

A Systematic Review to Assess Prevalence of Toothache and Associated Factors in Children and Adolescents

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ABSTRACT

Objectives: This systematic review aimed to estimate the combined prevalence of toothache among children and adolescents and to examine its association with sociodemographic factors and history of dental caries.

Materials and Methods: searches were conducted across six primary and three grey literature databases. Observational studies evaluating toothache prevalence and associated factors were included. Study quality was assessed using the Fowkes and Fulton guidelines.

Results: Seventy-one studies met the inclusion criteria, with thirty-two exhibiting high methodological quality and low risk of bias. The pooled prevalence of toothache among children and adolescents was 36.2% (95% CI: 33.0-39.42; I2: 99.72%; $P < 0.001$). Females (OR: 1.17; 95% CI: 1.08-1.26; I2: 91%; $P < 0.001$) and individuals with caregivers having ≤ 8 years of education (OR: 1.42; 95% CI: 1.30-1.56; I2: 77%; $P < 0.001$) were more likely to report toothache. Experience with dental caries increased the likelihood of reporting toothache by 3.49 times (95% CI: 2.70-4.51; I2: 92%; $P < 0.001$). The overall evidence certainty was rated as very low.

Conclusions: The pooled prevalence of toothache in children and adolescents is notably high. Sociodemographic factors, such as gender and caregiver education level, along with prior dental caries experience, were significantly associated with toothache prevalence.

Clinical Relevance: Toothache remains a widespread issue globally. Understanding its associated factors is critical to reducing its incidence among children and adolescents.

Introduction

Pain is a multifaceted experience, and in children, its perception can vary widely based on cognitive development, emotional state, maturity, and situational factors [1, 2]. Toothache, defined as pain originating from the tooth and its supporting structures [3], is recognized as one of the most common forms of orofacial pain [4].

Untreated dental caries are widely identified as the primary cause of toothache [5, 6, 7]. However, other oral health issues, such as traumatic dental injuries [8], molar-incisor hypomineralization [9], dental eruption, exfoliation [10], and oral ulcers [11], are also linked to reports of toothache in children and adolescents.

Toothache is further associated with social determinants [12], with higher prevalence among children and adolescents from socioeconomically disadvantaged families and vulnerable groups [6, 7, 13]. Additionally, lower educational levels of parents or caregivers are linked to a higher frequency of toothache in children [7, 14, 15]. Although demographic factors, like gender, have shown some association with toothache, with girls often reporting more pain than boys [14, 16], several studies have not found a clear correlation between gender and toothache [7, 17–21].

Toothache impacts oral health–related quality of life in children and adolescents, often resulting in sleep disturbances, reduced school performance, school absenteeism, difficulty with chewing, weight loss, and food avoidance [13, 18, 23]. Toothache can also affect broader societal aspects, causing parental work absences and increasing treatment costs [13, 18, 24]. Parents frequently report feeling distressed, stressed, or even guilty regarding their child’s discomfort and clinical condition [25].

Prevalence rates of toothache among children and adolescents have been reported in population-based studies, ranging from 10.7% [26] to 37.0% [27], with higher rates noted in studies using localized samples. A previous systematic review [28] indicated a pooled prevalence of 32.7%, yet it had limitations due to the exclusion of non-English studies and grey literature, potentially causing publication bias [29]. Additionally, the review did not assess toothache-related factors such as sociodemographic characteristics or oral health conditions.

Gathering comprehensive data on populations experiencing specific conditions helps policymakers and healthcare professionals better address these issues [30]. Although numerous primary studies have examined toothache prevalence and associated factors in children and adolescents, no systematic review has, to date, synthesized or critically evaluated this data to explore potential contributing factors.

Methods

This systematic review and meta-analysis was prepared in alignment with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

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guidelines [31]. The study protocol, based on PRISMA-P [32], was registered in the International Prospective Register of Systematic Reviews (PROSPERO) under registration number CRD42018110425 [33].

Search Strategies

Search strategies (Appendix A) were developed for six main databases: Medline/PubMed, Scopus, Web of Science, EMBASE, Latin American and Caribbean Health Sciences (LILACS), and CENTRAL. Additionally, grey literature was explored through Google Scholar, Open Grey, and ProQuest. All searches were conducted and updated as of February 2021, with relevant studies further identified by screening the reference lists of included articles. Duplicate references were removed using Mendeley Desktop (v. 1.16.1, ©2008–2016 Mendeley Ltd., Elsevier Inc., NY, USA).

Eligibility Criteria

The POS (Population, Outcomes, Studies) framework was used to define the study's main question: P – children and adolescents, O – prevalence of toothache, and S – observational studies. No restrictions were applied regarding publication date or language.

