



Risk factors associated with early childhood caries – a case control study

Marina de Deus Moura de Lima^a, Zacarias Soares Brito-Neto^a, Heylane Oliveira Amaral^a, Cacilda Castelo Branco Lima^a, Marcoeli Silva de Moura^a, Lúcia de Fátima Almeida de Deus Moura^a

ABSTRACT

Objective: The aim of this study was to determine the risk factors associated with early childhood caries (ECC).

Methods: It was an observational retrospective case-control study. The case group consisted of all patients diagnosed with ECC in the records of an active program of maternal and child care. The control group was composed of an equal number of children, matched for gender and age, who attended the program and did not have ECC. The process of data collection consisted of completing a pre-established schedule to analyse variables related to the mother/caregiver and child. Statistical analysis was performed using the chi-squared and odds ratio (OR), with alpha (α) = 0.05.

Results: History of caries in the mother (OR=2.61; CI 95%=1.45-4.67) and father (OR=1.72; CI 95%=1.02-2.89) were key determinants in the child being diagnosed with ECC.

Conclusions: The risk factors associated with ECC were the following: no oral hygiene acceptance, nocturnal feeding duration of more than 16 months, a daily intake of sugar greater than 4 times a day, a Baume type II maxillary arch, fewer than 3 consultations with the program, and a history of decay in the parents.

Key words: Dental caries; Child; Risk factors

^a Department of Pathology and Dental Clinic, Postgraduate Programme in Dentistry, Federal University of Piauí, Teresina, Piauí, Brazil

Fatores de risco associados à cárie precoce da infância – estudo caso-controlado

RESUMO

Objetivo: O objetivo deste estudo foi determinar os fatores de risco associados à cárie precoce da infância (CPI).

Metodologia: Foi um estudo observacional retrospectivo caso-controlado. O grupo caso consistiu de todos os pacientes diagnosticados com CPI nos registros ativos de um programa odontológico de atenção materno-infantil. O grupo controle foi composto por um número igual de crianças, pareadas por sexo e idade, que participaram do programa e não tinham CPI. O processo de coleta de dados consistiu no preenchimento de uma ficha pré-estabelecida para analisar as variáveis relacionadas à mãe/cuidador e a criança. A análise estatística foi realizada utilizando o teste do qui-quadrado e razão de chances (OR), com alfa (α)=0,05.

Resultados: A CPI foi associada à história de cárie na mãe (OR=2.61; IC 95%=1.45-4.67) e no pai (OR=1.72; IC 95%=1.02-2.89).

Conclusões: Os fatores de risco associados à CPI foram: não aceitação higiene oral, duração da alimentação noturna de mais de 16 meses, ingestão diária de açúcar superior a 4 vezes ao dia, arco superior tipo II de Baume, menos de 3 consultas ao programa, e história de cárie nos pais.

Palavras-chave: Cárie dentária; Criança; Fatores de risco

Correspondence:

Marina de Deus Moura de Lima
mdmlima@gmail.com

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INTRODUCTION

Early Childhood Caries (ECC) can be defined as the “presence of one or more decayed tooth surfaces (non-cavitated or cavitated), lost or restored in children younger than six years” [1]. ECC is considered a public health problem because it is highly prevalent, it is preventable, there is effective treatment available and its sequelae cause physical and emotional disorders in individuals [2,3]. Moreover, it has been shown that children with ECC have a worse quality of life related to oral health than those free of the disease [4,5]. Several preventive strategies have been used in recent decades to reduce the prevalence and severity of dental caries in the world, including the use of fluoride in its various forms of applications and the implementation of public policies regarding educational and preventive changes [6]. Epidemiological studies on the primary dentition have not reported the same decline in the prevalence of dental caries in permanent teeth examined, and these studies note an increase in the average decayed-missing-filled teeth (dmft) index, with high proportions of untreated carious lesions occurring up to five years of age [7,8].

