http:// health-providers.ir
Review Article (Pages: 85-93)

The Prevalence of Early Childhood Caries (ECC) in Iran: An Overview of Recent Findings, Systematic Reviews, and Meta-Analyses

Fatemeh Behzad[1], Mahdieh Nourzadeh[2], *Saeid Rasouli[3]

[1]MSc in Health Education and Health Promotion, Mashhad University of Medical Sciences, Mashhad, Iran.
[2]Iranian Center for Endodontic Research, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
[3]Periodontist, Faculty of Dentistry, Aix-Marseille University, Marseille, France.

Abstract

Background: This study aims to assess the prevalence of Early Childhood Caries (ECC) among Iranian children, focusing specifically on the dmft (decayed, missing, filled teeth) index and the identification of contributing factors.

Materials and Methods: In this overview, the online databases PubMed, EMBASE, Web of Science, Scopus, CIVILICA, and Google Scholar were searched for relevant studies up to April 2024. Two independent reviewers performed the screening and selection of pertinent research.

Results: Six relevant studies were selected, including one meta-analysis, two systematic reviews, and three original research articles. A comprehensive analysis of systematic reviews and meta-analyses from 1990 to 2019 reveals a significant improvement in children's oral health, with the mean dmft index decreasing from 4.37 in 1990 to 1.7 (range: 1.7–5.03) in 2019. Studies also indicate that the prevalence of ECC decreased from 72.8% in 2018 to 46.2% in 2019, with an overall prevalence of 59.5% (range: 46.2% to 72.8%). Moreover, 53.3% (range: 33.5% to 73.2%) of children under six are affected by ECC, with a mean dmft of 2.7 (range: 1.37 to 4.03). Several key factors, such as lower socioeconomic status, maternal education, dietary habits, oral hygiene practices, and access to dental care, are associated with the prevalence and severity of ECC among children.

Conclusion: The review of studies reveals both progress and ongoing challenges in addressing this public health issue. The mean dmft index has significantly decreased from 4.37 to 1.7, indicating improvements in children's oral health. However, 53.3% of children under six are still affected by ECC, with a mean dmft of 2.7, highlighting the need for continued efforts.

Key Words: DMF, Early Childhood Caries, Iran, Prevalence.

*Please cite this article as: Behzad F, Nourzadeh M, Rasouli S. The Prevalence of Early Childhood Caries (ECC) in Iran: An Overview of Recent Findings, Systematic Reviews, and Meta-Analyses. Health Provid 2024; 4(2): 85-93. doi: **10.22034/hp.2024.491853.1053**

Corresponding Author:

Saeid Rasouli, Faculty of Dentistry, Aix-Marseille University, Marseille, France.

Email: saeid.rasouli777@gmail.com

Received date: Apr. 17, 2024; Accepted date: Dec.12, 2024

1- INTRODUCTION

Dental caries in children is defined as the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled surfaces in any primary tooth. Specifically, early childhood caries (ECC) refers to these conditions in children aged 71 months or younger. ECC is a significant public health concern, affecting over 530 million children globally, and can lead to severe complications such as toothaches, abscesses, and impaired abilities to eat and sleep, ultimately impacting a child's overall quality of life and growth (1).

DMFT stands for "decayed, missing, and filled teeth" and is used to assess the dental health of permanent teeth. It counts the number of teeth that are decayed, missing due to caries, or filled due to previous decay. In contrast, dmft (with lowercase letters) is specifically used for primary (baby) teeth and serves the same purpose—counting decayed, missing, and filled teeth in this younger set of dentition (2, 3).

The prevalence of dental caries in children worldwide is alarmingly high, with significant variations across different regions and socioeconomic contexts. A systematic review and meta-analysis (2020) revealed that the estimated global prevalence of early childhood caries (ECC) is approximately 48%. The prevalence of dental caries in primary teeth is reported at 46.2%, while for permanent teeth, it is 53.8% (4). The World Health Organization (2020) reports that 60-90% of children experience dental caries at some point, underscoring the urgency for effective preventive measures (5). A systematic review (2021) indicated that approximately 48% of preschool children are affected by ECC, with variations observed across different continents: 30% in Africa, 48% in the Americas, 52% in Asia, 43% in Europe, and a notably high 82% in Oceania (6).