Exclusion criteria included studies that: (1) focused only on adults; (2) did not feature toothache as a primary outcome or predictor; (3) lacked clear reporting of toothache prevalence; (4) broadly assessed orofacial or oral pain rather than toothache specifically; (5) were reviews, case reports, protocols, or non-primary sources; and (6) did not provide accessible full texts after attempts to contact authors.

All included studies were initially screened to confirm the prevalence of toothache, and subsequently reassessed to identify if related factors (gender, caregiver education level, dental caries) were examined.

Study Selection and Data Collection

A two-step selection process identified eligible studies. First, two reviewers (P.S.S. and J.C.B.) independently screened titles and abstracts using Rayyan software [34]. In the second phase, eligibility criteria were applied to full-text articles. Disagreements were resolved by a third reviewer (B.S.M.).

Data collection captured details such as authors, publication year, country, sample size, age range, diagnostic criteria, study timeframe for assessing toothache, and prevalence data. When necessary, authors were contacted via email for clarifications and additional data.

Methodological Quality Assessment

Two reviewers (P.S.S. and J.C.B.) independently assessed study quality using the Fowkes and Fulton Critical Appraisal Checklist [35]. This checklist evaluates cross-sectional, case-control, and cohort studies on design, sample quality, controls, measurement reliability, outcome accuracy, and biases. Each category was assessed as having “major problems” (++), “minor problems” (+), or “no problems” (0). If a question was inapplicable, it was marked “NA.”

A summary of methodological quality was created, including three questions to identify the presence of potential bias, confounding variables, or chance effects in study outcomes. If any of these questions were answered “yes,” the study was considered at high risk of bias.

Results

Selection Process and Eligibility

The initial search identified a total of 6,590 references from various databases. Following the removal of duplicates, 4,114 articles were subjected to the first screening phase. From there, 110 full-text articles underwent eligibility assessment, leading to the exclusion of 39 studies. This resulted in 71 studies being included in the qualitative synthesis, with 70 deemed suitable.

Methodological Quality Assessment

The methodological quality evaluation revealed that 32 studies were deemed high quality with a low risk of bias, due to clear definitions of sample framing, recruitment methods, and sufficient sample sizes. In contrast, the remaining 39 studies exhibited notable biases, mainly due to issues in sample recruitment and descriptions of sample sizes or the use of convenience sampling, which increased the likelihood of chance findings. Quality assessments focused on measurement and outcome reliability, noting that studies using clinical records or ambiguous toothache reporting methods had directional bias.

Sociodemographic Influences on Toothache Prevalence

Sociodemographic factors were shown to significantly influence toothache prevalence. Twelve studies examined the relationship between caregiver education and toothache, finding that children with caregivers who had eight or fewer years of schooling were 42% more likely to experience toothache than those whose caregivers had more than eight years of education. Additionally, 19 studies investigated the link between dental caries and toothache, demonstrating that children with dental caries had a 3.49 times higher likelihood of experiencing toothache compared to those without. Age-related differences were also observed; for example, preschool children (ages 0–5) had a lifetime prevalence of 27.7% and a 6-month prevalence of 14.6%, while school-aged children (ages 6–9) had a pooled lifetime prevalence of 52%, a 6-month prevalence of 33.1%, and a past-month prevalence of 26.1%.

The findings indicate substantial variability in toothache prevalence among children and adolescents, influenced by gender, caregiver education, dental caries, and age. This analysis highlights the importance of implementing targeted dental health interventions that account for sociodemographic and clinical factors to effectively reduce the prevalence of toothache in young populations.

The pooled prevalence of toothache among children and adolescents was 36.2% (95% CI: 33.0–39.42; I²: 99.72%; P < 0.001). Females (OR: 1.17; 95% CI: 1.08–1.26; I²: 91%; P < 0.001) and individuals with caregivers having ≤8 years of education (OR: 1.42; 95% CI: 1.30–1.56; I²: 77%; P < 0.001) were more likely to report toothache.

Experience with dental caries increased the likelihood of reporting toothache by 3.49 times (95% CI: 2.70–4.51; I2: 92%; P < 0.001). The overall evidence certainty was rated as very low.

