

Prevalence and Severity of Early Childhood Caries and All Associated Risk Factors among Preschool Children

Received date: 12 July 2021; Accepted date: 24 July 2021; published date: 28 July 2021



Open access
review article
volume 1:1

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ABSTRACT: Early childhood caries (ECC) is a major oral health problem, especially in developing countries among preschool children.) It is defined as the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child at ≤ 71 months of age. Prevalence rate varies worldwide with 1-12% in developed countries and 70% in least developed countries. ECC is 5 times as frequent as asthma and 7 times as common as hay fever. The prevalence continues to remain high despite extensive research and progress in the field of cariology. Hence, this review aimed at understanding the risk factors, prevention and the management of ECC. Main Risk factors associated with ECC can be categorized under four headings: micro-organisms, diet, teeth and environmental factors. AAPD has laid down a policy statement to decrease the risk of developing ECC which includes both professional and at home preventive measures. In view of this, there is an urgent need to implement preventive and curative oral health programs for preventing and managing ECC at the earliest possible time.

KEYWORDS: Early childhood caries (ECC), Prevalence, Risk factors, preschool children

INTRODUCTION:

Early childhood caries (ECC) remains a major public health problem in preschool children, especially in developing countries, in view of its early onset and high prevalence, as well as the high likelihood of non-treatment.^{1,2} According to the American Academy of Paediatric Dentistry (AAPD), early childhood caries (ECC) is defined as the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child at ≤ 71 months of age.³ It is a complex disease involving the maxillary primary incisors within a month after eruption and spreads rapidly to involve other primary teeth.⁴

ECC relays serious socio-behavioral issues that afflict mainly the infants and toddlers.⁵ If left untreated, it can lead to prolonged poor food intake, leading to poor general health, caries affecting newly erupted permanent teeth, loss of school days, poor esthetics and self-esteem. Often young children less than 3 years, with multiple carious lesions need full mouth rehabilitation under general anesthesia. Little older children can be rehabilitated in the dental clinic on multiple chair side appointments. Most of the children might need multiple root canal treatments, fillings, crowns and extraction of teeth.⁶

The prevalence of ECC varies across population groups. In the most developed countries the prevalence rate of ECC is between 1 and 12%.⁷ In less developed countries and among the disadvantaged groups in the developed countries, the

prevalence has been reported to be as high as 70%.^{8,9} The national surveys from some countries, such as Greece (36%), Brazil (45.8%), India (51.9%), and Israel (64.7%), showed inconsistent prevalence of ECC.¹⁰ However, the greatest prevalence and severity of the disease are in Far East Asia, where the prevalence in 3 year olds ranges from 36% to 85%. In India, a prevalence of 44% has been reported among 8 to 48 month olds.¹¹⁻¹⁵

The factors responsible for ECC include a susceptible host, fermentable carbohydrate diet, presence of dental plaque, a high number of cariogenic microorganisms such as *Streptococcus mutants*, *Lactobacillus*, and most importantly, time.³ When compared with other common childhood diseases, ECC is five times as frequent as asthma and seven times as common as hay fever.¹⁶ It is a social, political, behavioral, medical, psychological, economical, and dental problem that affects the quality-of-life.⁵ The prevalence continues to remain high despite extensive research and progress in the field of cariology. Hence, the aim of this review is to understand the risk factors, prevention and the management of ECC.

RISK FACTORS ASSOCIATED WITH ECC

To understand the risk factors of ECC, the multifactorial etiology should be taken into consideration. Figure 1 gives a brief overview of the factors involved in ECC.