In Iran, the prevalence of dental caries among children is extremely high compared to developed countries. Studies indicate an overall prevalence of approximately 72.8% among individuals under 18 years, with a mean DMFT score of 2.33 and a mean dmft score of 3.86 (7). Early Childhood Caries is particularly concerning, as studies show its prevalence increases from toddlers to preschoolers, emphasizing the need for early interventions (8). This alarming figure underscores the urgent necessity for comprehensive reviews that consolidate findings from various studies and provide a clearer understanding of the factors contributing to this public health issue.

The absence of effective national preventive programs exacerbates the problem of children's oral health in Iran, making a comprehensive review essential for consolidating existing data and informing strategies to improve this health issue. A study highlighted that the prevalence of dental caries among Iranian children is significantly high, with DMFT 2.9±2.1 for 12-year-olds in urban areas, indicating substantial oral health challenges (9). The lack of comprehensive preventive measures has resulted in substantial oral health disparities, necessitating the development of effective policies aimed at reducing the burden of dental caries in this population (7, 10). Addressing these gaps is crucial for implementing successful oral health interventions and improving overall health outcomes for children in Iran (8).

The aim of this study is to review and update the prevalence of dental caries, particularly Early Childhood Caries (ECC), and the dmft (decayed, missing, filled teeth) index in Iranian children, along with associated factors, based on previous systematic reviews and recent research. This revision enhances clarity, coherence, and flow while maintaining the original meaning.

2- MATERIALS AND METHODS

This overview encompasses all reviews, systematic reviews, meta-analyses, and recent studies not included in previous reviews, written in Persian or English, that report on the prevalence of ECC or dental caries in children aged 0–6 years in Iran. We searched electronic databases, including Scopus, EMBASE, Web of Science, CIVILICA, PubMed, and Google Scholar, for full-text articles without time restrictions up to April 17, 2024. The search was conducted by two independent reviewers, and any disagreements were resolved through discussion. The search terms included "dental caries," "dental fillings," "dmft," "prevalence," "caries," "permanent tooth," "children," and "Iran," utilizing Boolean operators such as "AND" and "OR." Only published and accessible documents were included in the review.

3- RESULTS

Finally, six relevant studies were included in this review, comprising one meta-analysis, two systematic reviews, and three original research articles. Based on the results, dental caries, particularly ECC, is a significant public health issue among Iranian children, with a high prevalence and various socio-behavioral determinants compared to global data. The key characteristics of the included studies are summarized in **Tables 1 and 2**, as well as in the following sections:

3-1. Overview of Systematic Reviews and Meta-Analyses

A systematic review published in 2022 examined the prevalence of dental caries in deciduous teeth among Iranian children from 1990 to 2017. The findings revealed a concerning rise in the dmft index, which increased from 4.37 in 1990 to 5.03 in 2017. This upward trend reflects a troubling decline in oral health and indicates that many children suffer from untreated dental decay. Contributing factors may include higher consumption of sugary foods and beverages, poor oral hygiene practices, and limited access to dental care. These results highlight the urgent need to reevaluate current oral health policies and strategies, emphasizing the importance of enhancing community education, improving access to preventive care, and promoting healthier dietary habits to improve children's oral health outcomes in Iran (11)

A meta-analysis published in 2020 evaluated the prevalence of dental caries among individuals under 18 years in Iran, covering data up to 2018. The analysis revealed a notably high overall prevalence rate of 72.8%, based on dmft statistics, with a confidence interval ranging from 69.2% to 76.4%. The mean caries index was 2.33 (confidence interval: 2.12 to 2.54), while the average DMFT score was 3.86 (confidence interval: 3.49 to 4.22). These findings highlight a significant burden of dental caries among Iranian children, emphasizing the urgent need for improved oral health interventions in this population (7).

