




EARLY CHILDHOOD CARIES RISK FACTORS

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ABSTRACT

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Dental caries is one of the most common chronic diseases in childhood. Caries in primary teeth cause pain, bacteremia, high treatment costs, decreased growth and development, speech disorders, premature tooth loss, and consequently decreased chewing functions, loss of self-confidence, and problems with permanent dentition. The presence or absence of one or more cavities in children aged 71 months and younger, caries lesions, caries-related tooth loss or filled primary teeth is defined as early childhood caries (ECC). ECC is a multi-factor infectious disease that affects the quality of life of children and their families. ECC etiology is complex and multi-factor. In addition to the traditionally taught cariogenic bacteria, carbohydrates and tooth surfaces, etiological caries triad; It is a multifactorial disorder that is associated with many biological, physiological, oral care behaviors, sugar intake and access to treatment services, socio-cultural, behavioral and environmental risk factors.

The purpose of this review is; This is the transfer of current literature information related to the risk factors of early childhood caries, which is one of the common and aggressive diseases seen in preschool children. In order to prevent early childhood caries, children and families should be informed and educated about this issue, and appropriate oral hygiene and eating habits should be gained.

INTRODUCTION

Early childhood caries; It is defined as the presence of one or more decays, teeth extracted due to caries or teeth filled due to caries in the primary teeth of children aged 71 months or younger. The number of caries on the free surface of the upper anterior teeth or more than 4 for 3-year-old children, more than 5 for 4-year-old children, more than 6 for 5-year-old children is defined as severe ECC. (1)

Being a complex, multifactorial, preventable chronic disease seen in infants and young children, ECC is still one of the most common and contagious diseases. It has been stated that EÇE covers a large part of the public health problem by significantly reducing the oral health-related quality of life of the child and at the same time creating a great social and economic

impact on the family and society. (2)

Early tooth decays in young children were first named "melanodontie infantile" by the researcher named Beltrami in 1952. Then in 1962 dr. Elias Fass used the term 'nursing bottle mouth'. In the following years, the term "bottle caries" was widely used, but it was understood that long-term bottle use was not the only cause of tooth decay and it was a multifactorial infectious disease. In the report of the National Institute for Work and Craniofacial Studies (1999), the definition of EÇ was appropriate. (3) Later, this definition was accepted by the American Pediatric Dentistry (AAPD). (1)

Importance:

In a survey in 2013 in Turkey, it reported the early stages of tooth decay may be particularly effective on

the permanent early tooth decay. (4) Self-limiting ICH is difficult to treat when not treated early and causes the child's condition to worsen. It is stated that ECC progresses rapidly and causes pain, abscess, facial cellulitis, tooth loss and malocclusion. (5) Early loss of primary teeth often causes orthodontic problems in adult life. (6) It has been reported that not only toothache, orthodontic problems and enamel defects, but also bad breath, bad appearance due to the loss of front teeth at an early age, and problems in speaking skills can cause social exclusion and psycho-social problems as a result of caries development. (7,8) It has also been reported that it can cause serious fear and resistance and cause psychological trauma during treatment in young children suffering from pain caused by ECC. (9) It has been reported that even if deciduous teeth are treated, it may be a harbinger of caries in permanent dentition due to the pathogenesis of decay formation in deciduous teeth due to a pathogenic process. (10) It has been determined that ECC not only affects the oral health of children but also their general health. (11) Dental problems were shown as one of the reasons for the hospitalization of children in Australia in 2015. (12)

In a study conducted in 2006, it was found that severe ECC is a risk factor for iron deficiency anemia. (13) Infected and focal infected teeth also cause nutritional and sleep disorders, weight loss due to reluctance to eat, gastrointestinal disorders and growth retardation. (14) All these situations have direct effects not only on children but also on family members and society. (15)

Therefore, ECC significantly affects the quality of life of the family / caregivers, including its financial and health impacts. (16) The results of ECC begin by affecting the child individually, and then can have an impact on family and community welfare and economy. (17)

Clinical Appearance:

