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Got Caries? Breast milk and Early Childhood Caries?

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Abstract

- **Objective**: To provide an analysis of the association between the longevity of breastfeeding and development of ECC. Determine the optimal time frame in which mothers should cease breastfeeding to reduce ECC development.
- **Methods**: Dr. Brickhouse, PubMed, Google Scholar and other scholarly databases were utilized to find current scientific evidence on the effects of breast milk on ECC. Relevant articles were summarized to write a review of literature. 16 articles published from 2015 to the present date were reviewed and cited.
- **Results**: From the studies, there is strong evidence to support breastfeeding beyond 12 months of age increases the prevalence of ECC. Furthermore, increased frequency and duration of breastfeeding leads to higher incidence of ECC.
- **Conclusion**: Findings indicate dental health care providers should recommend either ceasing breastfeeding at 12 months of age or provide ECC prevention education to caregivers. Further research is required to minimize data discrepancies between US and international countries.

Introduction

According to The World Health Organization (WHO), mothers who breastfeed their children should continue to do so to provide infants with the nutrients they need for healthy growth and development until reaching the age of twenty-four months [1]. While the WHO is a credible source used and quoted by many, recent literature suggests an underlying consequence of breastfeeding for this established duration of time. Much research claims a positive association between prevalence and duration of exclusively breastfed children with ECC development [2].

In the United States alone, one in every ten children are affected by ECC thus making it the number one childhood epidemic in the United States. ECC is defined as the presence of one or more decayed, missing, or filled tooth surfaces in any primary tooth in a child six years of age or younger due to caries. It has been shown that children who initially experience ECC tend to be at an increased risk for further development of ECC in primary and permanent dentition [2]. Additionally, ECC treatment tends to expensive and often requires restorative work or complete tooth extractions at a very young age[3]. Restorations alone necessary to correct ECC cost upwards of $1,000 and when general anesthesia is involved, the dental care cost can increase by $1,000 - $6,000.

ECC have staggering life-threatening implications on childhood health, growth and development. Additional health implications of ECC include early tooth loss, subsequent malocclusion, growth retardation, loss of self-esteem, impairment of quality of life and failure to thrive [3]. Due to the health implications and rising cost of ECC, greater recognition is being placed on effectively promoting oral health with modern treatments

Results

Aim & Importance:
Provide substantial and beneficial resources to expecting, pregnant, and lactating mothers and other caregivers who may not be aware of such information

Factors having no significant impact on the development of ECC:
Age, gender, type of pregnancy and duration of pregnancy [3]

Factors in all of the studies shown to be of significance include:
Type of feeding, duration of feeding, frequency and monthly longevity of feeding

1. Type of feeding:
- -ECC as a multifactorial disease
- -Nocturnal bottle or breast feeding increased risk of developing ECC [4]

2. Duration of feeding:
- -Breast milk is not more cariogenic than formula or cow's milk
- - The frequency and duration of the milk on a child's teeth increases the risk of developing ECC.

3. Frequency:
- -Compared to children with infrequent bottle-use and breastfeeding at twelve months, the children at thirty-eight months had a 1.8-times higher prevalence in ECC when they were breastfed more than three times a day[5].
- -Positive association of ECC with high frequency feeding in late infancy

4. Monthly Longevity:
- -Studies concluded "children breastfed beyond twelve months, a time during which all deciduous teeth erupt, had an increased risk of dental caries" [6].

Additional Contributing Factors:

1. Dental IQ:
- -Higher ECC prevalence among children from low SES status, children belonging to working mothers and children with less educated parents.

2. Biology:
- -Casein, a major protein found in breast milk and formula was determined to be associated with the formation of biofilm.
- -One study concluded casein was involved in the increased prevalence of *S. Mutans* which subsequently led to an increase in biofilm formation [7].

Early Childhood Caries

Figure 1: ECC progression in primary dentition. Image taken from *The Smile Center.* [11]

Meta-analysis

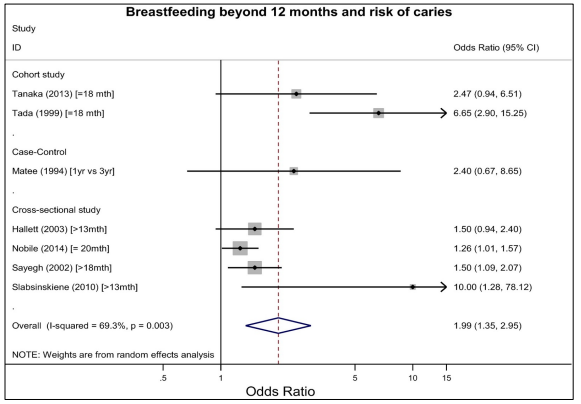

Figure 2: .Meta-analysis of breastfeeding beyond 12 months of age and caries risk [6]

Conclusion & Future Research

- Research shows longer durations of breastfeeding are associated with higher risk of developing dental caries particularly for children: > 12 Months
- There is a lack of data in the US when compared to other international countries therefore, dietary habits and cultural barriers may skew the results regarding Americans and the incidence of ECC

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Got Caries? Breast milk and ECC?

