RISK FACTORS FOR EARLY CHILDHOOD CARIES (ECC) IN 2-5 YEARS OLD CHILDREN

2-5 Yaş Arası Çocuklarda Erken Çocukluk Çürüklerine Neden Olan Risk Faktörleri

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ABSTRACT

Purpose: The aim of this study was to determine the association of dietary habits and socioeconomic status for early childhood caries (ECC) among 2-5 years old children.

Materials and Methods: A total of 200 children (aged 2-5 years) were examined for gender, dmft, dmfs, dietary and brushing habits, duration and contents of bottle feeding, number of family individuals, educational level and occupation of parents and socioeconomic status. Statistical analysis was performed by using NCSS 2007 software and one-way ANOVA, tukey test, t-test, chi-square test were performed between the groups.

Results: According to the results, 62.7% of the children had a history of bottle-feeding. Gender, number of main meal and drinking milk before sleeping were positively and total income was negatively associated with bottle feeding (p=0.031, p=0.017, p=0.038, p=0.0001). For children which were using bottle, the mean average of dmf and dmfs scores were 9.88, 15.5 respectively. Statistically significant differences were found between dmf, dmfs scores and bottle feeding (p=0.0001). Only breast feeding, only feeding bottle and bottle with breast feeding were significantly associated with dmf and dmfs scores (p=0.0001). Anterior caries pattern was significantly high for bottle feeeding than only breast and bottle feeding and only breast feeding (p=0.0001). Socioeconomic status was found significantly associated with dmf and dmfs scores (p=0.004, p=0.036).

Conclusion: ECC was more prevalent in preschool children especially who were in low socioeconomic status. It was concluded that night-time breast-feeding in children, using of a bottle at night and during the day correlated with the etiology of ECC.

Keywords: *Early childhood caries, primary teeth, dental caries*

ÖZ

Amaç: Bu çalışmanın amacı 2-5 yaş arası çocuklarda erken çocukluk çürükleri (EÇÇ) ile beslenme alışkanlıkları ve sosyoekonomik durum arasındaki ilişkinin karşılaştırılmasıdır.

Gereç ve Yöntem: Toplam 200 çocuk (2-5 yaş arası) cinsiyet, dmft, dmfs, beslenme ve fırçalama alışkanlıkları, biberon ile beslenme süresi ve biberon içeriği, ailede ki birey sayısı, anne ve babanın eğitim düzeyi ve iş durumu ile ailenin sosyoekonomik durumu gibi parametreler açısından değerlendirilmiştir. İstatistiksel değerlendirmede NCSS 2007 yazılımı kullanılmıştır; gruplar arası karşılaştırmalarda tek yönlü ANOVA, tukey testi, t-testi ile ki-kare testi uygulanmıştır.

Bulgular: Çalışmanın sonucunda çocukların % 62.7'sinin biberonla beslenme öyküsü bulundu. Biberonla beslenme ile cinsiyet, ana öğün sayısı, uykudan önce süt içme sıklığı arasında pozitif; toplam gelir düzeyi arasında negatif yönde istatistiksel olarak anlamlılık bulundu (p=0.031, p=0.017, p=0.038, p=0.0001). Biberon kullanan çocuklarda ortalama dmf ve dmfs skoru sırasıyla 9.88, 15.5 olarak saptandı. Dmf ve dmfs skorları ile biberon kullanımı arasında istatistiksel olarak anlamlı farklılık bulundu (p=0.0001). Sadece anne sütü ile beslenme, sadece biberon ile beslenme ya da hem anne sütü hem de biberonla beslenme ile dmf ve dmfs skorları arasında istatistiksel anlamlılık saptandı (p=0.0001). Ön dişlerde çürük görülme sıklığının biberon ile beslenen çocuklarda, sadece anne sütü ile beslenen ya da her ikisi ile beslenen çocuklara oranla anlamlı derecede yüksek olduğu izlendi (p=0.0001). Sosyoekonomik durum ile dmf ve dmfs skorları arasında istatistiksel anlamlılık saptandı (p=0.004, p=0.036).