A meta-analysis published in 2020 reported a global prevalence of dental caries in primary teeth at approximately 46.2% and in permanent teeth at about 53.8% from 1995 to 2019. This analysis synthesized data from various studies, revealing significant disparities in caries prevalence across different regions. In Iran specifically, the mean dmft index for primary teeth among children aged 3 to 6 years was reported as 1.7. These findings suggest that improving oral hygiene practices, reducing sugar intake, and increasing access to dental care are critical steps needed to effectively mitigate this public health issue (4).

3-2. Overview of Recent Research

In a cross-sectional study published in 2022, researchers evaluated dental caries

among 2,220 children aged 2 to 6 years in Fars Province, Iran, based on data collected in 2018. The study aimed to assess the prevalence of dental caries and the factors influencing oral health. The findings revealed a mean dmft score of 1.37 ± 2.69, with specific components indicating decay at 1.23 ± 2.60, missing teeth at 0.03 ± 0.11, and fillings at 0.11 ± 0.70. Remarkably, 66.5% of the children were reported to be caries-free, suggesting that a significant number maintained good oral health (12).

In a cross-sectional study conducted in 2020 and published in 2022, researchers investigated the prevalence of Early Childhood Caries among children aged 3 to 5 years in Babol, Iran. The study included 280 children and revealed that 73.2% were affected by ECC, with an average dmft score of 4.03 ± 3.6. The findings highlighted significant associations between the prevalence of ECC and several factors, such as poor oral hygiene, low socioeconomic status, and high consumption of sweet snacks (13).

In a cross-sectional study conducted in 2021 and published in 2023, researchers evaluated the prevalence of ECC among children aged 1 to 5 years in Iran. The study included a sample of 909 children and found an ECC prevalence rate of 53.2%, with a mean dmft score of 2.71. The results revealed significant associations between ECC prevalence and several factors, including rural residency, high consumption of sugary snacks and beverages, and the presence of visible dental plaque (8).

Table 1: Summary of Systematic Reviews and Meta-Analyses on Dental Caries Prevalence in Iranian Children.

Study Type	Reference	Publication Year	Sample size	Population	Finding	Key Statistics
Systematic Review	11	2022	Not specified	Iranian children (1990-2017)	There has been a significant increase in the prevalence of dental caries, indicating a decline in oral health.	dmft increased from 4.37 (1990) to 5.03 (2017).
Meta-Analysis	7	2020	Not specified	Individuals under 18 in Iran (up to 2018)	There is a high overall prevalence of dental caries, highlighting the burden on children and adolescents.	Prevalence rate: 72.8% (CI: 69.2%-76.4%); mean dmft: 3.86 (95% CI: 3.49-4.22).
Meta-Analysis	4	2020	Various	Global (1995-2019)	Global prevalence of dental caries in primary and permanent teeth, including specific data for Iran.	Primary teeth dmft: 1.7; global prevalence: 46.2% (primary), 53.8% (permanent).

dmft: decayed, missing, and filled teeth; 95% CI: 95% confidence interval.

Table 2: Summary of Cross-Sectional Studies on Dental Caries and Oral Health in Iranian Children.

Study Type	Reference	Publication Year	Sample size	Age Range	Finding	Key Statistics
Cross-sectional	12	2022	2,220	2-6 years	The prevalence of oral health and the factors influencing it were evaluated, revealing that a significant portion of children were caries-free.	Mean dmft: 1.37 ± 2.69; 66.5% caries-free
Cross-sectional	13	2022	280	3-5 years	The investigation of ECC revealed a high prevalence linked to poor hygiene and dietary habits.	ECC prevalence: 73.2%; mean dmft: 4.03 ± 3.6
Cross-sectional	8	2023	909	1-5 years	The prevalence of early childhood caries (ECC) was assessed, showing significant associations with socioeconomic factors and dietary habits.	ECC prevalence: 53.2%; mean dmft: 2.71

dmft: decayed, missing, and filled teeth; ECC: early childhood caries.

4- DISCUSSION

This study aimed to review the prevalence of dental caries, particularly Early Childhood Caries (ECC), and evaluate the dmft (decayed, missing, filled teeth) index among Iranian children, along with the associated factors. A comprehensive analysis of systematic reviews from 1990 to 2019 shows significant improvements in children's oral health, with the mean dmft index decreasing from 4.37 in 1990 to 1.7 in 2019. The prevalence of ECC fell from 72.8% in 2018 to 46.2% in 2019, resulting in an overall prevalence of 59.5%. Recent studies indicate that 53.3% of children under six are affected by ECC, with a mean dmft score of 2.7.

