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Original Article

Socioeconomic, Nutritional and Behavioral Factors Associated with Severe Childhood Caries in Children Aged 18-36 Months

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Abstract

Objective: To relate the occurrence of severe childhood caries with nutritional, socioeconomic and behavioral factors among preschool children. **Material and Methods:** This cross-sectional study included 111 children aged 18-36 months who sought dental care in basic health units of São Luis, Brazil. The oral health status was measured by the DMFT index (number of decayed, missing and filled teeth), IPV/ISG. Socioeconomic, nutritional and behavioral data were collected through a questionnaire applied to parents. Caries Group was defined as DMFT ≥ 1 . Data were analyzed using the Chi-square test and Fisher exact test. Poisson regression models and incidence rate ratio (IRR) were used for multivariate analysis, adopting significance level of 5% and confidence interval (CI) of 95%. **Results:** It was observed that 61 children (55%) were free from caries and 50 (45%) had the disease. In the Caries Group, 38 (76%) had white spot lesions, 70% had the habit of consuming sweets between meals ($p=0.04$) and the sucrose intake frequency was considered high (3x daily). After multivariate analysis, age (IRR=1.05, 95%CI=1.03 to 1.07, $p < 0.001$) and consumption of sweets (IRR=1.46, 95%CI=1.11 to 1.92 $p=0.006$) were associated with increased incidence of caries. **Conclusion:** The findings of this study suggest that frequent exposure to sugars in the form of sweets between meals, lack of guidance of mothers on oral hygiene and increased age were determining factors for the occurrence of severe childhood caries.

Keywords: Dental caries; Preschool; Public health.

Introduction

Severe childhood caries (CGI) is defined as the presence of one or more carious tooth surfaces (cavitated or not), lost (due to caries) or any restored deciduous tooth up to 71 months of age [1-2]. It is a serious public health problem that affects infants and preschool children worldwide, leading to pain, chewing and speech difficulties, general health disorders, psychological problems and poor quality of life [3].

Understanding the process of development of dental caries as a multifactorial disease involves not only the biological factors directly acting on the de-remineralization process (biofilm, diet, saliva), but also the modifying factors or modulators (income, educational level, behavioral factors and attitudes), being seen as responsible for the exposure of individuals or populations to a high risk / activity of developing the disease [4].

Among behavioral factors, dietary habits have been recognized as critical in the dental caries process [4]. The early introduction of sugar facilitates the development and colonization of new tooth surfaces by cariogenic microorganisms, especially *Streptococcus mutans*. The participation of these microorganisms in the oral environment reflects, at least partially, the eating habits of the individual. Thus, the greater access to sucrose in the first months after eruption of different dental groups, the greater the chance of participation of this group of microorganisms as potential colonizers, which possibly will contribute to increased disease prevalence [5,6].

The identification of the risk factors in the development of dental caries in children is important for planning of more effective strategies for health promotion and disease prevention in this population. The aim of this study was to relate the occurrence of severe childhood caries with socioeconomic, nutritional, and behavioral factors in preschool children.

Material and Methods

This analytical cross-sectional study was approved by the Ethics Research Committee of the Federal University of Maranhão (Process n. 23115-002986/2011-15), according to Resolution CNS 196/96. Parents or guardians were informed about the objectives and procedures of the study and signed the informed consent form. All participants received information on caries prevention and oral hygiene procedures. Children who needed dental treatment were referred to the Oral Health Team of the Health Unit and to the Pediatric Dentistry Clinic at UFMA.

The study subjects were children enrolled in Family Health Units of São Luís, Brazil. Inclusion criteria were children of both genders aged 18-36 months with at least 12 erupted teeth (including lost). Children who had dental anomalies (position, number, size, shape or structure) and those with systemic diseases that impaired oral clinical examination, premature and malnourished children, and children with salivary disorders were excluded, as these conditions influence the disease development and refusals from mothers.

The sample size calculation used prevalence of 29.91% found in children aged 18-36 months in northeastern Brazil, using data extracted from epidemiological oral health survey conducted in the

last census [6]. The calculation took into account the standard error and the population size assumed by the researcher. According to the formula ($n = 1/E02$), the population sample consisted of 111 children of different socioeconomic levels who sought dental care in 42 Family Health Units in seven districts of São Luis, Brazil.

Mothers completed a validated questionnaire [7], containing behavioral data, dietary survey of the last 24 hours prior to the interview, nocturnal bottle and during sleep, weaning time, presence or absence of sucrose in the feeding bottle. To characterize the socioeconomic aspects, the Brazil Economic Classification Criterion was used, which considers the possession of consumer goods and educational level of the family head [8]. The Access to Health Services was investigated by the existence of a Health Unit near the place of residence, whether it includes dental service and dental attention on early childhood, whether or not the child had access to it, the reason for the visit, periodic return to consultations, ease and / or difficulty in assessing dental care [9].

