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A Review of Breastfeeding in Infants: Relation to the Occurrence of Early Childhood Caries (ECC)

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ABSTRACT

Introduction: Early caries in childhood or ECC is an early form of dental caries caused by many factors. This is the main target in determining public health promotion. According to the World Health Organization (WHO), breastfeeding is an important factor in reducing infant mortality and malnutrition. Breast milk must be given exclusively for 6 months and continued with breastfeeding accompanied by complementary foods until the age of 2 years. However, breastfeeding is still a debate among researchers, there are several studies that find that breastfeeding in a long time is one of the risk factors for Early Childhood Caries (ECC).

Objective: To review the relationship of breastfeeding with early childhood caries(ECC) in children.

Methods: Scientific evidence and clinical cases were drawn from the literature to support this review and information about the relationship of breastfeeding with early childhood caries (ECC) in children was collected.

Discussion: There are several breastfeeding relationships with early childhood caries (ECC). Some of them are the relationship between the duration of consuming breast milk, the frequency of consuming breast milk, and the time of consuming breast milk.

Conclusion: The relationship between breastfeeding and ECC still needs further research. Variable factors causing caries risk in breastfeeding infants, such as wrong sucking technique, nutrient intake, frequency of breastfeeding, or the condition of the baby's tooth structure need to be followed up as further research material. Education and ways to prevent the occurrence of ECC should be done early which is mainly aimed at pregnant women, nursing mothers and health workers related to maternal and child health. Children's dental and oral hygiene need to be considered since the first teeth erupt, because the risk of caries can occur. The risk of caries in breastfeeding children can increase after the child first gets complementary food, so it is important to educate parents about dental health education on how to maintain oral health in toddlers.

Keywords: Breast milk, Breastfeeding, ECC, Caries

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INTRODUCTION

According to the World Health Organization (WHO), breastfeeding is one of the important strategies for reducing malnutrition and infant mortality. Breast milk is proven to be the best source of nutrition for infants in the early days of life.[1]The best contents of breast milk provide passive protection for children. Epidemiological research shows that children who are breastfed have higher endurance and have a history of lower digestive tract infections than children who are not breastfeeding. In 2003, WHO recommended that early breastfeeding should be given immediately after the birth process, namely by initiating early breastfeeding. Furthermore, breast milk must be given exclusively for 6 months, and continued with breastfeeding accompanied by complementary foods breast milkuntil the age of 2 years.[2]

From various studies it is known that the pattern of breastfeeding in a long time or what is referred to as prolonged breastfeeding has a great risk potential for the formation of early childhood caries (ECC).[3]Early childhood caries (ECC) is the most common dental disease in young children. According to the American Dental Association (ADA), early caries is the presence of one or more damage to teeth with cavity or without cavity, loss of teeth due to caries, or surface filling of deciduous teeth at preschool age (0-71 months).[4,5] Children in the age range 12-30 months have a special caries pattern that is different from older children.[6,7]

Growth rates of children with early childhood caries (ECC) tend to be slower when compared to children without caries. Early childhood caries (ECC) can also be affected by iron deficiency. Many factors affect the occurrence of ECC. Scientific studies show that, there is a relationship between breast milk and the onset of ECC.[3,5]

According to the American Academy of Pediatric Dentistry (AAPD), 70% of children aged 2-5 years have found caries. For years it has been known that after deciduous teeth begin to erupt, the consumption of breast milk during sleep at night and during the day that is too often can cause early childhood caries. Clinically, ECC occurs in children aged 2, 3 or 4 years by following certain distinctive patterns and shapes. This caries experience is related to other social and behavioral factors in the family.[8]

Parents often give improper eating patterns, namely milk containing sugar given when the child is in bed, so that when they fall asleep, the milk liquid will pool on the surface of the maxillary teeth. Lower anterior teeth are usually protected by the tongue so it is rarely affected. It can be seen that cariogenic microorganisms can multiply in the oral cavity due to liquid drinks that contain carbohydrates. Salivary flow decreases during child sleep, so that the

salivary clearance of liquid drinks in the oral cavity is also slow.[4,5,9]

MATERIALS AND METHODS

Scientific evidence and clinical cases were taken from the literature to support this review and information about the relationship of breastfeeding with early childhood caries (ECC) in children was collected.

LITERATURE SEARCH

A systematic review of the literature was carried out looking for all articles published about the relationship of breastfeeding with early childhood caries (ECC) in children. On April 20th2020, a literature search was performed using the following keywords: "Breast milk, Breastfeeding, ECC, Caries." The following databases were searched: PubMed and GoogleScholar.