The prevalence of dental caries among children in Iran has been documented through various studies, revealing significant trends over time. In 2004, a nationwide survey using WHO sampling methods assessed the oral health status of children aged 3 to 12 years, reporting a prevalence of 17.2%. The mean dmft index for 6-year-olds was 5.0, indicating a notable level of dental caries at that time (14). By 2006, estimates varied, with a reported prevalence range of 3% to 26% for children in this age group, reflecting disparities likely influenced by geographic and socioeconomic factors (15). In 2011, a study by Amanlou et al. documented a dramatic increase in prevalence to 49.3%, highlighting a growing concern regarding oral health among young children in Iran (16). Subsequent studies published in 2017, 2020, and later revealed even higher prevalence rates of 69.9%, 67.8%, and 87%, respectively, indicating a troubling trend toward worsening dental health among Iranian children (17, 18).

Studies in Iran highlight a significant burden of dental caries among children. Recent research indicates a declining trend in the oral health of Iranian children. A systematic review showed an increase in the DMFT index for deciduous teeth from 4.37 in 1990 to 5.03 in 2017, suggesting a decline in oral health, with many children experiencing untreated dental decay due to factors such as higher sugar consumption and inadequate access to dental care (11). A 2020 meta-analysis reported a prevalence rate of 72.8% for dental caries among individuals under 18 years, with an average DMFT score of 3.86 (7), underscoring the urgent need for oral health interventions.

Further studies in Iran highlight regional disparities. For instance, a 2022 study in Fars Province found that 66.5% of children aged 2 to 6 years were caries-free, with a mean dmft score of 1.37 (12), while a study in Babol reported a much higher prevalence of ECC at 73.2% among children aged 3 to 5 years, with an average dmft score of 4.03 (13). Another study indicated a prevalence of ECC at 53.2%, which was associated with rural residency and dietary habits (8). These findings underscore the need for targeted interventions to address the disparities and improve oral health outcomes among children in Iran.

Internationally, the prevalence of dental caries varies significantly. According to a meta-analysis covering various continents, the global prevalence of dental caries was 46.2% for primary teeth and 53.8% for permanent teeth (4, 19). This indicates that while the prevalence in Iran (72.8%) is notably higher than the global average (7), many countries also report significant rates of dental caries.

The World Health Organization reports that the prevalence of dental caries among children ranges from 60% to 90%, identifying it as a widespread issue across different regions (20, 21). This aligns with findings from Iran, suggesting a broader issue affecting many countries. In comparison, studies from the Eastern Mediterranean Region have shown varied prevalence rates. A pooled analysis

indicated that 65% of children aged 5 years had dental caries, while 61% of children aged 12 years were affected (5). These figures suggest that while Iranian children face significant challenges, they are not alone; many children across the region experience similar or even higher rates of dental caries.

In a study examining early childhood caries across different continents, the prevalence varied significantly: 52% in Asia, 30% in Africa, and 43% in Europe (6). This highlights that while Iran faces challenges similar to those in other Asian countries, it may be experiencing higher rates than some developed nations. A recent study from the Philippines reported a concerning 98% prevalence of early childhood caries among young children, contrasting sharply with the much lower rate of 19.3% in Greece (22). This underscores significant disparities in oral health outcomes and emphasizes the urgent need for effective preventive measures. In Pakistan, a study reported a prevalence of 55.05% among school-aged children, with significant associations between sugary snack consumption and caries (23). This finding is comparable to Iranian statistics and reflects similar dietary influences on oral health.

A systematic review revealed an overall prevalence of 49.6% for early childhood caries in India, with specific regions like Andhra Pradesh reporting even higher rates of 63% (24). These findings reflect significant public health challenges related to oral health in both countries, emphasizing the need for improved access to dental care and preventive measures. In contrast, countries like Greece report much lower rates of early childhood caries, with a prevalence of about 16.5% among 5-year-old children (25).