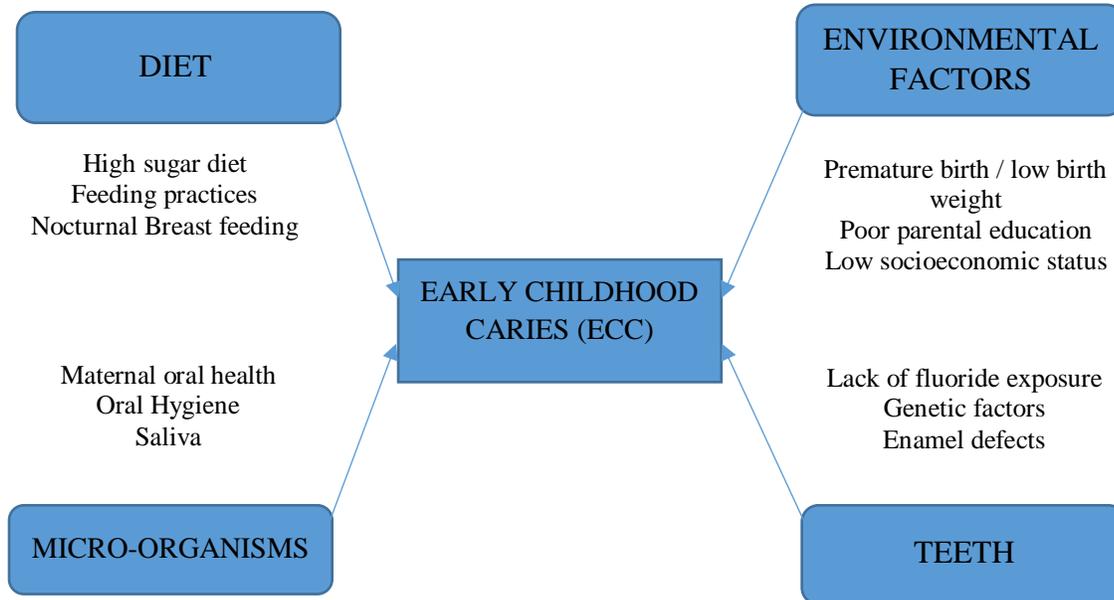


Figure 1- Risk factors for development of ECC ¹⁰

Micro-organisms:

The most common micro-organisms associated with ECC are *Streptococcus mutans* (SM) and *Streptococcus sobrinus*. *Lactobacilli* play an important role in lesion progression, but not its initiation.¹⁷ Colonization of a child's oral cavity with these micro-organisms is by the vertical transmission through saliva from the child's mother during first 12-24 months.¹⁰ Longitudinal investigations show that children with very high levels of *Streptococcus mutans* (SM) are 6 times more likely to experience additional cavities over time than those without SM at first visit.¹⁸ In addition, children who are colonized with SM at an early age are at higher risk for ECC than children who are colonized at older ages.¹⁹

Poor maternal oral hygiene maintenance and frequent snacking and sugar exposure increase the chances of transmission of the infection to child.²⁰

Micro-organisms contribute to caries formation with their increased ability to adhere to tooth surfaces, produce copious amounts of acid, and survive and maintain metabolism at low pH conditions resulting in demineralization of tooth enamel.²¹

Other oral acidogenic and aciduric microorganisms in the dental biofilm are also likely to play a role in ECC. The *Actinomyces* species and specifically *Actinomyces gerencseriae* were also associated with caries initiation,²² while *Bifidobacterium* species was associated with deep caries lesions.²³ The presence of *Candida albicans* may increase the carcinogenicity of *S. mutans* by enhancing biofilm formation and acid production.^{24,25} Teng et al. used *in vivo* samples from a 3-year cohort study and showed, with the help of mathematical modelling, that *S. mutans* were not the main trigger for caries instead *Veillonella* spp. and *Prevotella* spp. are mainly responsible for the development of ECC.²⁶

Diet:

Abundant evidence is present to show that dietary sugars, especially sucrose, plays an important role in the caries development and its progression.²⁷ Many clinical studies established the fact that the children with ECC consume more in-between meal sugars than caries free controls.¹⁹ Inappropriate feeding practices, bottle feeding during bedtime or sleeping has been associated with the initiation and development of caries in children as they can prolong the exposure of teeth to fermentable carbohydrates which aggravate the chances of ECC.¹⁰ A recent systematic review reported that breast-feeding in infancy is protective for ECC.²⁹ However, the review and other epidemiologic evidence also suggested that breast-feeding more than 12 months and during night times may be associated with increased risk for ECC.^{29,30} Milk contains lactose, which is a fermentable sugar that is responsible for caries, but the high concentration of calcium and phosphorus prevents dissolution of enamel and thus plays a protective role.³¹ In the clinical reports suggesting that ECC is associated with prolonged at-will breast-feeding, factors other than breast milk, developmental enamel defects and poor oral hygiene, are likely to have contributed to the caries risk.³² In addition, some studies have found that children receiving prolonged breastfeeding for 2 years or more are at a higher risk of early severe caries (S-ECC).¹⁰ Infant feeding practices such as frequent exposure to sugar, frequent snacking, taking sweetened drinks to bed, as well as maternal caries status, oral

hygiene and dietary habits predispose to development of ECC.³³

Teeth:

Poor oral hygiene practices promotes the development of ECC. Children cannot effectively remove plaque when they brush their teeth as they are unable to brush their teeth properly in the absence of parental help.³⁴ Therefore oral hygiene care should be given to children upon the eruption of first primary teeth.³

Major risk factor for ECC is the loss of tooth surface integrity resulting from developmental disturbances of the enamel.³² These defects enhance the plaque retention, enhances colonization of micro-organisms and increases the susceptibility to enamel demineralization.²⁷ Developmental defects of enamel is found in approximately 22% to 49% of healthy children in the primary dentition and more than 60% of preterm children. The major causes of defects are congenital medical conditions, birth prematurity, childhood metabolic and infectious illnesses, and the intake of certain medications, like, cytotoxic drugs.³²