DISCUSSION

Breast Milk

Breast milkprovides many benefits to children's health, both in terms of nutrition, also in the immune system, psychological, social, economic and environmental development.[9]The content of substances in breast milk can prevent diseases in children, such as diarrhea, infectious diseases, and chronic diseases. Research in 2003 proved that the risk of diarrhea in children aged 0 to 5 months is greater in children who are not given breast milk.[4,5]

The composition of breast milk can change along with the baby's needs. The enzyme content in breast milk helps digestion and antibody substances to prevent infectious diseases. Breast milk contains secretory Ig A (sIgA), lactoferin and lizozym which are important factors of the body's passive immunity.[4,5] Breastfeeding functions as a protection that minimizes the risk of dental caries formation. Breast milk produces relatively little acid in the baby's mouth, so the risk of dental caries in children who are not breastfed is greater than children who are breastfed.[4,10]

The sucking mechanism that a baby does for breastfeeding is different from the mechanism for sucking a milk bottle. Breastfeeding children will suck the mother's nipples and aerola, lip and tongue movements contribute more to squeezing than sucking and the tongue will press the nipples against the palate with peristalsis. Babies with milk bottles will use the tongue with a piston motion to press the pacifier against the palate.[9]

In other circumstances, the habit of pacifying a nipple will increase the likelihood of prolonged on demand breastfeeding. Children will feel very dependent on the mother, so parents will find it difficult to overcome this habit. If ondemand breastfeeding continues, the risk of ECC will increase. It has been proven in several studies that, breastfeeding is proven to minimize the risk of dental caries formation in children, but in some circumstances it appears that breastfeeding can suppress the body's capacity to combat dental caries.[5]

This condition occurs when the milk is given too often after passing the exclusive breastfeeding stage (6 months) or when baby teeth first grow, breast milk is given all night and not followed by cleaning the baby's mouth. The American Academy of Pediatric Dentistry (AAPD) has expressed its support for breastfeeding, although the organization also states that there is a potential risk of dental caries in breastfeeding children as well as children who are given milk bottles.[9,11]

Early Childhood Caries (ECC)

ECC is known as caries in primary teeth in preschool age. ECC is also defined as a condition where one or more dental caries, caries loss and caries on the surface of deciduous teeth in children under 5 years of age.[12,13] Prevalence and severity of dental caries in children under 5 years old in some country is quite high. In Indonesia, the prevalence of caries in children aged 3-5 years continues to increase. In 2001, the prevalence of caries in children aged 3-5 years in DKI Jakarta was 81.2%.[14]

The prevalence of caries in children under five in Indonesia was around 90.05%. Early caries in primary teeth will appear as white spot lesion, often in the upper incisors along the gingival border. White patches that appear are a process of demineralization by acids, which is formed from the fermentation of carbohydrates by bacteria and plaque. This acid will cause the demineralization process to occur and dissolve calcium and phosphate in the enamel and dentin.[15] If left untreated, there will be deeper cavity, brown in color and will cause destruction or damage to the crown of the tooth.[16]

The American Dental Association (ADA) defines ECC when there is one or more damaged teeth which can be cavity or non-cavity lesions, teeth removed due to caries, the surface of deciduous teeth patched in preschool children from birth to 71 months.[13,14]

According to the American Academy of Pediatric Dentistry (AAPD), 70% of children aged 2-5 years have found caries. Over the years it has been known that after deciduous teeth begin to erupt, consumption of bottled milk during sleep at night or during the day that is too often can cause early childhood caries.[15,24]

Clinical Overview of Early Childhood Caries (ECC)

Clinically, type I of ECC (mild to moderate) is the presence of one or several isolated carious lesions involving molars and /or incisors. The cause is usually a combination of semi-solid or solid cariogenic foods and lack of oral hygiene. The number of affected teeth usually increases as a further cariogenic challenge. This type of ECC is usually found in children aged 2 to 5 years.[17]

Figure 1: The initial stages of ECC- lesion can be stopped with fluoride application and improved oral hygiene[18]

ECC Type II (moderate to severe) is a carious lesion on the upper labiolingual surface of maxillary incisors, with or without molar caries depending on the age of the child and the stage of the disease, and mandibular incisors are not affected. The cause is related to the use of inappropriate milk bottles, to breastfeeding or a combination of both, with or without poor oral hygiene. This type of ECC can be found immediately after the first tooth erupts. If not controlled, it can continue to become ECC type III.[13]

Figure 2: Next Stage ECC - requires restoration or tooth extraction treatment.[18]

