

## Early Childhood Carious: A Literature Review

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### Abstract

Early Childhood Caries (ECC) is defined as having one or more decayed teeth, missed teeth (due to caries), or filled tooth surfaces; involving any primary tooth in children aged 71 months or younger. It represents a rising global health problem, with a high prevalence that may reach up to 94% in some communities. We have performed an extensive literature search of the Medline, Cochrane, and EMBASE databases to identify any papers relevant to ECC. ECC found to be multifactorial in nature, resulting from an interaction between micro-organisms, dietary, and socio-economic factors. Its progression may lead to pain and reduced ability to eat, with subsequent effect on child growth and development. The focus on the prevention and management of ECC should be modifying these factors along with proper health education of both the parents and the child.

**Keywords:** American Academy of Pediatric Dentistry (AAPD); Early Childhood Caries (ECC)

### Introduction

In accordance with the American Academy of Pediatric Dentistry (AAPD), early childhood caries (ECC) is defined as having one or more decayed teeth, missed teeth (due to caries), or filled tooth surfaces; involving any primary tooth in children aged 71 months or younger [1]. ECC is globally considered as one of the most common diseases of early childhood that can be recognized as an epidemic in some of the developing countries [2]. It is also identified by the American Dental Association (ADA) as a significant public health problem; especially among deprived communities rather than the general child population [3]. In comparison with other common childhood health problems, ECC is five-time as prevalent as asthma and seven times more prevalent than hay fever [4]. Therefore, the ADA keeps urging health professionals along with the public to identify the teeth that are susceptible to decay as soon as possible.

Baby bottle tooth decay is the term used to describe one of the severest clinical manifestations for ECC [2]. The “ECC” term was developed by the Centers for Disease Control and Prevention as early as 1994 [2]. The aim of this term was to draw attention to the multiple factors contributing to developing caries at that early stage of life, rather than ascribing the disease causation to only inappropriate feeding methods [2]. There are some well documented etiological factors including; cariogenic bacteria, susceptible host, fermentable carbohydrate substrate and the time needed for interaction of these factors [5]. The special nature of the primary teeth along with the efficiency of plaque removal and early childhood dietary habits; make children a highly susceptible group for caries [6]. Additionally, there are other identified environmental risk factors including; using fluoride-containing products, socio-economic status, demographic characteristics, and access to dental care [2]. In this context, children raised in underprivileged communities are found to have a higher prevalence and more severe forms of ECC [7,8].

ECC can be asymptomatic at early stages; however, pain or discomfort can occur on further progression of the disease and involvement of dentin or the dental pulp [9]. Untreated ECC may be manifested by sleeping difficulties and eating problems with further effect on children’s growth and development [10]. It was found that children suffering from ECC have lower height and body weight, compared to their healthy peers [11]. Noteworthy, absenteeism rates were found to be higher in children with untreated ECC with an associated negative effect on their educational performance [12]. In more severe cases, that may become serious and life-threatening, higher rates of hospitalization and emergency visits to dentists have been reported [13].

### Aim of the Study

The aim of the present review is to describe the updated information about the ECC prevalence, risk factors, clinical manifestations and possible management.

### Methods

We performed an extensive literature search of the Medline, Cochrane, and EMBASE databases on 1 September 2019 using the medical subject headings (MeSH) terms ‘child’ OR the keywords “dental caries” (MeSH) AND “child” (MeSH). All papers discussing ECC were screened for relevant information. There were no limits on date, language, age of participants or publication type.

### Risk factors

#### Microbiological risk factors

ECC is an infectious disease in nature and *mutans streptococci* (MS) is the most common causative organism including; *Streptococcus sobrinus* and *Streptococcus mutans* [14]. Other organisms that play a major role in the progression of the disease, but not in its initiation, are Lactobacilli [14]. Acquisition of MS is the key element in the clinical expression and natural history of the disease, which is affected mainly by diet [15]. The major source of the MS transmission to the children is their mothers; however, vertical transmission of MS from caregivers has been also reported [16]. Mothers with higher salivary reservoirs of MS are more susceptible to infect their children, and the successful colonization of the transmitted MS is mainly related to some factors including; the frequency of small-dose inoculations, the magnitude of the inoculum and the minimum infective dose [7,17]. Accordingly, unhealthy dietary choices of the mothers and bad oral hygiene increase the risk of transmission of the disease to their children [18]. Noteworthy, transmission from the disease from the father and horizontal transmission among group members (e.g. nursery toddlers, siblings) have been also reported [17,19].

In the same context, neonatal factors have been also identified as contributing factors in the vertical transmission of MS [20]. Cesarean section was associated with earlier acquisition of the infection, compared to infants delivered vaginally [20]. The infants of cesarean section are typically exposed to more septic conditions and atypical microbial environment that make them more vulnerable to early MS colonization [20]. The time interval between MS infection and developing caries is typically ranging from 13 to 16 months [20]. More compromised groups (e.g. low birth weight, pre-term, infants with hypomineralized teeth, malnourished infants) and infants with enamel hypoplasia show much shorter durations and higher rates of developing ECC [18,21].

**Dietary risk factors**

In addition to MS infection, regular and prolonged consumption of sugary beverages is a typical risk factor for developing ECC [22-24]. Organic acids, the results of metabolizing sugary beverages by MS and lactobacilli, causes demineralization of the dentin and enamel [7]. Unlike the assumption that cow milk in nursing bottles is the causative agent for ECC, the use of the nursing bottle itself is the main factor [25]. This use is associated with subsequent enhancement of exposure to lactose [25]. Moreover, many studies have found that the cariogenic effect of cow milk is negligible [22,23,25-27]. Saliva production is reduced during sleep, and the cariogenic effect of the fluid components of the infant's diet is also promoted by the presence of a teat or nipple [28]. Thus, water is the only fluid that should be given to infants during the night [28].