Table 1 Summary of descriptive characteristics of included studies

Study characteristics	Sample characteristics				Findings	
	Author (year); country	Size (N)	Age (years)	Diagnostic criteria	Period considered	Dental pain (n)
Shepherd, Nadanovsky, Sheiham (1999); England	589	8	Self-report	Lifetime Past month	280 45	47.5 7.6
Honkala et al. (2001); Finland ^a	2422 3338 8928 9556 11,105	12, 14, 16, and 18	Self-report	Past 2 years	751 834 2500 2771 4109	31.0 25.0 28.0 29.0 37.0
Milsom, Tickle, Blinkhorn (2002); UK	677	Unclear	Clinical records	Lifetime	324	47.8
Stewart, Sabbah, Owusu-Agyakwa (2002); Saudi Arabia	309	Not clear reported	Self-report	Lifetime Past month	208 122	67.3 39.5
Barrêto, Ferreira, Pordeus (2004); Brazil	401	8 to 9	Visual Analogue Scale of Faces	Past month Lifetime	94 (PM) 276 (LT)	15.6 (PM) 45.9 (LT)
Nomura, Bastos, Peres (2004); Brazil	169	12 and 13	Self-report	Past year	57	33.7
Kiwanuka, Åstrøm (2005); Uganda	614	10 to 14	Self-report	Past year	284	47.6

Ratnayake, Ekanayake (2005); Sri Lanka	576	8	Parental and Self-report	Past 2 months Lifetime	178 (PR;2 M) 139 (SR;2 M) 301 (PR;LT) 278 (SR;LT)	30.9 (PR;2 M) 24.1 (SR;2 M) 52.3 (PR;LT) 48.3 (SR;LT)
Vargas et al. (2005); USA	2411	Not clear reported	Parental report	Lifetime	284	11.8
Goes et al. (2007); Brazil	1052	14 to 15	Self-report	Past 6 months	353	33.6
Pau, Baxevanos, Croucher (2007); Greece	187	12	Self-report	Past month	70	37.4
Bastos et al. (2008); Brazil	339	6 and 12	Self-report	Lifetime (6/12y) Past Month (12y)	132 (LT/6y) 214 (LT/12y) 37 (PM/12y)	39.0 (LT/6y) 63.0 (LT/12y) 11.0 (PM/12y)
Moura-Leite et al. (2008); Brazil	549	5	Parental report	Lifetime Past 2 months	137 59	25.0 10.7
Pau et al. (2008); Pakistan	500	11 to 14	Self-report (adapted from DePaQ)	Past month	152	30.4
Rihs et al. (2008); Brazil	413	12	Self-report	Past months	94	22.8
Mashoto et al. (2009); Tanzania	1745	10 to 19	Self-report	Past 3 months	527	36.2
Oliveira et al. (2009); Brazil	1851	1.5 to 4	Parental report	Lifetime	170	9.2

Lewis, Stout (2010); USA	86,730	1 to 17	Parental report	Past 6 months	9280	10.7
Peres et al. (2010); Brazil	5815	12 and 15	Self-report	Past 6 months	1485	25.6
Carvalho, Rebelo, Vettore (2011); Brazil	300	12 to 14	Self-report	Past 3 months	101	33.7
Dandi, Rao, Margabandhu (2011); India	2203	12	Dental Pain Assessment Questionnaire (DePaQ)	Past month	1573	77.4
Du et al. (2011); Germany	14,836	3 to 17	Parental and Self-report	Past 3 Months	1571	10.6
Knackfuss, Costenaro, Zanatta (2011); Brazil	782	14 to 17	Self-report	Past 6 months	400	63.2
Moura-Leite et al. (2011); Brazil	549	5	Parental report	Lifetime Past 4 months	137 84	25.0 15.3
Oliveira, Biazevic, Michel-Crosato (2011); Brazil	15,971	15 to 19	Self-report	Past 6 months	5654	35.4
Boeira et al. (2012); Brazil	1115	5	Parental report	Past 6 months Past month	184 81	16.5 7.3
Freire et al. (2012); Brazil	54,985	11 to 19	Self-report	Past 6 months	9787	17.8
Maro et al. (2012); Tanzania	213	6 to 13	Self-report	Lifetime	120	59.1
Tove et al. (2012); Ivory Coast	630	6 to 15	Faces Pain Scale	Not reported	480	76.2