ECC Type III (severe) is a carious lesion involving almost all teeth including lower incisors. This condition is found between the ages of 3 to 5 years. This condition is severe and generally involves the surface of a tooth that is not affected by caries, for example incisors in the lower jaw.[13]

Figure 3: ECC type III which involves almost all teeth.[18]

Epidemiology

An epidemiological review shows that breastfeeding for more than one year and conducted at night is closely related to an increase in caries prevalence.[2] Research conducted by Chaffee, Felines and Vitolo, that breastfeeding for 24 months or more can increase the prevalence of severe teeth in early childhood in low-income families in Porto Alegre, Brazil.[2,15]

The prevalence of ECC varies in different countries, which may depend on diagnostic criteria. While in some developed countries that have advanced programs for oral health protection, the prevalence of ECC is around 5%. In some southeast European countries (neighboring Kosovo), this prevalence reaches 20% (Bosnia) and 14% (Macedonia). A higher ECC prevalence has been reported for regions such as Quchan, Iran (59%) and Alaska (66.8%).[19]

In American Indian children the prevalence is 41.8%. Similarly, in the North American population, the prevalence of high-risk children ranges from 11% to 72%.[20] National data on dental caries in 2002-2003 in Brazil shows a prevalence of 60% among children aged 5 years.[21] Although the prevalence and severity of caries have declined, no decrease in the rate of early childhood caries has been observed in infants and preschoolers.[22] The prevalence of dental caries in India suffers from dental caries, this disease is common among children, most of them are in rural areas and need dental care.[23]

According to the 2007 Regional Health Research of Indonesia results, the national prevalence of Active Caries was 43.4%. A total of 14 provinces have an active caries prevalence above the national prevalence, namely Riau, Jambi, South Sumatra, Bangka Belitung, In Yogyakarta, East Java, West Kalimantan, Central Kalimantan, South Kalimantan, East Kalimantan, North Sulawesi, Central Sulawesi, Southeast Sulawesi, and Maluku. The national DMF-T index is 4.85. This means that the average tooth decay in the Indonesian population is 5 teeth per person.[25,26] The biggest component is tooth extraction/M-T of 3.86, it can be said that the average population of Indonesia has 4 teeth that have been revoked or an indication of extraction. India reaches 60% - 65% more than 40% of children.[27]

Other studies have shown that dental caries is also related to lifestyle, for example consumption of cariogenic foods and consuming snacks between meals. The risk of caries in children increases with the number of carbohydrates consumed and the increasing frequency of eating. Other studies in India show prolonged breastfeeding increases the risk of greater ECC.[14]

Factors Causingof Early Childhood Caries (ECC)

Dental caries is a disease caused by various factors (multifactorial disease). The main factors that play a role in dental caries include host (teeth and saliva), agent (*Streptococcus mutans*), substrate (cariogenic carbohydrate) and time. The occurrence of dental caries is caused due to the synergy of the four factors. [24,28]

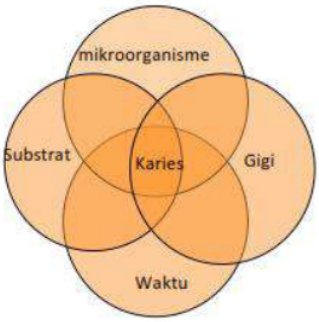

Figure 4: Factors Causing of ECC[28]

The morphology of primary teeth makes primary teeth more susceptible to caries. In addition, the number of carbonate ions in the structure of immature primary teeth causes the tooth structure to dissolve easily by acids. The presence of *Streptococcus mutans* in the mouth is strongly related to the occurrence of dental caries.[6,11,28]Irene found that 2 years old children who have been infected with *Streptococcus mutans* have greater caries activity at 4 years

of age. Other factors such as family socioeconomic factors, parental education level, frequency of cariogenic food, type of food, and child meal time are also factors that influence the prevalence of ECC.[24]

The most dental surface found for caries is the mesial side of the maxillary central incisors. This is caused by the habit of drinking milk while sleeping so that when they fall asleep, the liquid drink will pool on the surface of the maxillary teeth. The lower anterior teeth are usually protected by the tongue so they are rarely affected.[25]

