consumption and their impact on children’s health, as research trends may evolve over time.

CONCLUSION

In order to evaluate contributions and trends in research on children's health and sweet food consumption, several significant findings emerged. Analysis of publication contributions shows the dominance of high-income countries, but also highlights the important role of countries such as China, Brazil and Iran in contributing related publications. Individual researchers such as Matthiesen, J. as well as institutions such as the Universidade de Sao Paulo play a central role in generating knowledge in this domain.

The distribution of publications shows that the majority of research comes in the form of articles, but reviews also make an important contribution to establishing a comprehensive understanding of the impact of sweet food consumption on children's health. In addition, the role of institutions such as the National Institutes of Health (NIH) and the Robert Wood Johnson Foundation appears significant in supporting research in this area, underscoring the global commitment to understanding the health implications of children's diets related to sweet foods.

Keyword analysis highlights the research focus on the relationship between sweet food consumption and children's health, with particular emphasis on food types, eating behavior, and associated risk factors. Finally, the diversification in research topics reflects the complexity of this problem, spanning a wide range of disciplines from medicine to environmental science. Overall, these findings demonstrate the importance of a holistic approach in understanding the impact of sugar consumption on children's health, as well as the importance of cross-disciplinary collaboration in fostering relevant research and effective interventions.

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