Sonuç: EÇÇ'nin özellikle düşük sosyoekonomik durumu olan okul öncesi çocuklarda daha yaygın olarak görüldüğü saptanmıştır. EÇÇ'nin etiyolojisinde; geceleri anne sütü ile beslenme, gece boyunca veya gün içerisinde biberon kullanımı önemli rol oynamaktadır.

Anahtar kelimeler: *Erken çocukluk çürükleri, süt dişleri, diş çürükleri*

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Introduction

Dental caries is defined as a chemical dissolution of the tooth mineral resulting from metabolic events taking place in the dental biofilm covering the affected area. These events are the caries process, while the resulting caries lesion is the sign of the disease. Some components of the caries process act at the tooth surface (saliva, biofilm, diet, fluoride), while another set of determinants of the process act at the individual level (a person's behavior, knowledge, attitude, education, socioeconomic status, income) (1).

The development of dental caries is considered to involve a triad of indispensable factors: bacteria (dental plaque), carbohydrates (the diet), and susceptible teeth (the host). These factors interact in a certain period of time, causing an imbalance in the demineralization and remineralization between tooth surface and the adjacent plaque (biofilm) (2-4).

Dental caries (decay) is one of the most prevalent chronic childhood diseases worldwide and is a major problem both from a population health perspective and for individual families who have to deal with a young child suffering from toothache (5-9). According to the 2007 Report by the Centers for Disease Control and Prevention (the most current report to date), cavities have increased for toddlers and preschoolers. Cavities in children ages 2 to 5 increased from 24 percent to 28 percent between 1988-1994 and 1999-2004 (10). For children ages 2 to 5, 70% of the caries is found in 8% of the population (11).

Given time, the interaction of cariogenic microorganisms and fermentable carbohydrates (sucrose) may induce demineralization, which can progress to loss of tooth structure/cavitation (12). The disease of ECC has been defined as "the presence of 1 or more decayed (noncavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces" in any primary tooth in a child 71 months of age or younger (13-15). In children younger than 3 years of age, any sign of smooth-surface caries is indicative of severe early childhood caries (S-ECC). From ages 3 through 5, 1 or more cavitated, missing (due to caries), or filled smooth surfaces in primary maxillary anterior teeth or a decayed, missing, or filled score of ≥4 (age 3), ≥5 (age 4), or ≥6 (age 5) surfaces constitutes S-ECC (13, 16).

Early childhood caries lesions affect initially the primary upper incisors and they clinically appear as white spots along the gingival margin. In advanced cases, the crowns can be completely destroyed. Since the first caries lesions can develop as soon as the primary upper incisors erupt, it is very important that parents and caretakers are able to recognize the first clinical signs of the disease (17).

The American Academy of Pediatric Dentistry (AAPD) declared that breastfed and bottle-fed infants are at a potentially devastating risk for caries due to breastfeeding. This is related to prolonged and repetitive feeding without proper oral hygiene, and is also related to the fact that parents are encouraged to offer their infants beverages in drinking cups before their first year of life and to stop bottle-feeding them between 12 and 14 months of life. Similarly, the American Academy of Pediatrics considers that infants who are put to bed with the bottle or who breastfeed during the night are at great risk for dental caries (14).

The etiology of ECC is multi-factorial, and the exact interplay of risk factors in different communities remains controversial

(6). There are numerous risk factors significantly related to early childhood caries (ECC). The most important are probably high frequency intake of sugary snacks and drinks, and sweetened feeding bottles, particularly used during the night (18). Epidemiological data show that the most effective approach for the control of early childhood caries is based on the prevention and not on the restorative treatment. The ideal conduct would be to provide expectant mothers with counseling and guidance, since one of the greatest difficulties related to the control of early childhood caries is the fact that few parents take their children to the dentist before the age of three years. Severe early childhood caries (S-ECC) refers to a more progressive and acute pattern of childhood caries, and the term was developed to identify the children with the highest level of disease in each population (15). Children with S-ECC are those who are more likely to present pain, chewing difficulties, speech problems, general health disorders and psychological problems (19, 20).

