

Breast Feeding Patterns and Early Childhood Caries: A Cross-Sectional Study in Rabat

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Abstract

Introduction: Breastfeeding plays a vital role in human development. Its importance is both vital and functional. However, breastfeeding habits have often been identified as one of the etiologies of early childhood caries, which is a global health problem due to its prevalence and its impact on the health status of the child. The objective of this work is to evaluate the relationship between early childhood caries (ECC) and both breastfeeding and bottle-feeding in a child population of Rabat.

Materials and Method: This is a descriptive multicenter cross-sectional study conducted at the Dental Consultation and Treatment Center (CCTD), the Children's Hospital, and Urban Health Centers: (Yaacoub El Mansour, Ennour, El Amal in the city of Rabat). The study involved a convenience sample comprising 236 children aged from 6 months to 6 years. The data were collected through a questionnaire administered by interview technique; which collected socio-demographic determinants, breastfeeding practices, knowledge, and attitudes. A clinical examination of the children's dental status was conducted in a conventionally according to the recommendations of the World Health Organization (WHO) for oral health surveys. Data were analyzed by SPSS 13.0 software (Chicago, IL, USA), and statistical analyses were considered significant if $p < 0.05$.

Results: The prevalence of caries in our sample was 61.9%, with an average DMF (Decayed, Missing, filled) index of 3.76 and a median of 2 [0-7]. This prevalence increased statistically significantly with age ($p=0.000$) as well as in breastfed children [63.7%, $p=0.037$] compared to those who were bottle-fed alone or alternated bottle and breast. Unlimited bottle feeding and sleeping at the breast during breastfeeding in children aged from 6 months to 3 years also appeared to have a statistically significant relationship with the prevalence of caries, with values of 100% ($p=0.048$) and 75.8% ($p=0.05$) respectively. A statistically significant relationship was also found between caries prevalence and oral hygiene ($p=0.000$).

Conclusion: Our study shows that, according to WHO references, the DMF index in our sample is "average". The prevalence of caries would be related to the mode and frequency of breastfeeding. The statistical study revealed that breastfeeding was more incriminated in ECC than bottle-feeding or mixed breastfeeding and that falling asleep with a bottle of milk was responsible for early childhood caries, more than falling asleep at the breast.

Since the 1990s, the Ministry of Health in Morocco has established a National Oral Health Program, aimed at preventing common oral diseases, mainly among school children. The results of our study reinforce the idea that it would be relevant to extend this prevention program to the preschool age. Furthermore, special attention should be given to breastfeeding habits, and prevention and awareness messages should be delivered, regularly reinforced, to pregnant or breastfeeding women.

Keywords: Breastfeeding-early childhood caries-prevalence

Introduction

Breastfeeding is the feeding of the newborn or infant with the mother's milk. It provides the baby with the necessary needs until the age of 6 months.

It is said to be exclusive when the newborn or infant receives only breast milk to the exclusion of any other solid or liquid food, including water.

Breastfeeding is qualified as partial when it is combined with other foods such as milk substitutes, cereals, sweetened or unsweetened water, or any other food. It is the majority if milk provides at least 80% of the child's needs, a medium if it provides 20% to 80% of these needs, and low if it provides less than 20% [1]. For many years, WHO and UNICEF have emphasized the importance of breastfeeding and have made great efforts to revitalize it where it is in decline, solve the problems that may lead to its abandonment, and improve the

health and nutrition of infants and young children, through general nutrition and maternal and child health programs [2].

Formula feeding is a method of breastfeeding in which the child is given commercial infant formula or other breast milk substitute, without being breastfed at all or receiving human milk. It is a method that necessity led to its discovery and that time and experience have perfected.

Indeed, the progress in techniques and hygiene has made infant formula available to mothers since the 1930s, whose constant improvement, added to the evolution of morals and the constraints of modern society, has facilitated its diffusion [3, 4].

In Morocco, breastfeeding declined in the 1980s in favor of artificial feeding. Between 1992 and 1997 the rate of exclusive breastfeeding decreased from 62% to 46%. According to the 2011 National Population and Family Health Survey, only 27.8% of infants are exclusively breastfed for

the first six months of life, and 26% receive early breastfeeding within the first hour after delivery. [5, 6].