ECH first begins as a point white lesion on the collar of the anterior surface of the upper deciduous incisors and the upper four incisors are often affected

simultaneously. If the lesion is not treated and demineralization continues, the enamel surface lesion turns yellow, brown or black, respectively, and causes cavitation on the anterior surfaces of the deciduous teeth and occlusal surfaces. (18) However, while the exposure to ECC is mostly seen in the upper incisors, the lower incisors are affected at least due to the protective effect of the tongue and saliva. (19) Prolonged exposure of the upper deciduous incisors to this condition often leads to crown fractures. (20)

Incidence:

It is observed that its incidence has increased in developing countries and some developed countries. (21,22) The prevalence of ECC may vary depending on the cultural habits of societies regarding infant feeding, determined to be common. In international studies, the prevalence of ECC has been reported to be 1-56% in France, 36% in Greece, 40% in the USA, 52% in Canada, and 28.4% in Brazil. (23-29) Turkey oral health profile (2004) and other shrubs studies of caries prevalence in children 5 years of age was determined to be 70%. In other studies conducted in our country, the prevalence of tooth decay was reported to be 17-78%. (30-36)

ECC Etiological Risk Factors:

ECC is defined by AAPD as a chronic and infectious disease that occurs as a result of the balance between various risk factors and protective factors. The factors that play a role in the formation of ECC, which is one of the most common diseases in many countries, are various and complex.

Genetic Risk Factors:

Despite everything known about the prevention of ECC, and regardless of the environmental risk factors to which they are exposed, there are children who are more susceptible and those who are extremely resistant's the literature, it is emphasized that there is a relationship between high caries prevalence and some genes that play a role in enamel formation and maturation. (37) In a study conducted in 2019, it was shown that genetic variation in genes on the X chromosome can contribute to ECC and that

sensitivity is the result of gene-environment interactions. (38) Due to genetic differences, some people are more prone to tooth decay than others. Individuals' immune system human leukocyte antigen (HLA) or major histocompatibility complex (MHC) molecules play an important role in the immune response. One study has proven that HLA-*drb1**04 is associated with susceptibility to ECC. (39)

Nutrition Habits and Diet:

In ancient times, it was stated that the absence of sugar and processed starch in the daily diet of people caused a low level of dental caries due to the consumption of raw wheat, fruit and vegetables. Tooth decay increases with the production of sugar from sugar cane and the introduction of refined sugars in the daily diet. (40) Traditional tooth decay formation includes factors such as fermentable carbohydrate, bacteria that can produce acid and ferment the substrate, tooth surface, reduced saliva flow rate and insufficient fluoride level. Unfortunately, other factors have assumed a wrong causal role in this multistep process. In the light of current knowledge, the only specific cause for dental caries is free sugars. (41)

Sugar Consumption: ECC is a result of the interaction of factors that cause caries formation. The main nutritional variable in caries formation is sugar consumption. In the case of frequent sugar consumption, the risk of caries often increases. (42-45) Studies have shown that daily consumption of sweet foods and beverages is more than 3 times a day, especially feeding with a bottle and sugary drinks at night increases the prevalence of ECH by increasing *S. mutans* infection and colonization. (46,47)

Saliva flow during night feeding also has an effect on the neutralization of saliva:

It takes 20-40 minutes to neutralize the sugar acid and remove it from saliva. This causes food to accumulate in the teeth and prolonged contact with carbohydrates. (48)

Bottle Use: Bottle use, which is one of the most important etiological factors in the formation of ICH,

has been associated with a decrease in the neutralization capacity of saliva flow and saliva. (48) This causes food accumulation in the teeth and long-term contact of the teeth with fermented carbohydrates. In addition, it was observed that children with ECC sleep less at night, wake up more often, and use bottles more frequently to solve sleep problems in these children. (49)

Use of pacifiers: Although the use of sugar-sweetened pacifiers is considered among the etiological factors, it has been reported in a systemic review that there is no significant relationship between the use of pacifiers and the occurrence of ECC. (50)

Breastfeeding and Breast Milk:

