

Association of otitis media with dental caries in children: a systematic review

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Pakhtunkhwa, Pakistan**Citation:** Aziz S, Dawar AK, Jan AZ, Salahuddin A, Aziz H, Aziz S, et al. Association of otitis media with dental caries in children: a systematic review. J Rehman Med. Inst. 2022 Apr-Jun;8(2):26-30.**ABSTRACT**

Introduction: Otitis media, also known as middle ear infection, refers to any inflammation of the middle ear. It may be attributable to bacteria like *Streptococcus pneumoniae* and *Hemophilus influenzae* (most commonly involved), though viruses can also cause middle ear infection. It affects the pediatric group during the first three years of life, with 80% youngsters having had one otitis media episode at the minimum by age three years, 50% having had at least three episodes, while a smaller number experience their first episode after age three years. This phenomenon has also been linked to an increased presence of *Streptococcus mutans* which in turn raises the risk of acquiring dental caries.

Objective: To determine whether an association exists between middle ear infection and the high occurrence of *Streptococcus mutans* that ultimately leads to dental caries in children and causes poor oral hygiene problems.

Materials & Methods: A comprehensive and well-organized search of published articles was conducted in February 2022. The investigation was conducted using the Reporting Items for Systematic Reviews. Articles that fulfilled the predefined inclusion and exclusion criteria were appraised with respect to the key objectives of the review.

Results: Based on the findings of the studies highlighted in this systematic review, not only was there a positive correlation between middle ear infection and dental caries, but some data were also supplied on the nature of the link between early childhood caries and middle ear infection.

Conclusion: Increased *Streptococcus mutans* levels in early childhood together with other contributory risk factors such as middle ear infection could enhance the incidence of early childhood dental caries.

Keywords: Middle Ear Infection; *Streptococcus mutans*; Dental Caries.

The authors declared no conflict of interest. All authors contributed substantially to the planning of research, data collection, data analysis, and write-up of the article, and agreed to be accountable for all aspects of the work.

INTRODUCTION

Most ubiquitous disease found in children and the major cause of antibiotic prescriptions is the middle ear infection.¹ Before the age of seven, almost every child will experience at least one episode of ear infection.² *Streptococcus pneumoniae* is the most prevalent bacterium pathogen. Other microorganisms that cause this type of inflammation of the middle ear include *Haemophilus influenzae*, *Moraxella catarrhalis*, and *Pseudomonas aeruginosa*. The infection is frequently preceded by viral or polymicrobial upper respiratory tract infections.¹ Microorganisms enter the middle ears (on either side) through the Eustachian tubes which connect the middle ears to the back of the throat. The eustachian tube can also enlarge as a result of germs or viruses.³ The tube can get blocked as a result of such swelling, causing fluids to pool up in the middle ear instead of being able to drain away. The fact that children's eustachian tubes are shorter and have a lower slope than adults exacerbates the situation. As a result of this physical difference, these tubes are more likely to clog and drain. A virus or bacteria might infect the confined fluid, producing pain.⁴ Excruciating pain from changes in middle ear pressure could be due to chewing, sucking, or lying down. Also fever can make it difficult for children to eat, drink, or sleep. Older children may complain of earache, although a smaller child may simply tug at the ear or cry more than usual. If the pressure from the fluid buildup becomes too great, the eardrum can burst, resulting in fluid leaking from the ear. Children's eardrums are frequently ruptured as a result of this. A youngster with a ruptured eardrum may experience dizziness or nausea, as well as ringing or buzzing in the ears.⁵ It is critical to have a proper diagnosis and treatment as soon as possible.⁶ The therapeutic approach used is determined by the child's age, laterality, and the severity of the sickness.⁶ With or without antibiotic treatment, giving the young child analgesics such as acetaminophen or ibuprofen for pain and fever as needed will help to alleviate discomfort.⁷ As long as the eardrum is not burst, the doctor may also consider utilizing pain-relieving ear drops. However middle ear infections can be prevented by avoiding bottle feed, secondhand smoke, keeping hands clean and keeping the child's immunizations up to date.⁸