All this testifies to the interest of this study to highlight the existing relationship between breastfeeding patterns and early childhood caries (ECC) Early Childhood Caries (ECC) is a particularly virulent form of dental caries that specifically affects the temporary dentition of preschool children. The term is supplemented with an "S" (ECC-S) to mark the severity of the pathology (table1) [7, 8, 9].

Several terminologies have been used to describe it, such as "baby bottle caries", "creeping caries", "prolonged caries".. [10] The American Academy of Pediatric Dentistry (AAPD) in turn, defines ECC as "the presence of one or more carious lesions (cavitory or not), the loss of a tooth (due to decay), or the presence of filled teeth in the temporary dentition in a child younger than six years of age".

The table below summarizes the AAPD definition of early childhood caries in 2016 [11].

Table 1: Early Childhood Caries (dmf: decayed missed filled)

Early Child Hood Caries	
d≥1, m≥1, f≥1 on any temporary teeth in a child 71 months or less	
Early Caries in Young Children at A Severe Stage	
-Before 3 years: any sign of tooth decay or	
-From 3 to 5 years old: d≥1, m≥1, f≥1 on the temporary maxillary incisors or	
dmf ≥ 4 to 3 years	} on any other temporary tooth
dmf ≥ 5 to 4 years	
dmf ≥ 6 to 5 years	

Method

This work corresponds to a cross-sectional observational study, with descriptive and analytical aims. It was carried out at the Rabat Dental Consultation and Treatment Center, the Rabat Children's Hospital (Traumatology Department), and the MCDs (Mother and Child Department) of the Yaacoub El Mansour, Ennour, and El Amal Health Centers. The main objective of the study is to evaluate the relationship between breastfeeding habits and early childhood caries, to compare the prevalence of caries in breastfed and bottle-fed children; in an infant population under 6 years of age.

The sample consisted of 236 male and female children between 6 months and 6 years of age (in temporary dentition or set of teeth), in good general health without any current medication, whose mothers agreed to participate in the study after information and oral consent.

All children with at least one permanent tooth, all children with a general pathology or receiving treatment, and all children who had not yet been weaned were excluded from the survey.

This Survey was conducted using a Questionnaire that allowed us to collect the Information Necessary for our Study

- Frequency of breastfeeding
- Mode of breastfeeding
- Oral hygiene

Data were collected by interview technique. The examination material consisted of oral examination trays, tongue depressors, gloves, masks, saliva swabs, and paper towels. Data were entered using Excel 2010 and analyzed by SPSS (Statistic Package for Social Science) 13.0 for Windows

(Chicago, IL, USA). Categorical variables were expressed as numbers and percentages. Quantitative variables with an asymmetric distribution were expressed as median and interquartile ranges. Analyses and associations between different categorical variables were studied using the following statistical tests: The Chi-square test and Fisher's exact test. The significance level was set at $p < 0.05$.

Results

Among the 236 children, 46.6% were (Dental Consultation and Treatment Center) CCTD consultants, 39.8% were Rabat Children's Hospital's (RCH) consultants and 13.6% were MCDs. 52.5% of the children were male, compared to 47.5% female. 85.2% of the children were from low socioeconomic families, the rest were of average socioeconomic status.

The sample was divided into 2 groups A and B, because of the variability between temporary teething (6 months to 3 years) and temporary set of teeth (3 years to 6 years). Children aged 6 months to ≤ 3 years (group A) accounted for 30.5% of the sample and those aged >3 years to 6 years (group B) accounted for 69.5%

In group A, 58.7% of the children were exclusively breastfed, 28.9% were mixed breastfed, and 12.4% were exclusively bottle-fed. In group B, 56.7% of the children were exclusively breastfed, 26.2% were mixed breastfed, and 17.1% were exclusively bottle-fed.

According to the distribution of the frequency of breastfeeding and bottle-feeding, in group A, out of 71 exclusively breastfed children, 98.6% were breastfed ad libitum, and 1.4% were breastfed 3 to 4 times a day. Of 15 bottle-fed children, 53.3% were fed at will, 26.7% more than 3 to 4 times a day, and 20% 3 to 4 times a day. In group B, out of 93 exclusively breastfed children, 93.5% were fed at will, 5.4% more than 4 times a day, and 1.1% 3 to 4 times a day. Out of 29 bottle-fed children, 69% were fed at will, 24.10% more than 4 times a day, and 3.40% for those breastfed 3 to 4 times a day as well as those breastfed less than 3 times a day.