The assessment of social and environmental factors that directly interfere with the development of ECC can significantly contribute to identifying patients at risk and aid consequent implementation of public services that work in an interdisciplinary way to treat a multifactorial disease of unknown aetiology. The age range of children with ECC should be prioritized by current public health policies [8,9].

Although non-biological factors associated with ECC have been previously identified, those associated with the caregivers are not fully understood [10]. The determination of risk factors associated with ECC allow the development of strategies to work with problem solving, treatment, control and prevention of the disease refer to both children with the disease and those exposed to risk situations.

From this perspective, a group of professors at the Dentistry School, Federal University of Piauí (UFPI) started a university extension project on April 27, 1997 in Teresina, Piauí, Brazil – the Preventive Program for Pregnant Women and Babies (PPPWB) – whose goals are focused on the recovery and maintenance of the oral health of pregnant women and children aged zero to 36 months. The program's activities are developed at the Institute of Social Perinatology, Piauí (ISPP) by students of the undergraduate dental course at UFPI under the supervision and guidance of professors [11].

The objective of this study is to determine the risk factors associated with ECC and to determine the prevalence of ECC in the Dental Care Program Maternal and Child Health at Federal University of Piauí.

METHODS

This observational retrospective case-control study was ethically conducted in accordance with the Declaration

of Helsinki. It was initiated after approval by the Ethics Committee in Research of the Federal University of Piauí (UFPI) (CAAE: 0240.0.045.000-10).

To determine the groups, all records of a maternal and child care program [11] were inspected to select all patients diagnosed with ECC according to the criteria of the American Academy of Pediatric Dentistry [1].

The control group was composed of an equal number of children, matched for gender and age, at random, who attended the same program and were not diagnosed with ECC.

The data collection was performed by the review of the records and then the data were transcribed to a form designed specifically for this study. We analysed the following variables related to the mother / caregiver: identity of the caregiver for most days, number of prenatal visits, the education of father and mother, family income, whether the mother visited a dentist during pregnancy, whether the mother received dental education during pregnancy, individual who performed the oral brushing on the child, history of caries in the mother or father. The following variables regarding the children were evaluated: gender, age, whether the child was born at full term, birth weight, whether the child lives with both parents in the same house, when the child began practicing oral hygiene, whether oral hygiene is accepted, duration of exclusive breast feeding through the night, whether the child used a bottle during sleep, daily intake of sugar, maxillary and mandibular arch type (12) and the number of dental program queries.

Sugar intake was assessed by analysing the daily food recall (24 hours), and scores were defined as follows: high (intake of sucrose on demand or more than 6 times), medium (intake of sucrose between 4 to 6 times) and low (intake of sucrose up to 3 times). Data regarding the dmft index values were transcribed to form the study as a continuous variable.

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS)[®] version 17.0 (SPSS Inc, Chicago, USA) using the chi-square (χ^2) homogeneity, with alpha (α)=0.05 (significance level). To assess homogeneity between the study groups regarding variables related to the mother/caregiver and the child, a chi-squared test was used (confidence interval 95%). To carry out the preliminary exploratory analysis, variables were transformed into binary form and tested for association with the presence of caries, using the chi-squared test and odds ratio (OR) with a confidence interval of 95%, applied to each variable separately.

The study preserved only those variables whose effect was significant ($p < 0.05$) for the occurrence of caries. Multivariate logistic regression was performed for each variable individually, starting from the one with the largest odds in the univariate analysis. In the final model, we kept only those variables statistically associated with the event.

RESULTS

Table 1 describes the sample distribution according to gender and age of patients with Early Childhood Caries. 50.38% were male and 49.62% female. The average age was 2.72 years (± 0.693), and 39.24% in the age 1-2 years old and 46.79% were aged 3-4 years old.

The teeth most frequently affected by ECC were: upper incisors, and first molars (Graphic 1).