Dental caries is a tooth disease that occurs when decay-causing bacteria in the mouth make acids that attack the tooth's surface, or enamel. This can lead to a small hole in a tooth, called a cavity. If tooth decay is not treated, it can cause pain, infection, and even tooth loss.⁹ *Streptococcus mutans* and *Streptococcus sobrinus* are the principal agents of enamel caries.¹⁰ *Lactobacillus* and *Actinomyces* are also associated with caries. *Actinomyces odontolyticus* colonizes infants before eruption of teeth.¹¹ The other significant species involved in caries includes *Streptococcus mitis*, *Bifidobacterium* and *Actinomyces*, a group of 'low pH' aciduric isolates which have been isolated from white spot lesions in humans. It is hypothesized that middle ear infection in children can cause some damage to the ameloblasts that secrete the enamel proteins (Enamelin and Amelogenin which later form enamel), resulting in the formation of hypoplastic primary teeth, which increases their susceptibility to caries. Also middle ear infection may increase the levels of *S. mutans* which metabolizes sucrose to initiate biofilm formation on the tooth surface and consequently produces lactic acid to degrade the tooth's enamel. Previous research on dental caries

found salivary mutans streptococci to be a predictor and marker for caries risk. High level of mutans streptococci in the saliva tends to have early colonization in children.¹² Culturing Mutans streptococci from children's saliva has a high utility in determining caries risk. Salivary mutans streptococcus culture may be more effective, simpler, and time efficient.¹³ As mentioned above, infection of the middle ear that occurs in young individuals can cause damage to the enamel-forming cells, resulting in the formation of hypoplastic enamel on primary teeth and also when the levels of *Streptococcus mutans* levels rise above normal, makes them more vulnerable to caries. So, this study compares the levels of *Streptococcus mutans* in children with and without middle ear infections that will in turn help dental and medical providers identify children at high risk for dental caries.

MATERIALS & METHODS

A thorough and well-structured search of published articles was carried out. Reporting Items for Systematic Reviews were used to conduct the study (Figure 1).