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Abstract:

This review of literature was primarily designed to provide an analysis of the association between the longevity of breastfeeding and the development of early childhood caries (ECC). This topic is of great importance as ECC are a major dental and health concern among all demographic populations. The effect of breast milk on ECC has been a topic of discussion in research and requires further examination to help better inform mothers who present for dental treatment and have questions regarding their child's oral health. The main purpose of this review of literature was to determine the optimal time frame in which mothers should cease breastfeeding to help reduce the development of ECC. The methods used for this review of literature were articles with publication dates ranging from the year 2015 to present, all written in English. This information was obtained through careful evaluation of notable primary and secondary research sources via scholarly databases. To be more specific, meta analysis, cross sectional, and cohort studies, as well as secondary sources were obtained from electronic sources, PubMed and CINAHL Complete databases. Research on this topic revealed longer durations of breastfeeding and night feeding were associated with a higher risk of developing dental caries particularly for children breastfed beyond the age of twelve months and closer to twenty-four months in age. While breastfeeding up to twelve months has been shown to be beneficial to the child, beyond this time the odds of developing ECC are increased. This literature review will help the dental professional comprehend the topic at hand and advise mothers on how to best take care of their child's dentition to prevent cariogenic development during and beyond infancy.

Introduction:

According to The World Health Organization (WHO), mothers who breastfeed their children should continue to do so to provide infants with the nutrients they need for healthy growth and development until reaching the age of twenty-four months [1]. While the WHO is a credible source used and quoted by many, recent literature suggests an underlying consequence of breastfeeding for this established duration of time. In fact, the *Indian Journal of Dental Research* claims a positive association between prevalence and duration of exclusively breastfed children with ECC development [2]. As previously stated, this topic was chosen to be examined as a review of literature in order to provide an in-depth analysis of how breastfeeding truly impacts the manifestation of ECC. More specifically, the goal was to clarify two objectives pertaining to this topic: provide an evidence-based analysis that breastfeeding for an extended period of time increases the risk of developing ECC and determine the optimal time frame for mothers to breastfeed and when to cease to prevent the development of ECC.

In the United States alone, one out of every ten children are affected by ECC. ECC is defined as the presence of 1 or more decayed, missing, or filled tooth surfaces in any primary tooth in a child six years of age or younger due to caries. Consistent evidence reveals the seriousness and societal costs of ECC among families worldwide. It has been shown that children who initially experience ECC tend to be at an increased risk for further development of ECC in primary and permanent dentition [2]. Additionally, ECC treatment tends to expensive and often requires restorative work or complete tooth extractions at a very young age. This can be dangerous and scary when general anesthesia is involved as well as time-consuming for the child and parent [3].

Implementation of anesthetic procedures to treat ECC often results in time away from work for the parents and school for the child. Restorations alone necessary to correct ECC cost upwards of $1,000 and when general anesthesia is involved, the dental care cost can increase by $1,000 - $6,000.

Not only is it costly to correct and treat ECC, but there are staggering life-threatening implications on childhood health, growth and development. As stated in *International journal of clinical pediatric dentistry*, children with ECC were shown to weigh less than 80% of their ideal weight placing them in the lowest 10th percentile for weight [4]. Most likely, this decrease in weight is due to the pain associated with ECC restricting the child from eating normally. The journal of diagnostic and clinical research in Salem, India discusses additional health implications of ECC including early tooth loss, subsequent malocclusion, growth retardation, loss of self-esteem, impairment of quality of life and failure to thrive [5]. Due to the health implications and rising cost of ECC, greater recognition is being placed on effectively promoting oral health with modern treatments. One such program has already taken steps to develop a pilot disease management program in an effort to prevent ECC among children younger than five years of age. At the Boston Children's Hospital dental practice the program's cost effectiveness was assessed and proven to decrease societal costs for treating ECC by up to about $700 [6].