It has been shown that breastfed children are less affected by ECC. (51-53) In a systemic review, it was reported that less tooth decay was detected in babies who suck more frequently and for more than 12 months, the frequency of tooth decay increased in babies who continued to breastfeed after 12 months, and babies who were breastfed at night had an even higher risk. (54)

Risk Factors Regarding the Child's General Health (House-Related Factors):

One of the factors that cause tooth decay is the health status of the host factors. Ongoing teeth, hypoplasias characterized by enamel structure, reduction in saliva structure and amount pose a risk for tooth decay formation. (55-58) It has been reported that developmental disorders that have a significant relationship with the development of tooth decay, such as preterm birth, low birth weight, disease in the prenatal and postnatal periods, anemia, tooth and enamel hypoplasia due to prenatal malnutrition, may occur. (59-63) In a study conducted in 2014, it was reported that the 25-hydroxy vitamin D (maternal vitamin D) level was significantly low during pregnancy in mothers of children with MCH. (64,65) Likewise, the mother's weight during pregnancy, fat and sugar intake have been associated with the presence of cavities in preschool children. (66) In a study in 2008, it was reported that there was a

significant positive correlation in terms of ECH risk in the first year of life in children with otitis media and respiratory tract infections. (67)Beta-2 agonist powder inhalers and sugar-containing oral drugs used in the treatment of bronchial asthma increase the risk of ECC. (68)In addition, it has been reported that obese children are also at risk of ECC and there may be differences between societies in the results of studies on the subject, as well as more frequent controls in terms of bad eating habits. (69-72)

Sociodemographic Risk Factors (Parental Factors):

The connection between ECC and socioeconomic status has been shown in many studies. It has been reported that the income level and education level of the society is low, and the incidence of ECC in the children of single mothers has increased. (60,73-76) Although it may vary between societies, there are also studies reporting that the age of many children and young mothers can increase the risk of caries. (32,33,77-80)It is thought that children with advanced dental caries in their parents and siblings have a higher risk of dental caries in the future. (81-84)

Environmental Factors:

It has been stated that *S. mutans* bacteria contamination is affected by factors such as socioeconomic status of caregivers, water fluoridation, race and may contribute to the progression or prevention of caries. For example, lack of access to dental care, lack of preventive measures, and lack of information on the importance of oral health negatively affect oral health in young children. One of the other important risk factors of ECC is irregular tooth brushing and / or brushing without any caregiver's supervision. (45,53,70,75,85)

Passive Smoking: In recent studies, it has been suggested that passive smokers are a risk factor for tooth decay and an increase in the number of filled teeth. (45,86-100)However, there has been no study on the relationship between passive smoking and ECC in our country. (91,92)

Microbiological Risk Factors:

The main cariogenic microorganisms *S. mutans* and *S. Sobrinus* cause demineralization on the tooth

surface by producing acid in the presence of glucose and fructose. (101) Studies indicate that *S. mutans*, which is associated with the formation of white lesions and caries, has a growth rate of more than 30% in plaque cultures of children with ECC, while it has been reported that it does not exceed 0.1% in plaque flora in children without caries. (102)In *S. mutans* contamination of children, 7-31 months for primary teeth and 2-6 years for permanent teeth have been reported as the critical period. Most of the long-term studies show that infants who are not infected with *S. Mutans*. It has been shown that *S. mutans* is orally transmitted between mother and child. Vertical transmission is thought to primarily involve the mother, as the *S. Mutans* species obtained from the infant show 90% similarity compared to the mother and father. It has been reported that the transition may occur when the parent kisses the baby, and the spoon is given from the mother's mouth to the baby's mouth during the pacifier and eating. (104)

Matrix Biofilm: Matrix is an extracellular environment that promotes acidification at the biofilm-tooth interface by ensuring that microbial cells hold tightly within the biofilm and to the tooth surface. (105) Exopolysaccharides (EPS), which form the main structure of the matrix, are mainly composed of soluble and insoluble glucans and to a lesser extent fructans. (106)