ECC is more commonly found in children who live in poverty or in poor economic conditions who belong to ethnical and racial minorities, born to single mothers, of parents with low educational level, especially of illiterate mothers. In this population, prenatal and perinatal malnutrition or undernourishment are the cause of enamel hypoplasia; oral hygiene is usually poor; exposure to fluorine is probably insufficient and there is a greater preference for sugary foods (21).

Clinical outcomes for treatment of ECC are often poor, and several studies have reported that 23% –57% of children treated under general anesthesia require further treatment for new carious lesions within months. Untreated ECC can lead to harsh consequences such as abscesses, pain,

malocclusions and lasting psychosocial impediments (22).

The aim of this study was to determine the association of dietary habits and socioeconomic status for early childhood caries among 2-5 years old children.

Materials and Methods

This study was approved by the Ethical Committee of Istanbul University, Medical Faculty. A total of 200 children (boys and girls) living in different areas of Istanbul, Turkey were randomly selected according to age and order of arrival in Istanbul University Faculty of Dentistry, Department of Pedodontics between 2008-2010 years. Data were collected by means of visual clinical examinations, preceded by short interviews with the mothers. The parents were previously informed about the study aims and their informed consents were maintained. Permission was received from the appropriate authorities.

Mothers were first interviewed with a questionnaire and after that, the child was examined. The questionnaire covered background factors such as child's gender, df, dfs, dietary and brushing habits, duration and contents of bottle feeding, number of family individuals, educational level and occupation of parents and socioeconomic status.

A total of 200 children (aged 2-5 years) were examined. Clinical examination was performed by a sole examiner (MK) using disposable mouth mirrors for indirect vision of lingual areas of the teeth, and torch light. Mouth mirrors were used for indirect vision of lingual areas of the teeth. During the examination, the older children were seated on a chair and infant were examined with assistance of their mothers', by means of

the "knee-to-knee" technique. Gauze pads were used to clean and dry teeth surfaces before examination. A dental surgeon was sitting close to the examiner so that the codes could be easily heard and recorded correctly. Radiographs were not taken due to practical reasons. The WHO criteria (1997) for carious lesions were used to diagnose caries (23).

Statistical Analysis

The clinical and questionnaire data were analyzed using Statistical Package for the Social Sciences (SPSS), version 12.0 for Windows. The percentage of caries-affected and caries-free children within each variable category was compared using cross-tabulation procedure and the relative proportions within each group were analyzed using the chi-square test of association. For comparisons between the groups, simplex variance analyze applied and for comparison of the subgroups, Tukey test was used. In the above tests, "p" value of <.05 was considered as statistically significant.

Results

The data were collected for 200 children (110 boys and 90 girls) aged 2-5 years. ECC was diagnosed in 102 children (51%) and the mean dmft was 2,34.

According to the results, 62% of the children had a history of bottle-feeding. Gender, mother education, number of main meal, drinking milk before sleeping and total income were associated with bottle feeding (p=0.031, p=0.004, p=0.038, p=0.017, p=0.0001) (Table 1).

Table 1. Statistical "p" values of gender, occupation, education, total income and feeding habits.

	Gender	Father occupation	Father education	Mother occupation	Mother education	Total income	Feeding before sleeping	Main meal	Snack	Brushing
X^2	4.63	1.97	0.87	4.44	11.27	19.91	5.65	6.56	2.28	3.14
p	**0.031**	0.373	0.646	0.108	**0.004**	**0.0001**	**0.017**	**0.038**	0.517	0.076

Total income is significantly high and duration of breast feeding is significantly low in bottle feeding group (p=0.0001) (Table 2).

Table 2. Comparison of bottle using with age, total income, number of individuals in the family and duration of breast feeding.