While this is a great step in the right direction, awareness and supply of information is still limited among most Americans and programs such as the one in Boston are limited within the United States. In fact, developing countries across the board are failing to use the modern

technology and resources available to bring adequate awareness to mothers [2]. For these reasons, it was important for the examiners to analyze the current literature and provide detailed research, prevention methods and caregiver instructions to families in an effort to aide in the reduction in the amount of children affected by ECC.

Methods and Materials:

Literature analyzed regarding breastfeeding and ECC came from meta-analysis interpretation, cross-sectional studies, cohort studies and secondary sources. Articles were found and evaluated through scholarly databases and sources such as pubmed, Google Scholar and Dr. Tegwyn Brickhouse, a Pediatric Dentist and professor at Virginia Commonwealth University whose educational focus is on infant oral health and ECC.

Results and Discussion:

In all of the research reviewed, certain factors were found to have no significant impact on the development of ECC. These factors include age, gender, type of pregnancy and duration of pregnancy [5]. Factors in all of the studies shown to be of significance include type of feeding, duration of feeding, frequency and monthly longevity of feeding. In some studies, nocturnal feeding was an important predisposing factor for ECC. In the *Journal of Epidemiology,* researchers found a significant increase in the prevalence of dental caries in children ages eighteen to twenty-three months associated with nocturnal breastfeeding [7]. A recent study conducted by the University of Iowa and found in *Pediatric Dentistry* confirms this finding by stating “bedsharing and nocturnal feeding are associated with an increased caries risk” among

children ages zero to three years old [8]. A final important factor associated with ECC is socioeconomic status. Many studies determined a higher ECC prevalence among children from low socioeconomic status, children belonging to working mothers and children with less educated parents.

The increased risk of developing ECC is known to be associated with physiological factors as well as biological factors, of which can alter a child's normal oral flora. One specific bacteria widely known to be associated with an elevated caries risk is *Streptococcus mutans*. When the oral cavity experiences a decrease in pH due to milk consumption, *S. Mutans* are able to adapt to the increasingly acidic environment and survive, thus resulting in increased risk of ECC. A study conducted by *Indiana University School of Dentistry* investigated the effects of breast milk on *Streptococcus mutans* biofilm formation. The researchers studied four main components of breast milk which includes lactose, lactoferrin, IgA, and casein. Among these four major components and the concentrations analyzed, casein, a major protein found in breast milk and formula was determined to be associated with the formation of biofilm. In fact, the study concluded casein was involved in the increased prevalence of *S. Mutans* which subsequently led to an increase in biofilm formation [9]. This information confirms the current knowledge of the effect breast milk has on ECC through biofilm formation and offers explanation of how ECC develop on the oral cavity. The following studies offer further analysis of results found in literature.

A cohort study conducted by *The Department of Pediatrics, Department of Nutrition and The Department of Preventive and Restorative Dental Sciences* in Brazil analyzed feeding frequency in infancy and its effect on ECC. By obtaining two twenty-four hour infant dietary recalls with mothers, the researchers were able to make correlations at thirty-eight months between early childhood caries and feeding in infancy. Compared to children with infrequent bottle-use and breastfeeding at twelve months, the children at thirty-eight months had a 1.8-times higher prevalence in ECC when they were breastfed more than three times a day. The study also showed at thirty-eight months there was a 1.5-times higher prevalence with combined frequency of bottle and breastfeeding [10]. This study concluded a positive association of ECC with high frequency feeding in late infancy for both bottle usage and breastfeeding.

Another cross-sectional study conducted by the *Department of Child Dental Health, College of Medicine University of Lagos* confirms the above results. This study examined the prevalence of ECC and its association with infant feeding and oral health-related behavior among preschool children. A structured questionnaire regarding oral hygiene practices, dietary habits and breast and bottle feeding were administered to the mothers of children. A dental exam was performed and the status of dental caries was recorded according to the WHO criteria. The prevalence of ECC among 302 children aged 6-71 months was 21.2%. Based on these findings, breastfeeding during the first six months of life shows significantly lowered prevalence in ECC but prevalence significantly increases when the longevity of breast or bottle feeding increases [11]. Additionally, the data showed ECC as a multifactorial disease in which, nocturnal bottle or breast feeding

increased the child's risk of developing ECC [11]. In conclusion, ECC were shown to be significantly higher in children who were bottle or breast fed at night.