There is contradicting evidence regarding the cariogenic effect of human milk. A systematic review has suggested that breastfeeding for durations longer than one year and at night are associated with a higher risk of dental caries [29]. Another study has shown that human milk is a promoter for developing smooth-surface caries and has a higher cariogenic effect than cow milk [23]. However, on further comparison of human and cow milk, no statistically significant differences in the caries scores of the sulcal surfaces have been detected [23]. In the same context, increased duration of breastfeeding with higher risk for ECC and a greater prevalence of filled or decayed tooth surfaces [30].

**Environmental risk factors**

Children are more likely to develop ECC if MS was transmitted at an early age; however, this can be partially compensated by avoiding a cariogenic diet and having good oral hygiene [31]. Oral hygiene habits are usually associated with the socioeconomic standards in which children live. These factors include poverty, educational level, ethnicity and dental insurance coverage [32-34]. A decline in caries severity and prevalence in high-income countries; however, many children still suffering from caries [35,36]. Children whose siblings or primary caregiver are suffering from severe dental caries, have a higher risk of developing ECC [36,37]. Moreover, children with low socioeconomic environment have shown worse adult dental health [38]. Nevertheless, a Japanese study has reported that dental caries is more associated with child-related factors rather than mother-related factors [39].

**Prevalence**

The Centers for Disease Control and Prevention (CDC) reported that the prevalence of dental caries among children, aged 2 - 5 years, was 24.2% between 1988 and 1994 and 27.9% between 1999 and 2004 [40,41]. In the developing countries, the prevalence of ECC is higher and may reach up to 85% among less fortunate groups [42,43]. In Western countries, the prevalence was as low as 19.9% and the association between ethnicity and socioeconomic status has been identified [44].

In 2019, a systematic review on the prevalence of EEC has concluded that the median prevalence was 62.7%; ranging from 22.5% (India) to 90% (Indonesia) [2]. Moreover, it was reported that two-thirds of the included studies reported a prevalence higher than 50%. In the same context, an earlier literature review has found that prevalence of ECC among pre-school children had a great variation ranging from 17 to 94%. Additionally, the prevalence was higher than 50% in more than half of the included studies [45]. Bagramian., *et al.* indicated in their literature review that there is a marked increase in the prevalence of dental caries, which may be an alarming sign of impending global crisis [4].

**Clinical features**

The progression of ECC usually follows a specific pattern. The attack of caries usually starts at the labial surface of the upper anterior incisors [45,46]. A whitish decalcification of the teeth is the initial lesion that appears along the gingival margin [45,46]. These lesions will advance to be pigmented with spreading both carnally and laterally [45]. Caries affecting molars could simultaneously affect the

gingival area of the buccal surface along with pit and fissure area [45,46]. The four upper incisors are among the first teeth to erupt with longer exposure to the cariogenic factors; hence, they are severely affected [45,46]. Additionally, pooling of the nursing liquid around them makes them even more susceptible [45,46]. In contrast, the mandibular incisors are much less vulnerable to develop caries [45,46]. This can be explained by being close to the submandibular glands secretion area along with the tongue cleansing action during suckling [45,46]. Moreover, the anterior extension of the tongue during suckling forms an oral seal, which prevents pooling of the nursing liquid around the mandibular incisors [47]. Also, it has been shown that the pulp can stay vital in the primary teeth even with deep dentine and without pulp exposure [45,48].

### Management of ECC

Regarding the prevention and treatments of ECC, the main focus should be on modifying the infectious, dental and behavioral determinants of the disease [49]. The main management objectives are usually to eliminate/arrest carious lesions and to improve the functionality and aesthetics of the affected children [50]. The main two components of conventional dental care are restorative and preventive.

The preventive care includes dental health education, following a healthy diet, the use of fluoride and the use of antibacterial agents. The AAPD recommends the use of fluoridated toothpaste twice-daily for dentate children [51]. Thus, Pre-school children should do an assisted tooth brushing with the help of their parents [45]. Moreover, oral hygiene measures should be implanted for all children before the eruption of the first primary molar teeth [45]. In the same context, one study has reported that regular brushing of teeth with fluoride toothpaste is an effective measure in re-hardening dentine caries and preventing EEC [52,53]. Another study found the arrest of active dentine caries is possible using effective oral hygiene measures and fluoride varnish [54]. Nevertheless, a systematic review has found that the evidence supporting the efficacy of fluoride is quite fair and insufficient for all other methods [55]. Regarding anti-microbial therapy, topical use of povidone iodine and chlorhexidine varnish have been found to be effective in the prevention of ECC [56].

Restorative care involves using different dental materials to restore the carious teeth [45]. The used materials include composite resins, silver amalgam, and glass ionomer cement [45]. To restore large multi-surface carious teeth, a stainless steel crown could be used [45]. Moreover, carious lesions involving the pulp are treated with pulpectomy or pulpotomy [57]. Nevertheless, if the prognosis of the affected teeth is poor, it should be extracted to avoid pain and prevent the spread of infection [45].

### Conclusion

ECC is a chronic, infectious disease, and a rising public health problem; however, it is one of the most preventable diseases. ECC is multifactorial in nature, resulting from an interaction between micro-organisms, dietary, and socio-economic factors. The focus on the prevention and management of ECC should be modifying these factors along with proper health education of both the parents and the child. Additionally, dentists should establish effective methods to detect signs of early and advanced ECC and provide advice and education on how to prevent and control to the patients.

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