	Bottle (+)	**Bottle (-)**	**t**	**p**
Age	5.27±1.59	4.92±1.32	1.61	0.109
Total income	1009.2±504.47	735.33±237.49	4.41	**0.0001**
Number of individuals in the family	4.29±1.55	4.03±1.52	1.16	0.247
Duration of breast feeding	1.61±0.49	1.84±0.37	-3.54	**0.0001**

Statistically significant differences were found between dmf, dmfs values and feeding habits. dmf and dmfs values were found significantly high in bottle feeding group. Only breast feeding, only feeding bottle and bottle with breast feeding were significantly associated with dmf and dmfs scores (p=0.0001) (Table 3).

Table 3. Comparison of df, dfs values with feeding habits.

	Breast feeding	**Bottle feding**	**Breast+bottle feeding**	**F**	**p**
df	6.31±2.49	12.00±3.10	9.68±3.59	32.01	**0.0001**
dfs	8.85±4.87	18.36±6.92	15.22±8.24	21.55	**0.0001**

Dmf and dmfs values were found significantly low in bottle feeding group with high total income (p=0.004, p=0.036) (Table 4).

Table 4. Comparison of bottle using with total income and df, dfs values.

Total income		**< 500 TL**	**600-1000 TL**	**1000-1500 TL**	**>1500 TL**	**F**	**p**
Bottle (+)	**df**	12.25±3.19	9.38±3.56	9.38±3.41	8.92±3.33	4.76	**0.004**
	dfs	19.75±7.4	14.7±8.44	14.58±7.66	13.23±7.05	2.94	**0.036**
Bottle (-)	**df**	6.44±2.74	6.16±2.37	7±2.58	9.56±4.71	0.27	0.766
	dfs	9.56±4.71	8.36±5.09	9.5±3.79		0.53	0.59

Anterior caries pattern was significantly higher in bottle feeding group than the other groups (p=0.0001). Posterior caries pattern was found high in bottle + breast feeding group but there was no significance (p=0.093) (Table 5 and Figure 1).

Table 5. Comparison of caries pattern with feeding habits.

		Breast feeding		Bottle feeding		Breast and bottle feeding		
Anterior	No	41	54.70%	0	0.00%	4	3.50%	χ^2:71.28
	Yes	34	45.30%	11	100.00%	110	96.50%	**p=0.0001**
Posterior	No	14	18.70%	3	27.30%	11	9.60%	χ^2:4.76
	Yes	61	81.30%	8	72.70%	103	90.40%	p=0.093
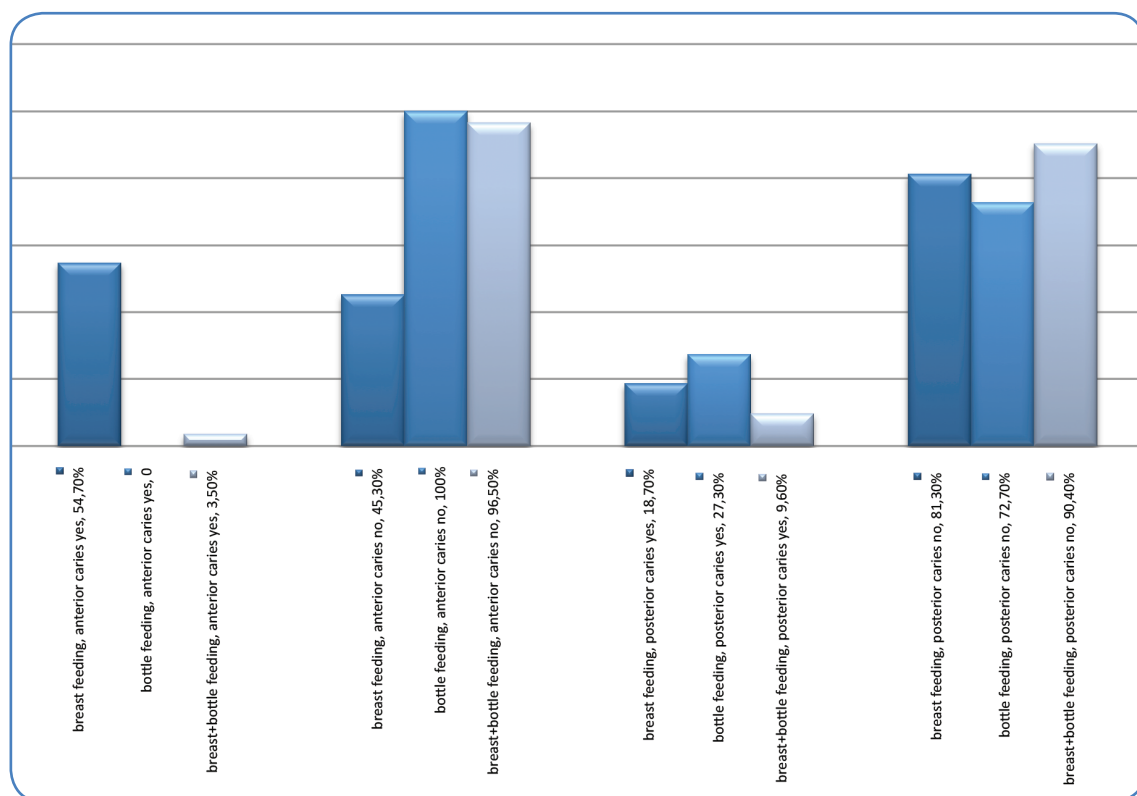
Figure 1. Caries pattern according to feeding habits.

