



# Early Childhood Caries – literature review on risk factors, prevalence and prevention

Próchnica wczesnego dzieciństwa – przegląd literatury pod kątem czynników ryzyka, występowania i zapobiegania

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## Abstract

**Introduction.** Early Childhood Caries (ECC), one of the most prevalent chronic diseases among children, is still a severe problem worldwide. It is an infectious disease of mineralized tooth tissue that can affect general health.

**Objective.** The aim of this study is to summarize evidence-based knowledge on the etiology, prevalence, clinical manifestation and management of ECC, as well as its consequences for proper development.

**Materials and method.** The research included the PubMed and Google Scholar databases. Only articles published in 2013 and later were reviewed.

**Brief description of the state of knowledge.** The prevalence of ECC among countries is highly inhomogeneous. It is reported that in some countries more than a half of children suffer from ECC. Furthermore, ECC can vary in severity and is classified into 3 types: type 1 (mild to moderate), type 2 (moderate to severe), type 3 (severe). The most common risk factors include beverages containing sugar, large amounts and high frequency of sugar consumption along with the lack of proper oral hygiene. Studies have shown that social background can also strongly affect the probability of ECC occurrence. Depending on severity, ECC can lead to various consequences that have been divided into short- and long-term. ECC can even cause developmental problems.

**Summary.** ECC is an entirely preventable disease. It appears that the awareness of gynaecologists and paediatricians may be one of the crucial factors. These specialists are the first doctors that have contact with the mother and her infant, thanks to which they can convey knowledge about ECC before it appears. On the other hand, the final effect depends on parent's behaviour and willingness to apply the guidelines.

## Key words

oral health, early childhood caries, dental care, paediatric dentistry

## Streszczenie

**Wprowadzenie i cel pracy.** Próchnica wczesnego dzieciństwa (ECC), jako będąca jedną z najczęściej występujących chorób przewlekłych wieku dziecięcego, jest nadal znaczącym problemem na świecie. Jest to choroba infekcyjna zmineralizowanych tkanek zębów, która może wpływać na ogólny stan zdrowia.

**Cel pracy.** Celem pracy było podsumowanie informacji na temat etiologii, występowania, objawów klinicznych i leczenia ECC, jak również konsekwencji tej choroby dla prawidłowego rozwoju.

**Metody przeglądu.** Przegląd piśmiennictwa obejmował bazy PubMed oraz Google Scholar. Uwzględniono jedynie artykuły opublikowane w roku 2013 lub później.

**Opis stanu wiedzy.** Zachorowalność pośród w populacji różnych krajów nie jest jednolita. W niektórych krajach na ECC choruje powyżej 50% dzieci. Ponadto ECC może cechować się różni różnąsię ciężkością przebiegu. Rozróżnia się 3 typy ECC: typ 1 (przebieg lekki do umiarkowanego), typ 2 (przebieg umiarkowany do ciężkiego), typ 3 (przebieg ciężki). Do najczęstszych czynników ryzyka należą słodzone napoje, częste spożywanie dużych ilości cukrów prostych oraz brak odpowiedniej higieny jamy ustnej. Badania wskazują, że pozycja społeczna również wpływa na prawdopodobieństwo rozwoju ECC. W zależności od ciężkości przebiegu, ECC może powodować zróżnicowane konsekwencje, które zostały podzielone na krótkoterminowe i długoterminowe. ECC może skutkować zaburzeniami w prawidłowym rozwoju.

**Podsumowanie.** Odpowiednia prewencja umożliwia ograniczenie występowania ECC. Lekarze ginekolodzy i pediatrzy są pierwszymi specjalistami, którzy mają kontakt z matką i noworodkiem, dzięki czemu mogą przekazać informacje o prewencji ECC, zanim choroba wystąpi. Ostatecznie, skuteczność prewencji jest zależna od postępowania rodziców i ich chęci do przestrzegania wytycznych.

## Słowa kluczowe

próchnica wczesnego dzieciństwa, higiena jamy ustnej, zdrowie jamy ustnej, stomatologia dziecięca

## INTRODUCTION

Early Childhood Caries (ECC) is still believed to be one of the most prevalent chronic diseases in children worldwide [1]. As consequences might be short-term, long-term or even life-threatening [2], the need for education about proper oral hygiene measures, especially among parents and/or medical specialties other than dentists, is still high [3].