Relationship of Breastfeeding with Early Childhood Caries (ECC) in Children

No.	Authors and Titles	Years	Results	Conclusion
1.	Tanaka K, Miyake Y Association Between Breastfeeding and Dental Caries in Japanese Children.	2012	2056 research subjects (3 years old) The prevalence of caries was found to be higher in the group of children who breastfed for more than 18 months than the group of children who breastfed 6 months to 11 months (p for linear trend <0.0001, p for quadratic trend <0.0001)	Significant results indicate that prolonged breastfeeding increases the risk of caries.
2.	Prakash P,Subramaniam P, Durgesh B, Konde S Prevalence of early childhood caries and associated risk factors in preschool children of urban Bangalore, India: A crosssectionalstudy.	2012	1500 samples (8 months - 48 months) The prevalence of caries is higher in the group of mothers with prolonged on demand breastfeeding than the group of mothers who breastfeed properly (30% compared to 27%)	Longer breastfeeding will reduce the pH of the mouth and will increase the risk of ECC
3.	Irene Dental Caries Risk Simulator Model in Preschoolers.	2008	2656 research subjects pre-school age children There was a significant relationship between breastfeeding for more than 1 year and the occurrence of caries (p <0.0001, OR 1.69.95%	There is a relationship between breast milk and ECC, where the habit of children over 12 months of breastfeeding to fall asleep so as not to clean teeth at night.
4.	Febriana The Role of the Pattern of Breastfeeding (Breast Milk) in Preventing Early Childhood Caries (ECC) in Jakarta.	2012	210 people (51.3%) of the study subjects were breastfed for more than 12 months, 101 people (48.1%) experienced ECC The duration of breastfeeding was 2.76 times greater for children who were breastfed for more than 1 year (p <0.001)	There is a significant relationship between the duration of breastfeeding with ECC How to give breast milk and complementary foods breast milk risk 4 times greater to get ECC.
5.	Okawa R, Nakano K, Yamana A, Nishikawa N, Nakai M, Taniguchi M, et al Evaluation of factors related to nursing caries in 18-month-old Japanese children.	2011	2,506 research subjects aged 18 months (1,295 males 1,211 females) The prevalence of caries in children who breastfeed until the age of 18 months 55.6% (P = 0.0002)	Significant results indicate that children who breast up to the age of 18 months are 6 times at risk for caries.
6	AmaliyaFirdaus, RetnoSetyoIswati	2013	30 respondents at this study population is all mothers and children aged 2-4 years. There is a relationship between exclusive breastfeeding and the	There is a relationship between exclusive breastfeeding and the incidence of dental caries in children aged 2-4 years.

			incidence of dental caries in children aged 2-4 years: α 0.05 (5%) and 95% confidence level obtained 2 counts = 18.8> χ2 tables = 3.841	
7	RahelWahjuniSutjipto, Herawati, danSatitiKuntari Prevalensi early childhood caries dan severe early childhood caries padaanakprasekolah di GunungAnyar Surabaya	2014	65 respondents consisting of children aged 6 months (5 children), 1 year (8 children), 2 years (24 children), and 3 years (28 children). High prevalence of ECC and SECC was found in the group of children aged 3 years. The area of the tooth most commonly affected by caries is the mesial portion of the maxillary central incisors.	The prevalence of ECC in the group of children aged 6 months-3 years in the Anyar Mount area of Surabaya is 30.8%, while the prevalence of SECC is 29.2%.

Several studies have shown that breastfeeding for a long time is a potential risk factor for the formation of ECC. In 2012, Prakash et al showed that prolonged breastfeeding was one of the risk factors associated with ECC. From 554 breastfeeding mothers, 164 were known to have prolonged on-demand breastfeeding with a prevalence of caries of 29.6% and 202 people who breastfed until the age of 1 year of age with a caries prevalence of 26.7%. This proves that, breastfeeding habits of more than 1 year will significantly increase the risk of caries in children. Prolonged breastfeeding will reduce the pH of plaque in the mouth, thereby increasing the risk of ECC.[17]

A Japanese study in 2011 found significant results that breastfeeding until the age of 18 months is one of the risk factors for ECC (p = 0,0002; OR = 6,373). The study concluded that children who breastfeed more than a year, are 6 times more at risk for ECC.[16] Another study in the same year showed 20.7% of caries prevalence had a significant relationship with breastfeeding for 18 months or more.[4] Research in Indonesia years 2008 shows that breastfeeding for a long time is one of the risk factors for caries (POR = 1.73; 95% CI = 1.11-1.67).[11]