Milk with sugar was the most used nutrient (%32) when compared with the other contents of bottle (Figure 2).
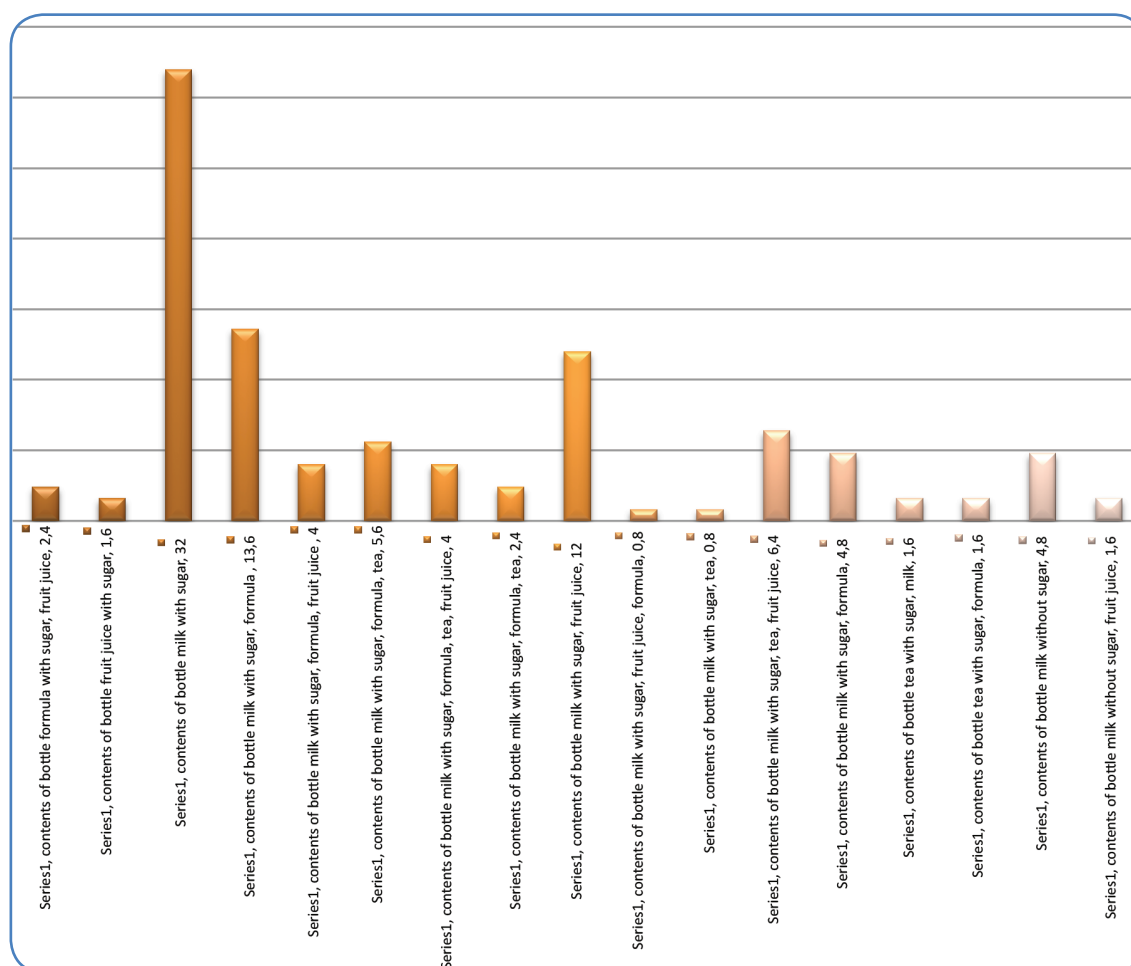
Figure 2. Contents of bottle.