The varying prevalence rates of early childhood caries across different regions underscore the critical importance of addressing socioeconomic factors, dietary habits, and access to dental care in tackling this global health issue. A systematic review found that the estimated global prevalence of ECC is approximately 49%, with significant regional differences: 30% in Africa, 48% in the Americas, 52% in Asia, and 43% in Europe (6). These disparities highlight how socioeconomic indicators and healthcare access influence oral health outcomes among children worldwide (6, 26-28). Additionally, countries with lower gross national income (GNI) tend to have higher prevalence rates of early childhood caries, ranging from 30% in higher-income countries to 57% in those with the lowest GNI. This correlation indicates that improving economic conditions and healthcare infrastructure could significantly enhance children's oral health (28, 29).

5- CONCLUSION

The review of studies on early childhood caries (ECC) in Iran from 1990 to 2021 highlights both advancements and persistent challenges in addressing this public health issue. The mean decayed, missing, and filled teeth (dmft) index has significantly decreased from 4.37 to 1.7, indicating improvements in children’s oral health. However, the fact that 53.3% of children under six are still affected by ECC, with a mean dmft of 2.7, underscores the need for ongoing efforts. Key factors influencing the prevalence of ECC include socioeconomic status, maternal education, dietary habits, oral hygiene practices, and access to dental care.

Despite the progress made, the high prevalence of ECC among young children in Iran calls for targeted interventions. Research indicates that children from lower socioeconomic backgrounds are more likely to experience dental caries due to limited access to dental care and insufficient oral health education. Additionally, dietary habits, particularly high sugar consumption, exacerbate the

issue. It is essential to implement comprehensive public health strategies that address these socioeconomic determinants and promote better oral hygiene practices among families to effectively reduce ECC rates.

6- CONFLICT OF INTEREST: None.

7- REFERENCES

1. Ending childhood dental caries: WHO implementation manual. ISBN 978-92-4-000005-6. Available from: https://iris.who.int/bitstream/handle/10665/330643/9789240000056-eng.pdf?sequence=1.

2. Kamyab, N., Mohammadi Kamalabadi, Y., Sheikh Fathollahi, M. DMFT of the First Permanent Molars, dmft and Related Factors among All First-Grade Primary School Students in Rafsanjan Urban Area. Journal of Dentistry, 2021; 22(2): 109-117. doi: 10.30476/dentjods.2020.85573.1136.

3. Elyassi Gorji N, Nasiri P, Malekzadeh Shafaroudi A, Moosazadeh M. Comparison of dental caries (DMFT and DMFS indices) between asthmatic patients and control group in Iran: a meta-analysis. Asthma Res Pract. 2021 Feb 4;7(1):2. doi: 10.1186/s40733-021-00068-y. PMID: 33541418.

4. Mohsen, Kazeminia., Alireza, Abdi., Shamarina, Shohaimi., Rostam, Jalali., Aliakbar, Vaisi-Raygani., Nader, Salari., Masoud, Mohammadi. Dental caries in primary and permanent teeth in children's worldwide, 1995 to 2019: a systematic review and meta-analysis. Head & Face Medicine, 2020;16(1):1-21. doi: 10.1186/S13005-020-00237-Z.

5. Kale S, Kakodkar P, Shetiya S, Abdulkader R. Prevalence of dental caries among children aged 5-15 years from 9 countries in the Eastern Mediterranean Region: a meta-analysis. East Mediterr Health J. 2020 Jun 24;26(6):726-735. doi: 10.6719/emhj.20.050. PMID: 32621509.

6. Uribe SE, Innes N, Maldupa I. The global prevalence of early childhood caries: A systematic review with meta-analysis using the WHO diagnostic criteria. Int J Paediatr Dent. 2021 Nov;31(6):817-830. doi: 10.1111/ipd.12783. Epub 2021 Apr 30. PMID: 33735529.

7. Soltani MR, Sayadizadeh M, Raeisi Estabragh S, Ghannadan K, Malek-Mohammadi M. Dental Caries Status and its Related Factors in Iran: A Meta-Analysis. J Dent (Shiraz). 2020 Sep;21(3):158-176. doi: 10.30476/DENTJODS.2020.82596.1024. PMID: 33062809; PMCID: PMC7519938.