In the case of mixed breastfeeding, in group A, 54.3% of the children were breastfed more frequently, 42.9% were breastfed and bottle-fed at the same frequency, and 2.9% were bottle-fed more frequently; whereas in group B, those breastfed more frequently represented 57.1% and 42.9% were breastfed and bottle-fed at the same frequency.

Between 6 months and 3 years of age, more than half of the children (67.8%) fell asleep with the breast. 9.1% of these children fell asleep with the bottle, 8.3% of them fell asleep with both the breast and the bottle, and 14.9% used neither the breast nor the bottle to fall asleep.

Between 3 and 6 years of age, 52.4% fell asleep with the breast. 14.6% of these children fell asleep with a bottle, 11% fell asleep with both a breast and a bottle, and 22% did not use either a breast or a bottle to fall asleep.

In the case of bottle-feeding, formula milk was consumed either alone by 21.5% of the children, combined with drinks by 9.9%, or combined and/or alternated with cow's milk by 9.9% of the children. The percentage of cow's milk combined with drinks consumed in the bottles was 1.7% in group A; and in group B, formula combined and/or alternated with cow's milk represented 39.4%, followed by formula consumed alone, with a percentage of 32.4%.

In group a, 55.7% and 60.8% of the children were breastfed and bottle-fed respectively until 18 and 24 months; then in group B, 54.4% of these children were breastfed, and 50% were bottle-fed until 18 and 24 months.

Questionnaire responses reported that 33.1% of children cleaned their teeth for those aged 6 months to 3 years; 59.1% of mothers reported that their children brushed their teeth in group B.

Mothers reported cleaning their child's teeth once a day for children aged 6 months to 3 years. 58.8% of the children brushed their teeth only once a day, 26.8% twice a day, and 14.4% three times a day. In the morning, only 8.7% of the children reported brushing their teeth before meals while 91.3% did so after meals. All children who brushed at noon, in the afternoon, and the evening did so after meals. 97.5% of the children used a toothbrush during brushing, 1.7% of the children's mothers used pads or towels to clean their child's mouth, and 0.8% used finger massage.

After a dental examination of the children, 61.9% had cavities compared to 38.1% of the children who were free of cavities. 27.3% of the children aged 6 months to ≤ 3 years had caries compared with 72.7% of the children who were unscathed; 75.6% had caries compared with 24.4% of the children who were free of caries in group B. The children who had a zero DF index represented 72.7%, followed by the children who had a DF index equal to 2 and 4 who

represented 5%. The distribution of the DMF index among children in group B shows that children with a zero DMF index make up 24.4%, followed by children with a DMF index equal to 2, who represented 12.2% (Table 2).

The analysis of all the information collected revealed a relationship between age and the DMF index with $p=0.00$, then between the mode of breastfeeding and the ECC with $p=0.03$.

In this sample, it was found that whatever the mode of breastfeeding, (breast, bottle, and mixed) the relationship with the ECC is the same. (Respectively $p=1.00$, $p=1.00$ and $p=0.30$).

On the other hand, a significant association between the frequency of bottle-feeding and ECC in children aged 6 months to ≤ 3 years was noted ($p=0.04$).

Investigation of the association between ECC and sleepiness during breastfeeding revealed a statistically significant association in children from 6 months to ≤ 3 years of age ($p=0.05$).

We found a statistically significant association between ECC and poor oral hygiene ($P=0.00$). No association between ECC and the socioeconomic level was found ($P=0.34$).