Discussion

While the collective oral health of children has improved over the past several decades, between 1988-1994 and 1999-2004, the prevalence of caries in primary teeth increased for youths aged 2 to 11 years.3 For 2 to 5 year olds, the prevalence increased from approximately 24% to 28% (21, 24). ECC, a serious public health problem, is prevalent in low socioeconomic groups, but also is found in the general population (25). In this study, 18 of the 102 children (17.6%) demonstrated ECC, and 84(82.4%) were caries-free. The mean dmft among the whole group was 0.57 teeth.

Prolonged or on demand breast-feeding has been implicated in the development of ECC. The American Academy of Pediatric Dentistry's policy on breast-feeding states that: Although breast-feeding is essential in providing the best possible nutrition to infants, the AAPD cautions that frequent breast-feeding at night and on demand after eruption of teeth may be implicated in contributing to the development of ECC (26). Frequent bottle feeding at night, ad libitum breast-feeding, and extended and repetitive use of a non-spill training cup are associated with, but not consistently implicated in, ECC (27). While ECC may not arise from breast-milk alone, breast-feeding in combination

with other carbohydrates has been found to be highly cariogenic (28). The severity of ECC is associated with poor feeding habits (29). Because poor feeding practices alone will not cause caries, previously used terms such as "baby bottle tooth decay", "bottle mouth", and "nursing decay" are misleading (25).

Although many authors (29-31) report an association between nocturnal bottle-/breast-feeding and early childhood caries, Santos and Soviero (17) stated in their study that it was not possible, to assure this association. In their study, more than 55% of the children who were bottle-/breast-fed at night did not develop caries. They concluded that; this result suggests that other factors also contributed to the establishment or prevention of the disease.

In reality most babies are fed with a nursing bottle for at least some of the time and yet as Horowitz (32) points out most of them do not develop ECC. Two bottle-related behaviours have attracted most interest in ECC research – the use of bottles at night/nap time and the use of the bottle beyond 12months. Reisine and Douglass (33) found little strong evidence to support either of these ideas and suggest that this paucity of evidence may be due to the use of retrospective parental self-reports. The alternate explanation they offer is that the critical period may be soon after the eruption of teeth into the mouth and that early use of the bottle containing sweet fluids supports the early establishment and dominance of cariogenic microflora. This may be more important than bottle use after 12 months. Litt et al. (34) that the use of the bottle at night-time was associated with sugar intake. The mothers who reported night-time bottle use were also more likely to have children with a higher sugar intake (9).

In this study, 62,7% of the children had a history of bottle-feeding. Statistically significant differences were found between df, dfs values and feeding habits. df and dfs values were found significantly high in bottle feeding groups.