Of the 3,374 records contained in the active dental program binder, 140 (4%) presented in dental chart teeth with white spot lesions and 390 (11%) were cavitated or lost due to caries or restored. Thus, the prevalence of program the ECC was 16.0%.

The average value of the dmft in patients with ECC was equal to 3.25 ($SD \pm 3.62$) and the value of the modified dmft index, including active white spot lesions, was equal to 4.08 ($SD \pm 3.28$).

It was observed that 322 children (61%) in the ECC group already had carious lesions at the first visit, and 208 (39%) did not have the disease. A total of 125 (60%) were diagnosed after 2-3 visits, 65 children (31%) were diagnosed after 4-6 visits and 18 children (9%) were diagnosed after seven or more visits.

Univariate analysis of variables related to the development of the early childhood caries is shown in Table 2.

In Table 3, it can be seen that a history of caries in the mother ($OR = 2.61$; $IC\ 95\% = 1.45-4.67$) and father ($OR = 1.72$; $IC\ 95\% = 1.02-2.89$) were key determinants in the child being diagnosed with ECC. Conversely, oral hygiene acceptance ($OR = 0.35$; $IC\ 95\% = 0.22-0.56$), no longer feeding nocturnally by the age of 16 months ($OR = 0.51$; $IC\ 95\% = 0.39-0.65$), intake of sugar less than or equal to 4 times a day ($OR = 0.37$; $IC\ 95\% = 0.15-0.95$), a Baume

type I maxillary arch ($OR = 0.45$; $IC\ 95\% = 0.26-0.78$), and having a number of queries greater than or equal to 4 ($OR = 0.49$; $IC\ 95\% = 0.29-0.82$) were determinants of a lower chance that the child would be diagnosed with ECC.

Table 1. Sample distribution according to gender and age of patients with early childhood caries

Age (years)	Gender		Female	
	Male	Female	N	%
< 1	N	%	N	%
< 1	2	1.0	2	1.0
1-2	93	35.0	115	43.0
3-4	131	49.0	117	45.0
≥ 5	41	15.0	29	11.0
Total	267	100.0	263	100.0

Graphic 1. Distribution of teeth affected by ECC.

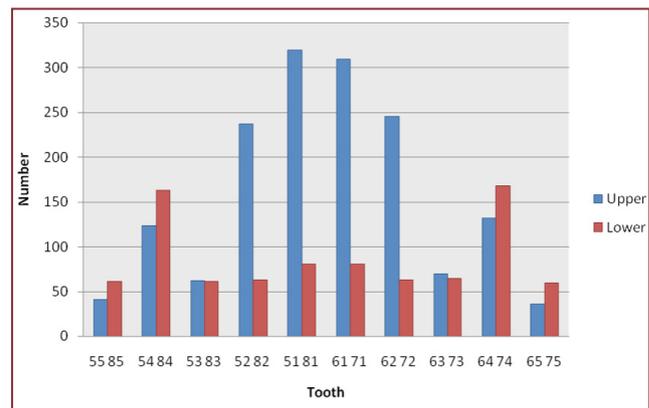


Table 2. Univariate analysis of variables related to the development of the early childhood caries.

Variables	Case		Control		P
	N	%	N	%	
Identity of the caregiver for most days					0.246
Mother/father	438	86.9	431	84.2	
Other person	66	13.1	81	15.8	
Number of prenatal visits					0.697
≤ 3	12	2.7	15	3.4	
> 3	429	97.3	426	96.6	
Mother's education (years of formal study)					0.002
< 11	250	48.1	202	38.5	
≥ 11	270	51.9	323	61.5	
Father's education (years of formal study)					< 0.001
< 11	294	59.3	226	47.2	
≥ 11	202	40.7	253	52.8	
Family income (minimum wage)					< 0.001
< 2	97	18.5	47	9.0	
≥ 2	426	81.5	477	91.0	

(continue)

Table 2 (conclusion)