Table 2: Table showing the distribution of breastfeeding mode, breastfeeding frequency, brushing frequency and caries prevalence according to age group

Item	Group A (6 months-3 years) 72 children or 30.5%			Group B (3 years-6 years) 164 children or 69.5%		
	Breast	Feeding Bottle	Mixed	Breast	Feeding Bottle	Mixed
Distribution of groups by breastfeeding mode	58.7%	12.4%	28.9%	56.7%	17.1%	26.2%
Breastfeeding Frequency						
-As often as needed	98.6%	53.3%		93.5%	69%	
-At least 3 to 4 times a day	1.4%	46.7%		6.5%	30.9%	
Sleeping while breastfeeding	67.8%	9.1%	8.3%	52.4%	14.6%	11%
Brushing Frequency	100%			58.8%		
-1 time						
-2 times						
-3 times and more						
Caries prevalence df/DMF Index	df : 2 to 4, or 5% for 27.3% of caries			DMF : 2 or 12.2% pour 75.6% of caries		

Discussion

WHO and UNICEF recommend exclusive breastfeeding until 6 months of age, after which breast milk should be supplemented with an appropriate complementary food until the age of two years. However, no more than 35% of infants worldwide are exclusively breastfed for the first four months of life, which is insufficient for the child [12].

In our sample, both breastfeeding modes are equally present, with a slight predominance of breastfeeding (55.8% for children aged 6 months to 3 years and 56.7% for children aged 3 to 6 years). Children exclusively breastfed had more caries (63.7%) than children exclusively bottle-fed (15.1%) or both bottle and breastfed (21.2%), with a statistically significant difference ($p=0.037$; $p<0.05$).

This observation has also been reported by other studies such as SOWOLE and al. [40] and VACHIRAROJPISAN and al. in Thailand [32], who also found that the prevalence of caries and the risk of early caries were higher in exclusively breastfed children. However, QADRI and al. in Syria [13] found that bottle-feeding was associated with a higher prevalence of caries in children.

On the other hand, SUBRAMANIAM and al. in India [7], EL ARABI and al. in Morocco [14], ROSENBLATT and al. in Brazil [15], BAGHER and al., ALMUSHAYT and al. and

ALHUSSYEEN and al. in Saudi Arabia [16,17] found no relationship between breastfeeding mode and ECC in preschool children.

Breast milk is the richest, most complete, and most suitable for infants. However, its poverty in remineralizing ions (Ca: 33 mg/100mL and P: 15 mg/100mL) compared to cow's milk (Ca: 125mg/100mL and P: 96mg/100mL), and its high lactose content (5.7 g/dl versus 4.5 g/dl in cow's milk), are favorable characteristics for the development and cariogenic activity of *mutans* streptococcus, which may explain our result [18] [19] [20,21]. The divergent results reported by other authors [7, 15, 16, 17] prompted us to investigate other parameters to evaluate the relationship between breastfeeding and ECC or DF/DMF, such as frequency, bottle content, sleepiness during breastfeeding, and oral hygiene.

In the present study, when analyzing the association between breastfeeding frequency and ECC (DF/DMF index), the highest prevalence of caries was observed in the children fed at will; however, no statistically significant association was found. These results are consistent with those of SHRUTHA and al. in India who, using a sample of 2000 children aged 3 to 5 years, found no statistically significant association. The same is true for OLATOSI and al. [22] in a study carried out in Nigeria.

The study of the relationship between the frequency of bottle-feeding and the prevalence of caries in children aged 6 months to 3 years showed that these children had more caries when they were breastfed ad libitum, and the association was statistically significant ($p=0.04$). This is in agreement with many studies, notably those of FELDENS and al. in Brazil [23, 24], STEPHEN and al. in India [25], and HALLETT and al. in Brisbane [26].

This result differs from that of ZHOU and al. in China [27] who found in their study in 394 children aged 2 years, no correlation between the frequency of bottle feeding and caries (>3 times per day or ≤ 3 times per day) and early caries in children.

Under normal feeding conditions, milk alone is not considered to be a cariogenic food. However, repeated exposure and frequent intake of fermentable carbohydrates lead to higher acidity, which will extend the duration of oral pH below the demineralization threshold of 5.5, preventing the action of salivary buffering systems. Under these circumstances, the period of demineralization lasts 11 hours before returning to a normal pH, and therefore breastfeeding on demand can be equated with nibbling [28,29].

In this study, an investigation of the association between ECC (DF/DMF index) and falling asleep while breastfeeding revealed a statistically significant association in children aged 6 months to 3 years. Children who fell asleep at the breast had a higher prevalence rate than those who fell asleep at the bottle. HELDERMAN and al. in Asia [30] in a study of 198 children aged 25 to 30 months found the same result.