Dental caries is an infectious disease of the mineralized tissues of the teeth, including enamel and dentine, as well as cementum [4]. Four factors are required for caries to develop: cariogenic bacteria, susceptible host (erupted teeth), fermentable carbohydrate substrate along with time for the previous factors to interact [5].

The American Academy of Pediatric Dentistry (AAPD) defines Early Childhood Caries ‘...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 under the age of six’ [5]. This chronic childhood disease is considered to be a global problem, affecting children in developing as well as industrialized countries [4, 5].

The aim of this study was to conduct a literature review on Early Childhood Caries in order to present updated knowledge about its prevalence, etiology, clinical manifestation and management, as well as consequences.

A thorough search was carried out for articles describing the topic of ECC which included the PubMed and Google Scholar databases. The search focused on literature published in 2013 and later, in order that the summarized knowledge could refer to the most up-to-date understanding of the disease. The final review cited only one article published prior to 2013.

**Prevalence.** The reported prevalence of ECC differs strongly from study to study and also between continents. Elidrissi et al. described a prevalence of 56.1% for ECC in Sudan (Africa) [6], and according to Chen et al., the prevalence in Asia ranged between 22.9% – 90% [5]; European studies reported ECC prevalence at 26.2% in Germany [7], from 27.9% (England) to 41% (Wales) in the United Kingdom [8], from 29.8% [9] to 43.4% [10] in Italy and 64.2% in North-eastern Greece [11]. The prevalence of ECC according to studies from the Middle East was 75% in Saudi Arabia [12] and 66.9% in Turkey [13]. In Brazil, the ECC prevalence ranged from 41.6% – 67.8% [14].

Due to the widespread prevalence and inhomogeneous reports, it is rather difficult to identify certain risk groups for ECC. However, some authors describe the highest prevalence of ECC among the 3–4-year-old age group. Also, boys seem to be more affected than girls during the age interval of 8 months to 7 years. ECC is reported to be randomly spread in the population, excluding socially disadvantaged groups, where the prevalence is said to be significantly higher [15]. Seow et al. present a similar statement, describing deprived, poor or minority families as risk groups for ECC [16].

**Etiology.** Although the etiology of caries itself is well recognized, the process of developing ECC differs from individual to individual, depending strongly on their genetics, environment, along with family and community factors [17]. Parents play a paramount role in the etiology of ECC since, as primary care givers, they provide nourishment, control the child’s environment and oral hygiene [18]. The age at which sugar is actively introduced into the diet [19], as well

as the frequency, amount and timing of sugar consumption, are the main dietary factors influencing the development of ECC [1]. The excessive use of nursing bottles filled with cariogenic fluids also contributes to ECC, especially among infants and toddlers. Products recognized as being often used in bottles and potentially damaging to teeth are juice, sweetened tea, soft-drinks or flavoured water (containing sugar). The use of nursing bottles containing sweetened fluids as a calming agent or sleeping aid during the night leads to continuous delivery of simple carbohydrates to the oral cavity. In consequence, the oral microorganisms have enough substrate for constant acid production, resulting in increased tooth demineralization [18].

The social background of the parents was also identified as an etiology factor in childhood caries; therefore, children from a low socio-economic background are twice as likely to develop ECC compared to children from high income families [15]. Moreover, the oral hygiene of the parents plays an important role, as children of mothers suffering from dental caries are at greater risk of developing caries themselves [17]. Some studies also identified breastfeeding over the age of 12 months as a risk factor for ECC [20] [21]; however, a systematic review by Moynihan et al. contradicts those findings, stating that breastfeeding up to 24 months of age does not increase the risk of ECC [22].

**Clinical manifestation.** Early Childhood Caries can be classified according to Wyne [23] into three types:

- Type I (mild to moderate) ECC – isolated carious lesion(s) can be observed on molars and/or incisors, usually among children 2 – 5-years-old.
- Type II (moderate to severe) ECC – carious lesions on the labio-oral surfaces of maxillary incisor can be observed. Depending on the patients age, molars may or may not be affected. Mandibular incisors are unaffected. Occurs soon after teeth erupt. Unless controlled, may lead to Type III ECC.
- Type III (severe) ECC – carious lesions affect almost all or all teeth, mandibular incisors are affected. Can usually be observed between the age of 3–5 years.

According to Wyne, the cause for each type The cause for each type, lies mostly in a combination of cariogenic food and poor oral hygiene [23].