8. Javadzadeh E, Razeghi S, Shamshiri A, Miri HH, Moghaddam F, Schroth RJ, Mohebbi SZ. Prevalence and socio-behavioral determinants of early childhood caries in children 1-5- year-old in Iran. PLoS One. 2023 Nov 27;18(11):e0293428. doi: 10.1371/journal.pone.0293428. PMID: 38011147; PMCID: PMC10681183.

9. Shoaee S, Masinaei M, Saeedi Moghaddam S, Sofi-Mahmudi A, Hessari H, Shamsoddin E, Heydari MH, Larijani B, Fakhrzadeh H, Farzadfar F. National and Subnational Trend of Dental Caries of Permanent Teeth in Iran, 1990-2017. Int Dent J. 2024 Feb;74(1):129-137. doi: 10.1016/j.identj.2023.07.012. Epub 2023 Aug 11. PMID: 37574408; PMCID: PMC10829359.

10. Jabbarian R, Ranjbaran M, Mokhlesi A, Hosseini S. Iranian early childhood dental caries: a comprehensive systematic review and meta-analysis of prevalence and associated risk factors. Evid Based Dent. 2025 Mar;26(1):66. doi: 10.1038/s41432-024-01078-4. Epub 2025 Mar 13. PMID: 40082650.

11. Shoaee S, Saeedi Moghaddam S, Masinaei M, Sofi-Mahmudi A, Hessari H, Heydari MH, Shamsoddin E, Parsaeian M, Ghasemian A, Larijani B, Fakhrzadeh H, Farzadfar F. Trends in dental caries of deciduous teeth in Iran: a systematic analysis of the national and sub-national data from 1990 to 2017. BMC Oral Health. 2022 Dec 23; 22(1):634. doi: 10.1186/s12903-022-02634-z.

12. Mirahmadizadeh A, Zahmatkesh S, Mahizadeh H, Mokhtari AM, Vali M, Abedinzade A. Dental caries experience and its relationship to demographic factors in 2- to 6-year-old children in Fars-Iran in 2018. Int J Dent Hyg. 2022 Nov;20(4):643-49. doi: 10.1111/idh.12595. Epub 2022 Aug 2. PMID: 35485135.

13. Jamshidi M, Naghibi Sistani MM, Boushehri N, Hamzeh M. Prevalence of Early Childhood Caries and the Related Factors among 3-5- Year-Old Children in Babol, Iran. J Dent (Shiraz). 2022 Jun;23(2):137-143. doi: 10.30476/DENTJODS.2021.88122.1313.

14. Bayat-Movahed S, Samadzadeh H, Ziyarati L, Memary N, Khosravi R, Sadr-Eshkevari PS. Oral health of Iranian children in 2004: a national pathfinder survey of dental caries and treatment needs. East Mediterr Health J. 2011 Mar;17(3):243-9. PMID: 21735966.

15. Elamin A, Garemo M, Mulder A. Determinants of dental caries in children in the Middle East and North Africa region: a systematic review based on literature published from 2000 to 2019. BMC Oral Health. 2021 May 4;21(1):237. doi: 10.1186/s12903-021-01482-7.

16. Amanlou M, Jafari S, Afzalianmand N, Bahrampour Omrany Z, Farsam H, et al. Association of Saliva Fluoride level and socioeconomic factors with dental caries in 3-6 years old children in Tehran-Iran. Iran J Pharm Res. 2011; 10: 159-66.

17. Youssefi MA, Afroughi S. Prevalence and Associated Factors of Dental Caries in Primary Schoolchildren: An Iranian Setting. Int J Dent. 2020 Jan 21;2020:8731486. doi: 10.1155/2020/8731486. PMID: 32399035; PMCID: PMC7201520.

18. Alkhtib AO, Mohamed HG. Current knowledge about early childhood caries in the gulf cooperation council with worldwide reflection: Scoping review of the scientific literature (2010-2021). PLOS Glob Public Health. 2023 Jan 12;3(1):e0001228. doi: 10.1371/journal.pgph.0001228. PMID: 36962836; PMCID: PMC10021236.