Saliva because of its defense system plays a protective role against dental caries development, the main immune defense against *S mutans* is provided largely by salivary secretory immunoglobulin A (IgA) or serum and gingival crevicular fluid.³⁵ A Saliva flow rate, antimicrobial properties, the buffering capacity, and clearance of foods from the oral cavity are factors that are important in reducing the development of caries.³⁶ It also functions as a mineral reservoir for calcium and phosphate necessary for enamel remineralization. During sleep, the decrease in salivary flow

rate reduces its buffering capacity, consequently making tooth susceptible to caries.³⁵

Fluoride is presently the corner stone of dentifrice anti-caries therapy. Tooth-brushing with fluoridated dentifrice has played a major role in the decline of caries worldwide.³⁷ Data from over 20 clinical trials show caries reduction in primary teeth of 30% to 80% from fluoride supplements, provided that therapy is started close to birth and continued for 5 or more years.²⁷ The American Dental Association's 2006 topical fluoride guidelines recommend that fluoride varnish be applied every 6 months for those preschool children at moderate caries risk, and every 3 to 6 months for children at high risk.³⁸

Environmental factors:

Low socioeconomic status, poor parental education, and life style factors have significant influence on ECC.³⁹ Children from low-income families are more likely to suffer from childhood illnesses¹ like low birth weight, malnutrition resulting in enamel defects and increased susceptibility for ECC.¹⁰ Maternal education influences beliefs and attitudes towards the oral health care of children. Mothers and caregivers play a role in cultivating children's dental health behavior, including tooth brushing, dental care, and dietary habits, which are acknowledged to be protective factors for the primary teeth.¹ In addition, mothers with limited absolute financial means are more likely to forgo preventive dental visits and have children with greater unmet dental needs than more advantaged families.³²

Prevention:

The AAPD recognizes early childhood caries as a significant chronic disease resulting from an imbalance of multiple risk and protective factors over time. To decrease the risk of developing ECC, the AAPD encourages professional and at home preventive measures that include:

1. Avoiding frequent consumption of liquids and/or solid foods containing sugar, in particular:
 - Sugar-sweetened beverages (e.g., juices, soft drinks, sports drinks, sweetened tea) in a baby bottle or no-spill training cup.
 - Ad libitum breast-feeding after the first primary tooth begins to erupt and other dietary carbohydrates are introduced.
 - Baby bottle use after 12-18 months.
2. Implementing oral hygiene measures no later than the time of eruption of the first primary tooth. Tooth brushing should be performed for children by a parent twice daily, using a soft toothbrush of age-appropriate size. In children under the age of three, a smear or rice-sized amount of fluoridated toothpaste should be used. In children ages three to six, a pea-sized amount of fluoridated toothpaste should be used.
3. Providing professionally-applied fluoride varnish treatments for children at risk for ECC.
4. Establishing a dental home within six months of eruption of the first tooth and no later than 12 months of age to conduct a caries risk assessment and provide parental education including anticipatory guidance for prevention of oral diseases.

5. Working with medical providers to ensure all infants and toddlers have access to dental screenings, counselling, and preventive procedures.
6. Educating legislators, policy makers, and third-party payers regarding the consequences of and preventive strategies for ECC.⁴⁰

Management of ECC:

Management of ECC can be accomplished through different types of intervention, depending on the progression of the disease, the child's age, as well as the social, behavioral and medical history of the child.⁴¹ However, data from expert panels suggest appropriate interventions to reduce ECC (Table 1)²⁷

Caries Management Approaches to Reduced Early Childhood Caries by Risk Category

Approach	Low Risk	Moderate Risk	High Risk
Tooth brushing with fluoridated toothpaste*	Yes	Yes	Yes
Systemic fluoride supplements†	No	Consider	Consider
Fluoride varnish	No	At least every 6 mo	Every 3 mo
Counseling to reduce high frequency of sugar exposure	Yes	Yes	Yes
Dental referral	No later than age 3 y	Age 1 y	Age 1 y

*“Smear” of toothpaste for children under age 2; “pea-size” over age 2; twice daily.

†Patient's age, parent's compliance, and knowledge of fluoride levels in tap water.

Conclusion:

Despite recent advances in preventive dentistry, early childhood caries remained a major public health problem worldwide. It is preventable and manageable with early

detection and referrals. Since most of the untreated children are present in the schools, there is an urgent need to implement preventive and curative oral health programs at school level by educating school teachers, parents and care givers.

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How to cite this article: Sharma S,Sande A(2021). Prevalence and severity of early childhood caries and all associated risk factors among preschool children. *Int J Med Den Ph All Hlth Sci* 2(1):147-156