Colares et al. (2013); Brazil	970	5 to 12	Parental report	Lifetime	436	44.9
Lacerda, Bem Pereira, Traebert (2013); Brazil ^b	385	7 and 8	Self-report	Past month	122	31.7
Santiago et al. (2013); Brazil ^c	375	15 to 19	Self-report	Past 6 months	106	28.3
Ferraz et al. (2014); Brazil	540	2 to 5	Parental report	Lifetime	134	24.8
Kumar, Acharya, Pentapati (2014); India	306	10 to 15	Child Dental Pain Questionnaire (Child-DPQ)	Lifetime	107	35.0
Noro et al. (2014); Brazil	688	11 to 15	Self-report	Past 6 months	219	31.8
Ortiz et al. (2014); Brazil	534	0 to 5	Parental report	Lifetime	54	10.1
Clementino et al. (2015); Brazil	843	3 to 5	Parental report	Lifetime	79	9.4
Ferreira-Júnior et al. (2015); Brazil	7280	5	Parental report	Past 6 months	1602	22.0
Lemes et al. (2015); Brazil	385	2 to 4	Parental report	Lifetime	38	9.9
Rosa et al. (2015); Brazil	1121	15 to 19	Self-report	Past 6 months	334	29.8
Saheer et al.; (2015); India	1237	10 to 15	Child Dental Pain Questionnaire (C-DPQ)	Past 3 months Past month	194 (3 M) 38 (PM)	15.6 (3 M) 3.1 (PM)
Schuch et al. (2015); Brazil	1199	8 to 12	Self-report	Past 6 months	428	35.7

Masood et al. (2016); Pakistan	440	11 to 14	Self-report	Past 6 months	128	29.1
Shekhawat, Chauhan, Nordstroem (2016); India	200	12 to 15	Self-report	Past 6 months	154	77.0
Adeniyi, Odusanya (2017); Nigeria	414	8 to 12	Self-report	Past month Past 3 months	103 (PM) 254 (3 M)	24.9 (PM) 61.4 (3 M)
Bansal et al. (2017), India	60	2 to 5	Dental Discomfort Questionnaire (DDQ)	Lifetime	30	50.0
Ghorbani et al. (2017); Australia ^d	9875	4 to 17	Parental report	Lifetime	2297	23.2
Guskuma et al. (2017); Brazil	1233	12	Self-report	Past 6 months	206	16.7
Muller et al. (2017); Brazil ^e	574	0 to 12	Clinical records	Not reported	140	24.4
Fernandes et al. (2018); Brazil	318	1 to 3	Brazilian Dental Discomfort Questionnaire (DDQ-B)	Lifetime	128	40.3
Gomes et al. (2018); Brazil	756	5	Parental report	Lifetime	180	23.8
Misrohmasari et al. (2018); Indonesia	2377	12 to 14	Parental report	Past month	331	13.9
Shabbir, Niazi, Kahn (2018); Pakistan	440	11 to 14	Self-report	Past 6 months	128	29.1
Alsubaie (2019); Saudi Arabia	725	7 to 12	Self-report	Past 6 months	250	34.5

Freire et al. (2019a); Brazil	34,776	11 to 19	Self-report	Past 6 months	7581	21.8
Freire et al. (2019b); Brazil ^f	46,482	11 to 19	Self-report	Past 6 months	9482	20.4
Miao et al. (2019); Taiwan	7022	11 to 18	Self-report	Past Year	2703	38.5
Paulino et al. (2019); Brazil	252	6 to 16	Parental report	Not clear reported	105	41.7
Rogers et al. (2019); West Bank	177	4 to 18	Wong-Baker Faces	Not clear reported	80	45
Santos et al. (2019); Brazil	1589	8 to 10	Self-report	Past month	819	51.5
Aillón et al. (2020); Brazil	485	3 to 4	Brazilian Dental Discomfort Questionnaire (DDQ-B)	Lifetime	56	11.8
Bakar et al. (2020); Indonesia	12,595	2 to 15	Parental report	Past month	1959	15.5
Felipak et al. (2020); Brazil	375	4 to 5	Brazilian Dental Discomfort Questionnaire (DDQ-B)	Lifetime	260	70.3
Gomes et al. (2020); Brazil	833	3 to 5	Parental report	Lifetime	262	31.5
Kalantary et al. (2020); Iran	465	5 to 9	Child Dental Pain Questionnaire (Child-DPQ)	Past month	440	94.6
Lamenha-Lins et al. (2020); Brazil	230	8 to 10	Self-report	Lifetime	184	80.0

Massoni et al. (2020); Brazil	458	10 to 19	Self-report	Lifetime Past 6 months	301 131	65.7 25.8
Nazir et al. (2020); Saudi Arabia	586	Not clear reported	Self-report	Past month	247	42.1
Pranati, Jeevanandan (2020); India	93	1 to 4	Dental Discomfort Questionnaire (DDQ)	Lifetime	69	74.2
Rauber et al. (2020); Brazil	448	7 to 14	Self-report	Past Year	225	50.1
Shekhawat, Samuel, Chauhan (2021); India	288	Not clear reported	Self-report	Past 6 months	93	32.3