The frequency of intake of sucrose is more important than the total amount consumed. A review of the role of substrate in ECC by Reisine and Douglass (33) found that the total weight of sugar in children's diet was not predictive of dental caries; however, the frequency of sugar intake was. Frequent consumption of sugar favours the establishment of cariogenic bacteria and provides continuous substrate that influences the initiation and progression of the caries (9). Tyagi (35) stated in the study that; another important criterion is the content of the bottle and % 63 of children who were bottlefed were using other substances like Horlicks, sweet water, and juices. Added sugar is one of the important factor that provides the carbohydrate source and when used for prolonged periods can promote high acid production by mutans streptococci (36). In this study, more than half of the children participated to the study (62.7%) were bottle-fed and it was determined that milk with sugar was the most used nutrient (%32).

Although the development of dental caries can be linked to specific actions or behaviours, SES and income level may be animportant determinant of ECC (37). Despite being widely studied in other age groups there are few contemporary reports dealing with SES and its association with dental caries in preschool children. A study investigating dental caries prevalence in preschool children (5months to 4 years) in Arizona found that caregivers' level of education and reported family income were negatively associated with ECC (38).

There is a strong inverse correlation

between incidence of ECC in children and the socioeconomic status of the families of those children. That is, children with ECC tend to come from low-income or lower socioeconomic backgrounds (39). Tang et al. (38) confirm that the children with parents in the lowest income group had mean decayed, missing, and filled teeth (dmft) scores four times as high as children with parents in the highest income group. The cost of ECC treatment, particularly in ECC cases in which restoration or extraction is needed, is extremely high for these low-income families- of ten times these families are unable to make dental care a priority over what is seen as more pertinent day-to-day costs. Thus, children in families with lower socioeconomic status are more likely to have their caries left untreated or are likely to have incomplete dental care.

Reisine and Psoter's (40) systematic review identified strong evidence of a consistent and significant inverse relationship between SES and caries in children under 6 years. This relationship was weaker but still significant in the 6–11 age group. A cross-sectional Australian study of the dental caries among 4– 5 year olds in North Brisbane reported a significant linear increase in caries prevalence with decreasing SES as measured by annual family income (41). In this study; df and dfs values were found significantly low in bottle feeding group with high total income (p=0.004, p=0.036). But there was no significant differences between without bottle feeding group and total income (p=0.766, p=0.59)

A study of 149 predominantly Hispanic children in the San Francisco area showed a significant correlation (inverse) between mother's level of education and presence of ECC; 73% of the children had parents with less than high school education (20). A study in Canada shows children of parents with university education had less than half the average number of mean decayed, missing, and filled teeth (dmft) scores of children who had parents with only elementary school education (42). In another study of families with children with ECC, only 22% of parents reported having knowledge of or information regarding ECC — despite the presence of ECC in one or more of their children (43). In this study, 62,7% of the children had a history of bottle-feeding. Mother education was associated with bottle feeding (p=0.004)

Santos and Soviero (17) reported in their study, other surveys have not found statistically significant associations between hygiene frequency and caries (44, 45). However, hygiene quality, evaluated through the presence of biofilm, was the risk factor most strongly associated with the prevalence of caries. From the children who had thick biofilm, 75% presented with caries, against 44.8% of those who had thin biofilm and 4.2% of those who presented with no visible biofilm. Other studies have also concluded that the accumulation of biofilm was the main risk factor for dental caries in children under 3 years old (17, 44). These results reveal the need for a better guidance of parents and caretakers on how to carry out effective oral hygiene in children. More important than the habit of tooth brushing many times a day is the ability to disorganize the biofilm, at least once a day. The majority of the children (95, 93%) did not have their teeth regularly cleaned. Out of the seven children whose mothers reported teeth cleaning, six used a toothbrush and fluoridated toothpaste, and one used only water, five of the seven children had their teeth cleaned twice a day, morning and evening. Of these – 53% cleaned teeth daily, 18.6% did so three times a week, and 28.4% less than three times a week.

Conclusion

According to the results, ECC was more prevalent in preschool children especially who were in low socioeconomic status. It was concluded that night-time breast-feeding in children, using a bottle at night and during the day correlated with the etiology of ECC.

Encouraging parents to take their children to the dentist before the age of 1 year, so that they can be provided with guidelines for caries prevention, seems to be the most effective way to prevent and control early childhood caries.

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