

Systematic Review

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Early Childhood Caries: A Preventable Disease

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ABSTRACT

Early Childhood Caries (ECC) is a preventable chronic disease which affects infants and children worldwide. The early detection of ECC can reduce pain, life threatening conditions and helps in the growth and the overall development of the child. The risk factors of ECC include: Mutant Streptococci (MS), dietary and feeding habits, socioeconomic and environmental factors, systemic diseases and certain medications.

The aim of this paper is to systematically review the global burden of ECC, contributing risk factors, preventive and treatment strategies. The literature search was based on published systematic reviews which were focused on diseases burden; heterogeneity of research studies on this subject did not allow a meta-analysis.

KEYWORDS: ECC; Epidemiology; Risk factor; Prevention.

ABBREVIATIONS: ECC: Early Childhood Caries; MS: Mutant Streptococci; WHO: World Health Organization; ART: Atraumatic Restorative Treatment; CDC: Centre for Disease Control and Prevention; AAPD: American Association of Pediatric Dentistry.

INTRODUCTION

Early childhood caries (ECC) is considered to be a big public health challenge for dental professionals' through-out the world.^{1,2} Early childhood caries is defined as the presence of one or more decayed, missing or filled tooth surfaces in any primary tooth of child age 71 months or younger.³ The smooth surfaces of maxillary incisors are commonly involved in initial stage of ECC. There are different terms used for early childhood caries which includes: feeding bottle tooth decay, feeding bottle syndrome, nursing caries, and nursing bottle mouth.⁴ The dangers of excessive bottle feeding, sweetened liquids and prolonged on-demand breastfeeding are highlighted as risk factors for ECC in the literature.⁴ An in-depth understanding and awareness about the natural history of ECC is required so that preventive strategies can be applied in inhibiting and/or reducing dental caries in very young children.^{5,6}

The World Health Organization (WHO) recommends that children should be breastfed up to 24 months of age. Whilst, healthcare professionals and paediatricians recommend that breastfeeding should be continued from birth of the child to one year and beyond. Mothers' desire to breastfeed on child's demand should also be considered.⁷ The prolonged and unrestricted nocturnal breastfeeding is reported to be a potential risk factor for the development of ECC.⁸⁻¹¹ The aim of this paper is to systematically review the literature on global burden of ECC, contributing risk factors, preventive and treatment strategies.

PREVALENCE

A comprehensive review of literature showed that the prevalence of ECC varies across the world, with it being between 1-12% in developed countries and up to 70% in developing countries.¹² The highest prevalence of caries found in Africa and South East Asia.¹³ Whilst in European countries (England, Sweden and Finland) the prevalence is estimated from 1% to 32%^{14,15} and in Eastern Europe it is reported up to 56%.¹⁶ The prevalence of ECC in Canadian general population is less than 5% and in high risk group 50% to 80%.¹⁷⁻¹⁹ The reports from developed countries showed that prevalence of caries is found high among preschooler and severity of the disease is reported more in certain ethnic and immigrant groups, which is a serious concern.^{20,21} In developing world the prevalence of ECC is reported very high. In Far East Asian region, ECC prevalence is reported from 36% to 85%.²²⁻²⁴ In India, it is reported 44% among 8 to 48 months old children.²⁵ The prevalence of dental caries in India among 3 years old children is reported 54.1%, 4 years 42.6% and 5 years 50.7%. About 60.9% of children reported to have one or more carious lesions.²⁶ In Middle East, high prevalence of caries is reported from 22% to 61% among 3 years old children²⁷⁻²⁹ depending up on the severity of the disease.^{30,31} The extent of disease is found different in various socio-economic groups, gender and age of individuals.³² The prevalence of ECC is continuously increasing in low socioeconomic groups due to lack of early preventive measures and availability of adequate treatment facilities.^{33,34} In United States, ECC is the most prevalent chronic disease and unmet health need among children. Ramos and co-workers reported that in predominant Mexican-American population of San Francis co-primary teeth caries is reported 43% in under 5 years old children. In Native American children, the prevalence of ECC is reported from 40% to 72%.³⁴