Variables	Case		Control		P
	N	%	N	%	
Appointment at dentist during pregnancy					<0.001
Yes	153	31.8	206	44.2	
No	328	68.2	260	55.8	
Attended a dental lecture during pregnancy					0.008
Yes	169	32.8	208	40.8	
No	347	67.2	302	59.2	
Individual who performed oral brushing on the child					0.423
Parents	485	94.4	472	95.9	
Child	08	1.6	02	0.4	
Other person	21	4.1	18	3.7	
Age when child began to brush teeth					<0.001
Before the 1st tooth erupted	239	45.6	336	69.0	
After the 1st tooth erupted	285	54.4	151	31.0	
History of caries in the mother					<0.001
Yes	457	89.1	362	73.9	
No	56	10.9	128	26.1	
History of caries in the father					<0.001
Yes	419	81.5	300	66.2	
No	95	18.5	153	33.8	
The child was born at full term					0.175
Yes	389	92.0	433	89.1	
No	34	8.0	53	10.9	
Birth weight (pounds)					0.500
< 2500	48	11.3	48	9.9	
≥ 2500	377	88.7	436	90.1	
The child lives with both parents in the same house					0.888
Yes	409	83.5	419	83.8	
No	81	16.5	81	16.2	
The child used a bottle during sleep (months)					0.157
No use	384	74.4	365	70.9	
< 6	12	2.3	09	1.7	
≥ 6	120	23.3	141	27.4	
Number of dental program queries					0.010
1-3	354	67.3	395	74.5	
≥ 4	172	32.7	135	25.5	
Oral hygiene acceptance					0.028
Yes	253	48.1	277	55.0	
No	273	51.9	227	45.0	
Breastfeeding duration (months)					<0.001
< 6	135	26.1	201	41.0	
≥ 6	382	73.9	289	59.0	
Duration of night-time breastfeeding (months)					<0.001
≤ 16	203	40.1	280	57.0	
> 16	303	59.9	211	43.0	
Daily sugar ingestion					<0.001
≤ 4 times	106	20.2	303	57.5	
> 4 times	420	79.8	224	42.5	
Maxillary arch type [Baume, 1950]					<0.001
Type I	132	35.0	145	48.7	
ype II	245	65.0	153	51.3	

Variables unanswered were considered missing.

Table 3. Logistic regression model of variables related to the development of the ECC. (Adjusted odds ratio)

Variables	OR*	(CI**·95%)	p-value
Oral hygiene acceptance			
Yes	0.35	0.22-0.56	<0,001
No	1		
Duration of night-time breastfeeding			
≤ 16 months	0.51	0.39-0.65	<0,001
> 16 months	1		
Daily sugar ingestion			
≤ 4	0.37	0.15-0.95	0.04
> 4	1		
Upper maxillary arch (Baume, 1950)			
Type I	0.45	0.26-0.78	0.005
Type II	1		
Number of appointments in the program			
1-3	1		
≥ 4	0.49	0.29-0.82	0.006
History of caries in the mother			
Yes	2.61	1.45-4.67	0.001
No	1		
History of caries in the father			
Yes	1.72	1.02-2.89	0.04
No	1		

* OR: odds ratio; ** CI: Confidence interval.

DISCUSSION

Early childhood caries is a preventable disease. Therefore, the determination of the risk factors related to ECC is very important because individuals with greater susceptibility to its development can be identified, and greater attention can be directed to them [9,13].

The present study has limitations inherent in a retrospective study; the main difficulty was related to the incompleteness of the records, but the statistical analysis excluded all variables that were not providing results from the calculations, minimizing the bias analysis.

The prevalence of ECC observed in the study population was 16%, which may be explained by the fact that most patients seek care in dental program after parents have observed the presence of cavitations, as well as the fact that most children in our study were still breastfeeding on demand (Table 2). The prevalence of ECC in the general population is not well defined because the cases used may not represent the general population in this age group. The cases used included children who seek dental treatment, and there were methodological and conceptual differences that may hinder the comparison of results [14].