1. *PM* past month, *2 M* past 2 months, *3 M* past 3 months, *LT* lifetime, *SR* self-report, *PR* parental report
2. ^aThe survey was conducted at 5 different years (1977, 1985, 1991, 1995, and 1997); therefore, there are 5 different sample sizes
3. ^bOnly the data related to spontaneous pain were collected
4. ^cOnly the data related to adolescents (15 to 19 years-old) were collected
5. ^dOnly baseline data were collected, as follow-up data included adults
6. ^eOnly the data related to spontaneous pain were collected
7. ^fOnly the data from 2012 were collected

Discussion

This study represents the first meta-analysis examining factors associated with toothache in children and adolescents, while also updating the global prevalence rate. The analysis revealed an overall toothache prevalence of approximately 36%, with a higher likelihood of occurrence linked to factors such as gender, caregivers' educational attainment, and presence of dental caries. Notably, girls, children, and adolescents with caregivers who had eight or fewer years of schooling, as well as those with untreated caries, faced an elevated risk of experiencing toothache [29-40].

Toothache is a widespread public health issue with extensive psychological, social, and economic repercussions. The pain not only affects the oral health quality of life for children and their families but also interferes with academic performance and daily activities. Additionally, toothache imposes a broader societal impact due to parental work absences, treatment costs, and increased medication use [45].

The study's findings indicate that nearly four in ten children and adolescents globally have endured toothache at some point. However, this figure should be considered cautiously due to high methodological diversity in the primary studies, which lacked

consistency in diagnosis, timing, and age groups evaluated. Ideally, prevalence data should come from large, national population-based samples, yet such studies are limited, with most of the included research focused on local samples from smaller geographic regions, which may not reflect broader populations [46-55].

The prevalence reported here is somewhat higher than previous studies, possibly due to the strict inclusion of research where toothache was a primary focus. This targeted approach likely provided more reliable data than studies where toothache was considered secondary. However, 20 studies added here were not included in prior reviews, potentially due to language limitations and a lack of exploration of grey literature. Furthermore, unlike earlier analyses, this review assesses factors linked to toothache in children and adolescents [60].

The study found that girls were more likely to report toothache, which may be attributed to differences in biological responses to pain influenced by hormones and neuroimmunological factors. Social norms may also play a role, as boys may report pain less frequently to align with masculine stereotypes of resilience [62-66].

Children whose caregivers had eight or fewer years of schooling showed a higher likelihood of experiencing toothache, reinforcing the impact of socioeconomic status on health outcomes. Higher educational attainment often correlates with improved living conditions, better health practices, and healthier diets, which can help prevent infections and diseases, including dental issues [80].

Toothache is commonly associated with untreated dental caries in advanced stages, underscoring the importance of early treatment to alleviate pain and prevent further damage. Preventive dental care, guided by a team of professionals, including dentists, pediatricians, and nutritionists, is crucial to maintaining oral health and preventing caries. A significant proportion of children and adolescents without caries also reported toothache, suggesting that other conditions, such as traumatic dental injuries, molar-incisor hypomineralization, dental eruption, and oral ulcers, could contribute to discomfort and pain [83].

The lifetime prevalence of toothache was highest in school-aged children, followed by adolescents and preschoolers. The prevalence of untreated caries, and consequently toothache, tends to increase with age. A prevalence of 27.7% in preschoolers, while somewhat high, may be explained by the rapid progression of caries in primary teeth compared to permanent ones [87].

Regionally, African children and adolescents experienced the highest rates of toothache, followed by children in Asia and Europe. In contrast, children in Anglo-Saxon American and Oceanian regions were less affected. These differences are likely tied to socioeconomic conditions, as children in underdeveloped areas are more vulnerable to diseases, including caries, and often have limited access to dental care. In less affluent regions, preventive healthcare and dental services are sparse, which negatively impacts oral health [89].

While self-reported pain data collection is generally reliable, parental reports or validated observational tools may be more accurate for younger children who may struggle to articulate pain. However, observational designs limit the certainty of the

evidence, particularly due to issues in sample representativeness and inconsistent sampling methods across the included studies [91].

The high prevalence of toothache identified in this study signals a need for enhanced attention to children's and adolescents' oral health, especially among disadvantaged populations. This information could guide healthcare professionals and policymakers in developing public health policies to improve oral health and general well-being. Future research should emphasize explicit sample size calculations, well-defined age ranges, and appropriate outcome measures to ensure higher-quality, globally applicable findings [93].

In summary, this systematic review estimated a high toothache prevalence of 36.2% among children and adolescents, with significant associations observed with gender, caregivers' educational levels, and dental caries. Girls, individuals with caregivers having fewer years of education, and those with a history of caries were at greater risk of experiencing toothache episodes.

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