RISK FACTORS

ECC is a multi-factorial disease. An early infection with *Streptococcus-mutans* group organisms is reported to be a major risk factor for the development of dental caries.³⁵ The determinants of ECC are identified as biological, social, and behavioural; they are reported to cause detrimental effects on dental health and quality of life of children. The high cost of treating ECC is considered to be a significant economic burden on families and health care system in developing countries which can be avoided by adopting appropriate preventive measures and prompt treatment.²⁷⁻³³ A report from CDC (Centre for Disease Control and Prevention) showed that 40% of five years old children are reported to suffer from dental caries and 8% of two years old children are reported to suffer from decayed or previous restoration of teeth.^{36,37}

The risk factors including; age of the child, educational and occupational status of mothers, number of siblings, time of cessation of breastfeeding, high intake of carbohydrate snacks and biscuits are found to be associated with child's oral health. These risk factors lead to development of ECC among preschool

children.

The classic aetiology of ECC involved bacterial, dietary, and host determinants with interplay of multiple sociological and environmental factors.^{38,39} *Streptococcus mutans* and *Streptococcus sobrinus*, are the most common identified causative agents of ECC,⁴⁰⁻⁴² acid-producing pathogens caused damage by dissolving tooth structures in presence of fermentable carbohydrates such as sucrose, fructose, and glucose.^{43,44} Vertical transmission i.e. mother-to-child transmission of cariogenic bacteria and repeated supply of substrate (sucrose) leads to plaque development and early childhood caries.

The formation of plaque and consumption of sugar at bedtime (night) without proper brushing of teeth leads to rapid progression of caries. The feeding on demand with or without cariogenic food and liquid is considered to be a co-factor for early childhood caries development.⁸

The use of baby bottle contributes a central role in aetiology and severity of ECC because of prolonged bottle feeding with sweetened lactose. Most of the studies showed significant correlation between ECC and bottle-feeding during night sleeping with a bottle in mouth.^{8,45,46} It is reported in several studies that most of the mothers preferred to breastfeed their children as compared to bottle feed and only few mothers preferred to use both. Many studies reported that one of the greatest advantages of proper breastfeeding is caries free healthy children.^{8,16,45-50} The exact duration and frequency of breastfeeding and human milk carcinogenicity is still debatable.

Numerous reviews are found to support the notion of frequent and prolonged breastfeeding as a causative factor for ECC, while only a few workers have reported that frequency and prolong breast feeding is a risk factor for caries in general.^{38-43,46,47,51,52} The literature explicitly reports that infant breastfeeding and its duration did not provide any association with increased risk of ECC or S-ECC and the benefits of breast feeding are numerous and cannot be ignored.^{33,53-55} Contrarily, few studies reported that children who never breast fed and children who fed longer than 24 months are more prone to develop ECC. This showed that children who never breastfed are found at risk to suffer from oral diseases and other systemic diseases like GI infections, asthma, atopic disease and diabetes mellitus.^{32,56,57}

The WHO7 recommendations stated that a child should be breastfed up to the age of 24 months. The prolonged nocturnal breast feeding or bottle feeding is found to be a risk factor for early childhood caries (ECC).^{8,10,11,51,58} The study conducted on animals found human milk more cariogenic than bovine milk.⁵⁹

The socio-demographic factors are reported as important risk factors for caries development and progression. Literature documented an inverse relationship between socioeconomic status and incidence and prevalence of diseases.⁶⁰ Among the risk indicators/factors universally identified for early childhood

caries is low socioeconomic status. The total household income is reported as a factor affecting utilization of preventive dental health care services. The high income group utilized more dental services available as compared to low income group.^{38,61-70} The children from low socioeconomic group are reported to consume more sugary edibles and in appropriate dental health practices; using tooth brush, tooth paste, and making routine dental visits. ECC is found more in children who belong to certain ethnic group and racial minorities.⁷¹ As far as gender difference are concerned the decayed, missing and filled teeth (DMFT) score is found similar in most of the studies worldwide.⁷²⁻⁷⁵ The most probable reported reason is dietary and oral hygiene measures which are under the control of parents or care giver.⁷⁶ This increase in severity of dental caries among children is mainly due to mothers behaviour and teaching healthier lifestyles to children from birth.⁷⁶