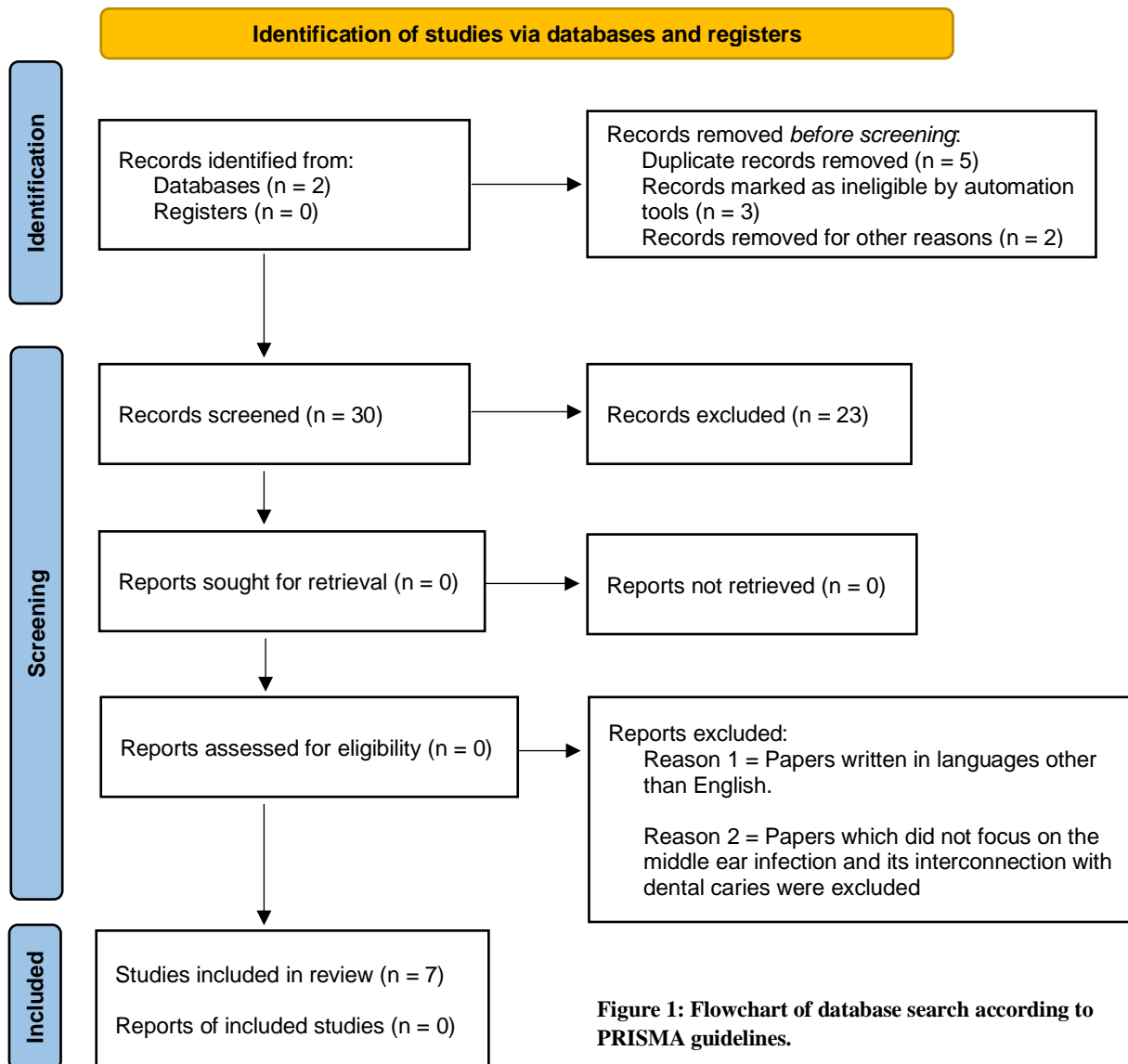


Figure 1: Flowchart of database search according to PRISMA guidelines.

Data sources

In February 2022, a systematic review was carried out by two reviewers, using PubMed and Google Scholar using the Boolean descriptors and operators: (Middle ear infection AND dental caries), (Otitis media AND streptococcus mutans), (Middle ear infection in children AND Streptococcus mutans OR dental caries). 30 articles were screened after removal of duplicate articles. Screening was carried out by reading the abstracts of these articles and 7 articles were finally selected that fulfilled the eligibility criteria.

Inclusion and exclusion criteria

All original full papers published in English language, focusing on middle ear infection and its interconnection with dental caries in children were included. Papers written in languages other than English and which did not focus on the middle ear infection and its interconnection with dental caries were excluded. Limitations for yearly publication was not included as very small set of data is available regarding this topic so all the articles and research work available and accessible till date has been collected.

Middle ear infection in children and its interconnection with dental caries

According to Knuuttila et al. (1975),¹⁴ there was an increase in the development of Streptococcus mutans and Streptococcus pneumoniae colonies in young children who utilized feeding bottles, which play a significant role in causing otitis media and dental caries.¹⁴

SM Alaki et al. in 2008,¹⁵ collected Medicaid data from Michigan and evaluated it for all continuously enrolled children born in 2001 who filed medical and dental claims between 2001 and 2004. There were 29,485 children in the research (51 percent males and 49 percent females). By their first year of life, 47 percent and 69 percent of children, respectively, had filed claims for MEI and RTI. Children who had at least one MEI or RTI claim were 29 percent more likely to develop ECC than those who had none. Children from Hispanic families with eight or more claims had a 91% higher chance of getting ECC than those with less than eight claims. The risk of ECC in children who had MEI or RTI during their first year of life, was assessed using proportional hazards survival models. The presence of middle ear infections or respiratory tract infections in the first year of life was linked to a significantly higher chance of acquiring early childhood caries in the following years. In the models investigated, race and ethnicity were potential predictors of ECC.¹⁵

In a study conducted by Esra E et al. in 2013,¹⁶ the researchers analyzed the current state of the middle ear. The children with obstructive hypertrophic adenoid tissues, allergies, upper respiratory infections, acute and chronic otitis media were not included. The parents were questioned about the ventilation tube and adenoidectomy operations, the ones operated on were not included either. The current state of tympanic membrane and tympanometric findings gave good clues about both the history and the prognosis of the middle ear. All of the patients were starting dental cures for the first time. The compliance values, the middle ear pressures and the effusion scores were not found to be

related to the OHI scores. There was a controversial finding in the middle ear pressure values. The control group had statistically meaningful low middle ear pressure values compared to the poor oral hygiene group. This also showed the irrelevant relation. There was no statistically meaningful relationship between the oral hygiene and the middle ear.¹⁶

Table 1: List of the seven articles selected for the review.