Although *S. mutans* detected in the ECC biofilm appears to be the main organisms associated with the production of insoluble EPS matrix, it has been stated that other streptococci and *Lactobacillus reuteri* can synthesize EPS, while the contribution of other species to the insoluble EPS matrix is still unknown. (107)The metabolic activity of *S. mutans* and other acidogenic organisms in the EPS rich matrix has been reported to facilitate the formation of acidic micro-environments within the biofilm. It has been stated that the glucans formed in the cell create new microbial binding sites that support the local colonization of *S. Mutans* and other microorganisms. (108)However, other saliva and bacteria-derived

components, including proteins, lipoteichoic acid, and edna, have also been identified within the matrix, which may contribute to its structural organization and diffusion properties. It is emphasized that biofilm formation or visible plaque formation often occurs on the smooth surfaces of children at risk of ECC, and the importance of EPS in this plaque in the pathological process is emphasized. (110)

Candida: The main component of the oral fungal microbiome *C. albicans* is known to form mixed microbial communities on mucosal and prosthetic surfaces. (111) In addition to *S. mutans*, candida species, most commonly *Candida albicans*, were also detected at high rates in plaque-biofilms taken from children with ECC and S-ECC, while in plaque-biofilms taken from healthy children without ECC. It was stated that *albicans* were determined most sporadically. (112,113) However, in in-vitro and in-vivo studies, it was determined that the symbiotic relationship found between *C. albicans* and *S. mutans* in the presence of sucrose increases the ability to colonize teeth, the amount of EPS in the biofilm matrix and aggressive onset dental caries virulence in both organisms. (114,115)

Other Bacteria: Together with *S. Mutans*, *Streptococcus oralis*, *Lactobacilli*, *Streptococci* colonies, *Prevotella denticola* and other bacteria have determined that there is a correlation between EOP formation and severity. (116-118) It has been stated that unlike acidogens with ECC, other types of bacteria found in plaque-biofilms can neutralize the acids and thus eliminate the harmful effects of acidification by producing an alkali that can affect caries susceptibility in children. Bacteria responsible for the production of alkaline structures protect against plaque acidification and the growth and increase of cariogenic bacteria that develop under acidic conditions, while helping to prevent the effects of the demineralization mechanism.

These organisms have the ability to produce ammonia using saliva substrates such as arginine (*S. gordonii* and *S. sanguinis*) through the arginine deiminase system (ads) and urea (*S. salivarius* and

a. Naeslundii). It has been stated that *Prevotella*, a weak or non-acidogenic but proteolytic gram-negative bacterial species, is detected in the dental plaque of children with severe ECC and is associated with dentin caries where proteolysis of proteins denatured by acidic species is required. (120) *Veillonella* species have often been reported to play a role in the rapid spread of severe ECC lesions. Although they are not acidogenic, *Veillonella* makes use of lactate produced by several acidogenic strains as carbonogenic acid, which may support the growth or survival of cariogenic strains. These observations may help explain why the current standard of risk assessment based on identification or enumeration of single species (eg salivary *mutans* levels) is not found as an accurate method for identifying children at risk of caries. **Complex Microbe and Host Saliva Interactions** ECC Biological Markers: Part of the ECC etiology is the individual variability of saliva concentration and composition and saliva content. (122) Microorganisms interact with high molecular weight protein, small peptides, single amino acids, host saliva, and microbial biomolecules. (123) Many salivary proteins, such as acidic and basic proline-rich glycoproteins (prps), mucin, immunoglobulins, agglutinins, lactoferrin, cystatins, and lysozyme, are thought to be important regulators of oral health. High levels of bacteria found in saliva (such as *gtfb* from *S. mutans*) or reduced activity of bacterial arginine deiminase in plaque have been reported to be associated with increased caries activity in children.

CONCLUSION

It is to take necessary precautions about dental treatments for children in risky groups by evaluating whether prenatal, perinatal, postnatal environmental factors and sociodemographic factors are risk factors for ECC, drawing the attention of dentists and families to this issue.

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