PREVENTIVE STRATEGIES OF ECC

Dental caries is an infectious disease transferred from mother to child. The understanding of the risk factors such as cariogenic microbes was found helpful in improving the preventive strategies.⁷⁷ The *Streptococcus mutans* transmits vertically from mother or caregiver to child through salivary contact, it is important to examine mothers or care givers teeth so that further transmission of infection to the child can be prevented. A study reported that mothers who had untreated dental decay are found at greater risk of transmitting *Streptococcus mutans* to the newborn.⁷⁸ The preventive interventions for mothers should be designed to reduce the translocation of bacteria from the mother to children and for better oral health of children.⁷⁹

It is a well documented fact that early initiation of brushing of a child helps to maintain good oral hygiene and secure primary dentition from cavity formation. Healthy baby teeth is an assurance that well-maintained primary dentition lead to safe and healthy permanent teeth. The appropriate tooth brushing and use of tooth paste is found to have a valuable outcome on dentition. The habit of brushing with emphasis on proper holding of brush is found equally important in prevention of caries. It is found difficult to train the young child but as the child grows and acquires skill to perform routine activities it is become easier to practice. It is the duty of elders to facilitate the child in learning the right way to clean teeth and proper holding of brush. Several studies reported that child should start tooth brushing independently from two years of age.^{47,65,66,80-85}

To decrease the risk of developing ECC, the American Association of Pediatric Dentistry (AAPD) encouraged professionals to take following preventive measures; to decrease the MS level among mothers to prevent the transmission of cariogenic bacteria to child, the infant should not sleep with a bottle containing carbohydrates, taking oral hygiene measures from the eruption of the first primary tooth, use of fluoridated tooth paste⁸⁴ and parents should be encouraged that infant should start drinking with a cup from the first birthday. Infants should be

weaned from the bottle between 12 to 18 months of age.⁸⁶ Preventive interventions taken up to the six months showed that the proportion of teeth with new decay reduced to 52% in primary teeth and 39% in permanent teeth of children. Moreover, the percentage of newly decayed or restored primary and permanent teeth in children is reduced to 25.4% and 53.2%, respectively.^{87,88}

TREATMENT

ECC is a preventable disease but neglected worldwide. It is a manageable disease if precise information is provided to mothers regarding risk factors and dexterity to treat the young toddler. Oral health education for mothers, early referral and prompt handling of children having signs of dental decay are critically important in promoting dental health of children.

The treatment of ECC is dependent on the disease progression, age of the child and extent of the disease. The social, behavioural and medical factors must be considered while treating children with ECC. Early intervention at first birthday of child is considered ideal.⁸⁹ At this stage, risk assessment should be performed and children found at higher risk identified. The children at moderate risk require restoration of progressed and cavitated lesion, white spot and enamel proximal lesion needs to be treated by preventive methods and monitored for further progression of disease. The children at high risk require early restorative interventions for enamel proximal lesion and intervention for progressed and cavitated lesions to reduce caries development.⁹⁰ The standard treatment for S-ECC is general anaesthesia despite its low risk of complications.

Atraumatic Restorative Treatment (ART) is a procedure based on removing carious teeth tissues using hand instruments alone and restoring the cavity with an adhesive restorative material.⁹¹⁻⁹⁴ ART is a simple technique with many advantages, including reduced,⁹⁵ and no necessity for electricity; and it is more cost-effective than the traditional approaches such as amalgam and no local anaesthesia is needed.⁹⁶ It is therefore indicated for use in children, for managing ECC particularly in developing countries.

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COMPETING INTEREST

The authors declare that they have no conflicts of interest.

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