In 2012, research in Indonesia showed that the duration of breastfeeding has a significant relationship to the occurrence of ECC (OR> 12 bl = 2.76; 1.82-4.2). The study also showed that groups of children who were givenbreast milkand complementary foods more than 3 times a day had a greater risk of ECC than the group of children who were given breast milk and complementary foods only 2 times a day (OR ed 3x per day = 4.07; 1, 54-10,7).[18] Research conducted by Amaliah et al (2013) shows that the majority of respondents who were given exclusive breastfeeding were 83.33% (5 respondents) did not experience dental caries and a small portion of 16.67% (1 respondent) experienced dental caries, while respondents who were not given exclusive breastfeeding were 95.84% (23 respondents) experienced dental caries and a small portion of 4.16% (1 respondent) did not experience dental caries. Based on the Chi-Square test obtained χ2 count = 18.8> χ2 table = 3.841 which means there is a relationship of exclusive breastfeeding with the incidence of dental caries in children aged 2-4 years.[26]

The correlation between breastfeeding and ECC which shows that there is no relationship between breastfeeding and the occurrence of caries.[19]This study was strengthened by Mahesh et al in 2013, who found that the relationship between breastfeeding and caries cannot be linked because the relationship is very complex. Many confounding factors from various variables such as Streptococci mutans, enamel hypolasia, excess sugar consumption and various other social variables such as parental education history and family socio-economic status.[22] A 2007 Iran study examined the relationship between caries prevalence and consumption habits sugar, in the target population studied there is a norm for prolonged breastfeeding. The results of this study indicate that prolonged breastfeeding does not have a negative impact on oral health (P = 0.5).[21]

Duration of Breast Milk Consumption against ECC

The American Academy of Pediatric Dentistry (AAPD) states that the cause of caries in children is parenting such as the pattern of breastfeeding for a long time, the frequency of administration, and duration (duration of milk in contact with teeth). If not cleaned immediately, as a result carbohydrates in milk fermented by bacteria so that there is damage to the teeth of children. The longer a food/drink containing carbohydrates is in contact with the surface of tooth enamel, the greater the possibility for the length of time the production of acid in the oral cavity. As a result, the rate of acid demineralization from enamel can be directly related to the amount of time the food is attached to the tooth surface.[29,30]

Frequency of Breast Milk Consumption with ECC Status in Children

The high frequency of consuming sucrose increases plaque acidity and heightens the potential for plaque formation and bacterial growth in the oral cavity. Between feeding periods, saliva will neutralize acid and help remineralize teeth through the buffer system. However, if carbohydrate foods and drinks are consumed too often, then the oral cavity will always be in acidic conditions, so that tooth enamel does not have the opportunity to carry out the remineralization process completely, which in turn causes dental caries.

Plaque pH studies conducted by Stephen. This study shows that after consuming sucrose, the pH of dental plaque will decrease from 6.5 to 5.0, which is a critical pH which results in enamel demineralization and lasts for 20-30 minutes, therefore one of the causes of caries is due to repeated contact by dental plaque to sugar over a period of 30 minutes, which results in tooth enamel being exposed to an acidic environment for a long time due to high frequency dietary patterns. Thus, if sugar is consumed with a high frequency per day, the potential for teeth to demineralize is higher, and the potential for caries is also greater.[31,32,33]

Timing of Breast Milk with ECC Status in Children

According to the Vipeholm study individuals who eat foods that are high in sugar content at main meal times and are followed by snacking between main meal hours have a higher potential for dental caries compared to individuals who only eat foods that are high in sugar content only at main meal times without snacking at between meals. Henkin also reports that there is a positive correlation between dietary patterns and the prevalence of caries in children in Hawaii if the frequency of food consumption is between 3-8 times per day. Teeth need about 3 hours to recover from every cariogenic exposure. If the time interval between meals is shortened by exposure to consuming only one milk, then caries can develop significantly.[34,35]

Thus, consumption of sugar between the main meals can cause the pH of dental plaque to be below the critical level for 8 hours which will disrupt the remineralization of teeth. This is related to lactose and sucrose in the rest of the milk that is inundated in the mouth throughout the night will experience the process of hydrolysis by plaque bacteria to become acidic. Consumption of formula milk before bedtime and without children brushing their teeth before going to sleep or after drinking milk, the rest of the milk is not sticky on the surface of the teeth and cause caries. [31,32,36]

CONCLUSION

The relationship between breastfeeding and the occurrence of ECC still needs further research. Variable factors causing caries risk in breastfeeding infants, such as wrong sucking technique, nutrient intake, frequency of breastfeeding, or the condition of the baby's tooth structure need to be followed up as further research material. Education and ways to prevent the occurrence of ECC should be done early which is mainly aimed at pregnant women, nursing mothers and health workers related to maternal and child health. Children's dental and oral hygiene need to be considered since the first teeth erupt, because the risk of caries can occur. The risk of caries in breastfeeding children can increase after the child first gets complementary food, so it is important to educate parents about dental health education on how to maintain oral health in toddlers.

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