In contrast, other studies such as DE MELO and al., SANTOS and al. in Brazil [31][32], MWAKAYOKA and al. in Tanzania [33], and LIDA and al. in the United States [34] found no effect of falling asleep during breastfeeding on ECC.

This is not in agreement with the results of studies in India, notably those of SUBRAMANIAM and al. [7], HALLETT and al. [35], STEPHEN and al. [36], and OLATOSI and al in Nigeria [37] who concluded that sleeping with the bottle had a role in the occurrence of early caries in young children with a significant result. This is due to the decrease in salivary flow and swallowing reflex during sleep, as well as the presence of carbohydrates contained in bottled milk which may remain in the mouth, thus allowing prolonged contact with the dental surfaces and thus favoring the initiation of caries.

In our study, the highest prevalence of caries was observed in children who were breastfed until 18 and 24 months of age, with no significant difference ($p=0.20$) for the association between ECC (DF/DMF) and age of breast weaning; $p=0.46$ for the association between ECC (DF/DMF) and age of bottle weaning.

YONEZU and al. in Japan [38] noted that children breastfed until 18 months of age were 3 times more likely to have dental caries at the age of 2 years than those weaned before 18 months. SLADE and al. in Australia [39] also reported the same result without significant difference.

In the same sense, SOWOLE and al. in Nigeria [40] in their study of children from 6 months to 5 years of age also found that the prevalence of caries tended to increase with longer bottle-feeding up to 18 months of age, after which it decreased, but no causal relationship was established in their studies.

Other studies have found that breastfeeding beyond 24 months may have a negative effect on oral health leading to the development of ECC, such as PERES and al. in Brazil [41] who noted that breastfeeding ≥ 24 months gives high values of caries prevalence in children at the age of 5 years. Their

study was based on a sample of 1303 children. Other studies are STEPHEN and al. in India [25], ZHOU and al. in China [27], and KHADRA-EID and al. in France [42]. Indeed, there is no uniformity regarding the definition of "prolonged breastfeeding", which makes it difficult to make an absolute comparison between the different studies as well as any conclusion.

Comparing breastfeeding and formula feeding, the highest prevalence is represented by children exclusively breastfed until 18-24 months (51.6%) compared to those bottle-fed (45.3%). As we have seen in the first part, breast milk contains a higher level of lactose than cow's milk [43]. Lactose is a carbohydrate with low cariogenic potential, but it is fermentable because it can cause a decrease in pH when it comes into repeated and prolonged contact with the teeth. Many studies have confirmed the role of good oral hygiene in the prevention of caries [44], and our study investigated this aspect. More than half of the children do not brush their teeth. This figure is alarming compared to studies in countries with similar development [45, 46].

A statistically significant association ($p<0.01$, $p=0.000$) was found when analyzing oral cleaning and ECC (DF/DMF index). However, the latter did not decrease in the presence of brushing in children aged 3 to 6 years, which may be explained by poor brushing technique or irregular brushing. In addition, some parents confirmed that the onset of decay in their children is a trigger for brushing, while others consider brushing as a treatment for tooth decay that can stop its progression.

This result is in agreement with ROSENBLATT and al. in Brazil [47], RAITIO and al. in Finland [48], PAUL and al. in Saudi Arabia [49], and BRENNAN and al. in Australia [50].

Conclusion

Taken together, the results of this study have an interesting clinical significance: The prevalence of caries was 61.9% with a median of 2 [0-7]. These figures are clearly high when keeping in perspective the biological consequences and financial burden of treating early caries in children, which confirms the relevance of implementing preventive activities for this age group.

Other factors have been confirmed as a risk for early caries in young children like the advancement of the child's age. The prevalence of caries increased with age from 27.3% in children aged 6 months to 3 years to 75.6% in those aged 3 years to 6 years. Exclusive breastfeeding, bottle-feeding at will, and sleeping at the breast while breastfeeding, are considered risk factors for caries damage. Nevertheless, it should be remembered that early caries in children is a complex and multifactorial infectious disease. So, further studies are needed, preferably longitudinal ones, to assess its relationship with breastfeeding habits. In addition, future studies will need to evaluate additional information, in order to unify the speeches regarding breastfeeding risks, as well as to draw definitive conclusions about the caries patterns of children with ECC and their control groups.

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