The upper incisors are primarily inflicted due to the proximity of the bottle teat and constant contact with sugar-containing beverages. The localization of salivary gland ducts openings also influences the order in which certain teeth are affected by demineralization. The lower incisors, for example, are protected and regularly remineralized by the saliva from the submandibular and sublingual glands. The protection of maxillary incisors, on the other hand, is weaker, resulting in earlier cavities [18].

**Consequences.** Early Childhood Caries, depending on its severity, can be asymptomatic, it can also lead to acute inflammation symptoms, such as swelling, pain or fever. In some cases, treatment is sought quite late, resulting in potentially life-threatening infections and abscesses [2]. The treatment of patients at such a young age often requires sedation or general anaesthesia, since the children are pre-cooperative [24]. Such procedures are directly related to higher risks for the children, greater efforts for the families, together with

substantial cost for the health care system [25]. Apart from short-term consequences, such as the need for hospitalization, systemic antibiotic intake or removal of teeth [17], the children also suffer long-term effects. Llena et al. [26] and Jordan et al. [27] reported that children suffering from ECC develop significantly more caries in the permanent dentition. Additionally, ECC can lead to mineralization defects of the permanent teeth, secondary crowding or delayed/premature eruption of permanent dentition [18]. The loss of molar teeth may result in mastication difficulties, whereas the lack of anterior teeth may cause speech development, as well as biting/eating problems, or lead to tongue malfunctions [24].

**Clinical management.** Primary prevention, beginning before the diseases development, has the potential to reduce the prevalence of ECC [19]. Educating parents or guardians about oral health methods along with preventive therapies has proved to be effective [28]. Parents should be educated that teeth brushing is supposed to begin with the eruption of the first primary tooth. Instruction in the proper teeth brushing technique and, especially in case of older children, informing the parents that they should always help their children while brushing, are also important preventive factors [29]. The use of toothpaste with an adequate dosage is also of great importance in caries prevention. In 2019, the European Academy of Paediatric Dentistry (EAPD) released new guidelines concerning the use of fluoride in children [30]. Table 1 shows the recommended use of fluoride in toothpaste.

**Table 1.** Recommended amount of fluoride toothpaste use in children

Age (years)	(ppm F)	Frequency	Amount	Size
First tooth – up to 2 years	1,000	Twice daily	0.125	Grain of rice
2–6 years	1,000*	Twice daily	0.25	Pea
Over 6 years	1,450	Twice daily	0.5–1.0	Up to full length of brush

\* Toothpaste with dosage >1,000 ppm F could be indicated in cases with high caries risk.

Furthermore, dietary preventive messages ought to include the limitation of free sugar in drinks and food along with exclusion of night-time nursing with milk or fluids containing sugar [19]. Secondary prevention of ECC includes progression prevention and remineralisation of teeth. Effective measures are application of fluoride varnish (up to four times per year) or sealing of pits/fissures by the dentist [31]. Tertiary prevention stops cavitated teeth from breaking down further and includes caries removal with subsequent restoration. Endodontic treatment may also be required, depending on the individual's age [32].

If tooth extraction is necessary, the importance of space holding devices should be stressed. In cases of multiple extractions, prosthetic appliances can ameliorate the patient's life quality by improving function (mastication, speech) as well as aesthetics [33].

**Awareness.** Some studies reported that paediatricians have limited knowledge about caries prevention [34]. Such knowledge, however, can be of primary importance since new parents seek help from paediatricians much sooner during their child's life than from dentists [15]. Also gynaecologists have a great opportunity to educate future mothers in their care about oral health [3].

Awareness concerning children's dental health has been evaluated in several studies which show a limited knowledge of caries preventive measures among parents [3, 35–38]. According to El Karmi et al., only 16% of expectant mothers taking part in the survey thought that primary teeth need brushing [38]. Another study reported 48% of mothers thought that tooth brushing should start from the age of three [36]. Dagon et al. state that 72% of mothers did not know the right fluoride concentration adequate to their child's age [37]. Furthermore, Suprabha et al. presented reports of parents being challenged by the choice of proper dental hygiene instruments (toothbrush, toothpaste) [39].

## SUMMARY

The evidence on Early Childhood Caries concerning prevalence, risk factors, clinical management and prevention is vast. Since it is an entirely preventable disease, the efforts of medical personal should concentrate on limiting ECC through parent education on oral hygiene and appropriate diet for children. By preventing ECC, potentially considerable damage to a child's health can be avoided.

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