A greater prevalence of ECC was detected in children aged 3-4 years (Table 1). The age group with lower prevalence of ECC was < 1 year, confirming the results of Tiberia et al. [15]. For ages ≥ 5 years, we observed a lower prevalence (15%

and 11% for males and females, respectively) because the dental program aims to serve individuals up to 4 years of age, and older patients are referred for care to the Children's Dental Clinic of UFPI.

We note, however, that the process of motivation and oral health education is slow and gradual, so returning to dental program more than three times represented a protective factor in the development of dental caries (Table 3).

In this study, there is a greater possibility of children having a dmft index equal to zero when parents have a high educational level, so the oral health of children is a reflection of the attitudes and behaviour patterns of the parents [16]. In fact, the education level of parents has been previously considered an important socioeconomic indicator related to the prevalence of ECC [9,17].

The development of carious lesions is directly related to the chronology of tooth eruption. The pattern of involvement of ECC is characteristic and pathognomonic for the condition (Graphic 1). The four lower incisors usually remain intact due to their location, which allows for self-cleaning and protection of the tongue, and also due to their proximity to the ducts of the sublingual glands, which allows for salivary protection. The four upper incisors are the teeth most affected because they are the first erupting in the maxilla and are strategically more exposed to the process involved in the initiation and progression of caries. Because bottle or breast milk ingested during sleep remains stored between the upper lip and upper incisors, there is an enabling environment for the cariogenic process to occur [18].

The results of this study showed that breastfeeding for a period greater than 16 months represents an important risk factor for the development of ECC (Table 3). Thus, after the eruption of the first teeth, mothers should be advised to suspend night-time feedings [1]. Feldens et al. [19] found that breastfeeding does not represent a risk factor if it occurs only once or twice a day. White et al. [20] stated that the lack of clarity and standardization of breastfeeding in the form of studies makes it difficult to compare results.

For dental caries to develop, the infant's mouth must be colonised by bacteria, and thinking that parents are usually responsible for the transmission of bacteria to the mouth of the child is dangerous [20]. It was observed that for parents who had poor oral health, the situation was repeated in their children. This fact can be attributed to a fatalistic culture so entrenched in certain social classes that having decayed teeth is a normal condition (Table 3). The results corroborate the views of several authors [19,20]. When parents have high counts of *S. mutans* in their saliva and/or carious lesions, the risk of transmission of cariogenic bacteria to their children is increased [21].

We observed an association between the intake of sugar more than 4 times a day and the development of ECC (Tables 2 and 3), a result that is consistent with data presented by Feldens et al. [19]. Diet is a factor difficult to control given that the intake of fermentable carbohydrates is directly related to economic and cultural conditions, leaving dentists to emphasise the importance of controlling dental plaque

by brushing with fluoridated toothpaste. In addition to the biological and social factors, genetic factors should not be overlooked [22].

In this study, the frequency that the children attended the preventive program was considered a protective factor against ECC and was able to reduce the chances of children developing the disease by 51% (Table 3). Those responsible should be motivated to develop healthy hygiene habits, and to control the risk of developing tooth decay, it is necessary to have a constant reinforcement of health education [11].

Children with a Baume type II upper arch were more vulnerable to developing ECC (Table 3), a result corroborated by Soviero et al. [23]. The absence of interdental spacing makes it difficult to brush, and consequently, dental plaque is retained [24]. The arch type associated with the location of the caries lesion, there is an increase interproximal lesions in patients with type II arch Baume [25]. So, for children presenting a Baume type II upper arch, the use of a dental floss should be indicated as soon as possible.

CONCLUSIONS

From the results obtained, it can be concluded that the risk factors associated with ECC were: oral hygiene acceptance, breastfeeding duration greater than 16 months, a daily intake of sugar greater than four times a day, a maxillary Baume type II arch, a number of queries below PPGB four visits, and a history of caries in the mother and father. The prevalence of ECC in our study was 16%, including white spot lesions.

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