A recent meta-analysis study conducted by the *Murdoch Childrens Research Institute and University of Melbourne Department of Paediatrics* aimed to summarize the current evidence regarding the association between breastfeeding and dental caries with specific reference to exposure windows and breastfeeding practices. Through analyzing dental caries health records, observational and experimental studies, statistical significance was determined from the data collected. The first topic analyzed was breastfeeding up to twelve months of age using one cohort study and four cross-sectional studies which reported ratios for the association between children who were exposed to more versus less breastfeeding up to twelve months. The second topic analyzed was breastfeeding after twelve months of age using two cohort studies, one case control study and four cross-sectional studies which reported odds ratios for the association of more or less breastfeeding after the age of twelve months and dental caries. The last study included one cohort, one case-control and three cross-sectional studies which reported odds ratios for the association between more versus less nocturnal breastfeeding and the risk of dental caries. These studies concluded the following "breastfeeding up to twelve months of age is not associated with an increased risk of dental caries and in fact may offer some protection compared with formula" [12]. However, these studies concluded "children breastfed beyond twelve months, a time during which all deciduous teeth erupt, had an increased risk of dental caries" [12]. This study further confirms the correlation between longevity in breastfeeding beyond twelve months and ECC.

In a population - based birth cohort study conducted in southern Brazil, data was collected regarding the average number of decayed, missing and filled primary tooth surfaces (dmfs) as well as the amount of severe ECC present in children of five years of age. Breastfeeding was the main variable observed and collected at the ages of three, twelve, and twenty-four months. Their results showed those who were breastfed up to twelve months had less presence of dmfs than those breastfed for longer than twenty-four months [13]. The study went on to mention the importance of prevention intervention with regards to feeding practices at the earliest point possible. Since breastfeeding is such a benefit for children's health and development, it should not be ceased to prevent ECC, rather prevention strategies should be provided to and implemented by caregivers. The study suggested prevention mechanisms and at home care be investigated to allow for breastfeeding as long as possible while preventing those ECC [13].

Another similar study was conducted by various universities and the *Department of Preventive Dental Science*. It was a cross-sectional study done on healthy urban children from ages one to six on the correlation of the duration of how long children were breastfed and their history of caries to date. Results were the same as the study conducted above with evidence that supports the notion that awareness and guidance for caretakers needs to be addressed and implemented more frequently in order to reduce the ECC rate [14]. This necessity for awareness and prevention implementation especially pertains to those children who are breastfeed beyond the twenty-four month mark [14].

ECC stem from diet and while breastmilk plays a role in a child's diet for a long period of time, eventually it comes to an end and other foods and beverages take its place. In a cross-sectional analytical study conducted by *The Department of Pediatric Dentistry and Dental Public Health* sixty preschool children were split into equal groups according to their caries history. The first group was caries free, second with caries and third with severe caries. Visual dental exams were conducted to collect data on decay, missing teeth due to caries and filled tooth surfaces. Demographic and twenty-four-hour recall dietary intake questionnaires were collected in order to provide association between ECC, age and diet. The caries free children obtained more whole fruits, milk and sodium in their diet, thus giving them higher Healthy Index Eating Scores (HEI-2005 scores). These scores are based off of a variety of healthy whole fruits, vegetables, legumes etc. and the amount the child obtains, ultimately giving those who obtain more of these food groups in their diets a higher HEI-2005 score [15]. This study confirms the correlation between ECC and emphasizes the importance of practicing a healthful diet especially if breastfed for a longer duration of time.

Conclusion & Limitations:

Based on the analysis of these studies it has been determined the great need for parental education regarding the negative effects of improper feeding habits on their children's dentition. Based on a conference paper written for *Pediatric Dentistry*, the only sufficiently evidence based treatment and prevention option for ECC is the use of fluoride dentifrices [16]. Since fluoride is

not accessible to all parts of the country or consumed by all people, this confirms the importance of educational and informative discussions with caretakers about feeding practices to decrease the prevalence of ECC in the United States. Dental professionals need to be prepared to answer questions regarding this topic and should provide informative resources for caretakers regarding the importance of ECC prevention at an early age.

Through the analysis of previous studies, research shows longer durations of breastfeeding are associated with a higher risk of developing dental caries in children who are breastfed greater than the recommended twelve month duration. While breast milk is not more cariogenic than formula or cow's milk, the frequency and duration of the milk on a child's teeth increases the risk of developing ECC. A limitation of this review of literature was a consistent lack of data in the United States compared to other international countries. Further research needs to be conducted on this topic, as results may be skewed due to discrepancies in dietary habits, cultural habits and overall data regarding carogenicities in breast milk. In conclusion, this review of literature has greatly improved the knowledge of the clinicians who examined the data regarding the correlation between breastmilk and ECC. It will further help future dental colleagues and healthcare professionals provide more appropriate instructions to primary care takers regarding infant and child feeding habits.

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