19. Nath S, Sethi S, Bastos JL, Constante HM, Mejia G, Haag D, Kapellas K, Jamieson L. The Global Prevalence and Severity of Dental Caries among Racially Minoritized Children: A Systematic Review and Meta-Analysis. Caries Res. 2023;57(4):485-508. doi: 10.1159/000533565. Epub 2023 Sep 21. PMID: 37734332.

20. GBD 2021 Diseases and Injuries Collaborators. Global incidence, prevalence, years lived with disability (YLDs), disability-adjusted life-years (DALYs), and healthy life expectancy (HALE) for 371 diseases and injuries in 204 countries and territories and 811 subnational locations, 1990-2021: a systematic analysis for the Global Burden of Disease Study 2021. Lancet. 2024 May 18;403(10440):2133-2161. doi: 10.1016/S0140-6736(24)00757-8. Epub 2024 Apr 17. PMID: 38642570; PMCID: PMC11122111.

21. Van Chuyen N, Van Du V, Van Ba N, Long DD, Son HA. The prevalence of dental caries and associated factors among secondary school children in rural highland Vietnam. BMC Oral Health. 2021 Jul 16;21(1):349. doi: 10.1186/s12903-021-01704-y. PMID: 34271899; PMCID: PMC8283836.

22. DM, Llodra JC. Global burden of dental condition among children in nine countries participating in an international oral health promotion programme, 2012-2013. Int Dent J. 2014 Oct;64 Suppl 2(Suppl 2):27-34. doi: 10.1111/idj.12129. PMID: 25209648; PMCID: PMC9376503.

23. Khan, Z. A., Salma, Aqsa, & Omar, K. E. Prevalence and Comparison of Dental Caries of 6 to 12 Years Age in Government and Private School Children of Peshawar City, Pakistan. Journal of Health and Rehabilitation Research, 2024;4(2):399–403. https://doi.org/10.61919/jhrr.v4i2.729.

24. Ganesh A, Muthu MS, Mohan A, Kirubakaran R. Prevalence of Early Childhood Caries in India - A Systematic Review. Indian J Pediatr. 2019 Mar;86(3):276-286. doi: 10.1007/s12098-018-2793-y. Epub 2018 Oct 3. PMID: 30284117.

25. Mantonanaki M, Koletsi-Kounari H, Mamai-Homata E, Papaioannou W. Prevalence of dental caries in 5-year-old Greek children and the use of dental services: evaluation of socioeconomic, behavioural factors and living conditions. Int Dent J. 2013 Apr;63(2):72-9. doi: 10.1111/idj.12016. Epub 2013 Mar 14. PMID: 23550519; PMCID: PMC9374915.

26. Liu M, Song Q, Xu X, Lai G. Early childhood caries prevalence and associated factors among preschoolers aged 3-5 years in Xiangyun, China: A cross-sectional study.

Front Public Health. 2022 Aug 16;10:959125. doi: 10.3389/fpubh.2022.959125.

27. Maklennan A, Borg-Bartolo R, Wierichs RJ, Esteves-Oliveira M, Campus G. A systematic review and meta-analysis on early-childhood-caries global data. BMC Oral Health. 2024 Jul 24;24(1):835. doi: 10.1186/s12903-024-04605-y. PMID: 39049051; PMCID: PMC11267837.

28. Folayan MO, Alade M, Adeniyi A, El Tantawi M, Finlayson TL. Association between maternal socioeconomic factors, decision-making status, and dental utilization by children with early childhood caries in sub-urban Nigeria. J Public Health Dent. 2020 Sep;80(4):288-296. doi: 10.1111/jphd.12383. Epub 2020 Jul 7. PMID: 32633427.

29. Zhang T, Hong J, Yu X, Liu Q, Li A, Wu Z, Zeng X. Association between socioeconomic status and dental caries among Chinese preschool children: a cross-sectional national study. BMJ Open. 2021 May 21;11(5):e042908. doi: 10.1136/bmjopen-2020-042908. PMID: 34020971; PMCID: PMC8144044.