Author(s)	Title of Research	Association between middle ear infection and dental caries
Knuuttila et al. (1975)	Effect of xylitol on the growth and metabolism of Streptococcus mutans.	Positive association was observed
Alaki SM et al (2008)	Middle ear and respiratory infections in early childhood and their association with early childhood caries.	Positive association was observed
Esra E et al. (2013)	Poor oral hygiene and middle ear infections: any relationship?	Negative association was observed
Sangeetha et al. (2014)	Feeding pattern a dual risk? otitis media (OM) and early childhood caries	Positive association was observed
Kashyap N, et al. (2019)	Middle ear infection in children and its association with dental caries.	Positive association was observed
Singh RK et al. (2019)	Association Between Middle Ear Infection and Dental Caries Amongst Children: A Hospital Based Study	Positive association was observed
Jalali MM et al. (2019)	Evaluation of the association between dental caries status and middle ear effusion in preschool children in Rasht City.	Positive association was observed

In another experiment by Sangeetha et al. in 2014,¹⁷ children who were bottle fed had a greater rate of otitis media (91%) than children who were breastfed (3%). This could be as a result of bottle feeding, which is regarded hazardous since it causes negative pressure in the mouth, which is carried up to the middle ear, causing fluid buildup, infection, and early childhood caries.¹⁷

Kashyap N et al. in 2019,¹⁸ performed a research on 120 youngsters, aged 5 and under. They were chosen at random from a variety of schools and hospitals. *S. mutans* were enumerated in saliva samples, and their parents were given a questionnaire to complete out regarding their child's feeding method, pattern, and specific childhood ailment. There were 62 boys and 58 girls among the 120 children tested. The mean CFU in the middle ear infection group was 5.60+9.53, whereas it was 1.70+3.34 in the children who did not have a middle ear infection. The number of *S. mutans* was higher in children with middle ear infections than in children who were not sick, which could lead to dental caries in the future.¹⁸

In another study done by Singh RK et al. in 2019,¹⁹ two groups were made. Group 1 was labelled as children who had middle ear infection while in Group 2, the children had no middle ear infection. There were five young individuals in Group I and 30 children in Group 2 with very good oral hygiene. The individuals' average age was 10.67+/-3.62 years. In Group I, the mean colony forming units were 5.7+/-9.65, while in Group II, they were 1.6+/-2.78. The deposits collected after 10 minutes of centrifugation were used for culture. All of the information gathered was tallied and analyzed using SPSS software. It was concluded that there was an elevation in the risk of early childhood caries amongst children with middle ear infection.¹⁹

Jalali MM et al. in 2019,²⁰ studied a total of 310 children aged 3–6 years old. The WHO,(decayed and filled primary teeth) index was used to assess the children's dental caries. The children were separated into two groups: those who had caries and those who did not, and they were referred to Amiral Momenin Hospital in Rasht for a clinical examination and an audiometry test. At a significance level of 0.05, descriptive and analytical statistical tests were performed. Children with dental caries had significantly more middle ear effusion than children without dental caries.²⁰

RESULTS

Out of the 7 original papers studied, 6 provided the grounds that showed a positive association between middle ear infection and dental caries in children while 1 experimental study concluded no relation between middle ear infection and dental caries or poor oral hygiene. Based on the outcomes of those 6 studies highlighted in this systematic review, not only a positive correlation was seen between middle ear infection and dental caries but also some data was provided on the nature of the link between early childhood caries and middle ear infection as well.

CONCLUSION

In this systematic review, only 6 studies were found to provide good evidence of the study topic. However, it can be concluded that increased *Streptococcus mutans* counts in early ages of youth combined with a potential contributory risk factors such as middle ear infection, could raise the likelihood of early childhood caries in children.

RECOMMENDATIONS

To acknowledge young children who are at risk for caries is of great regard to both dentists and pediatricians in an era of increased interdisciplinary collaboration; it will also help to identify youngsters who would benefit from regular dental checkups and aggressive caries prevention.

In young children, salivary culture of Mutans streptococci is a clinically useful method for identifying people at high risk of caries incidence and development, including those who do not yet have visible signs of caries.

Furthermore, for better clinical judgement, more research work is required as there are very limited data available on the association between middle ear infections and dental caries.

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