Children were submitted to clinical examination of the oral cavity performed in the dental office under artificial light in the Health Units, and the data were recorded on clinical records standardized for the study. The DMFT index (number of decayed, missing and filled teeth) was used to assess carious lesions. The presence of biofilm and gingival bleeding were measured by the Visible Plaque Index (VPI) and Gingival Bleeding Index (GBI), which summarize the percentage of tooth surfaces with visible dental plaque and gingival bleeding [10]. The intra-examiner reliability for the DMFT index was measured by the Kappa coefficient ($K = 0.86$). When performed by parents or guardians, oral hygiene performed at least once a day and before bed was considered desirable. The use of fluoride was considered to be present in the form of toothpaste or professional gel application [7].

Data were tabulated in an Excel spreadsheet and analyzed using the SPSS software (version 17.0). The dependent variable was dichotomous for early caries experience ($DMFT \geq 1$). Independent variables included demographic and socioeconomic profile and dietary and behavioral habits. Initially, descriptive statistics was performed using absolute frequency, percentage, mean and standard deviation. For numeric variables, the distribution normality was checked by the Shapiro-Wilk test, and after this process, the Student t test was applied. The chi-square or Fisher's exact test was used for categorical variables, adopting significance level of 5% ($p < 0.05$). Poisson regression models and the incidence rate ratio (IRR), with confidence intervals (CI) of 95% were used for multivariate analysis between DMFT index and exposure variables.

Results

Of the 111 children examined, 50 (45%) had caries lesions and 61 (55%) had no experience of the disease. In the Caries Group, 38 (76%) had white spot lesions, no children had restorations and 46.8% had some dental surface with visible plaque ($IPV \neq 0$).

Table 1 shows the socioeconomic characteristics of children included in the study according to caries experience. It was observed that the average age of children was 28 months and the average

age of mothers was 28.2 years. Most mothers (82%) had between 5 and 11 years of schooling and 87.4% had 1-3 minimum wages as family income. None of these variables showed significant differences between groups ($p > 0.05$).

Table 1. Demographic and socioeconomic characterization of children and mothers included in the study according to the experience of severe childhood caries.

Variables	Total		Caries experience ¹				p-value
	n	%	No	%	Yes	%	
Breastfeeding							0.74
No	85	76.6	46	75.4	39	78.0	
Yes	26	23.4	15	24.6	11	22.0	
Breastfeeding after 1 year							0.97
No	72	64.9	39	63.9	33	66	
Yes	39	35.1	22	36.1	17	34	
Current Bottle							0.75
No	76	68.5	41	67.2	37	70.0	
Yes	35	31.5	26	32.8	15	30.0	
Wakes up to feed							0.42
No	85	76.6	49	80.3	36	72	
Yes	26	23.4	12	19.7	14	28	
Sleeps while feeding							0.91
No	86	77.5	48	78.7	38	76.0	
Yes	25	22.5	13	21.3	12	24.0	
Sweetens the bottle							0.30
No	69	62.2	41	67.2	28	56.0	
Yes	42	37.8	20	32.8	22	44.0	
Nocturnal bottle							0.91
No	76	68.5	41	67.2	35	70.0	
Yes	35	31.5	20	32.8	15	30.0	
Eats sweets and candies							0.04*
No	45	40.5	30	49.2	15	30.0	
Yes	66	59.5	31	50.8	35	70.0	
Feeds before going to bed							0.24
No	34	30.6	22	36.1	12	35.3	
Yes	77	69.4	39	63.9	38	76.0	

In the analysis of nutritional factors associated with the occurrence of severe childhood caries (Table 2), only the habit of eating foods such as candies, sweets etc. showed statistical differences between groups ($p = 0.04$). Among children with caries lesion, 70% had this nutritional habit, while the same habit was observed in only 50.8% of the caries-free group. Regarding the frequency of sucrose intake, dietary recall (last 24h) showed high frequency of consumption of foods considered cariogenic.

Habits and behavioral factors associated with severe childhood caries are shown in Table 3. Of 111 mothers interviewed, only 5.4% received guidance on oral hygiene early in the first years of

life of their children. It was observed that children of mothers who reported early oral hygiene were free from caries ($p = 0.02$).

Table 2. Association of nutritional variables and experience of severe childhood.

Variables	Total		Caries experience				p-value
			No (n=61)		Yes (n=50)		
Child's age in months (mean ± SD)	28.0	±6.5	27.2	±6.6	28.9	±6.2	0.17
Mother's age in years (mean ± SD)	28.2	±6.9	28.3	±6.6	28.0	±7.2	0.80
Maternal schooling (n; %)							0.43
0 to 4 years	15	13.5	7	11.5	8	16.0	
5 to 11years	91	82.0	50	82.0	41	82.0	
More than 11 years	5	4.5	4	6.6	1	2.0	
Income (n; %)							0.11
No income	5	4.5	3	4.9	2	4.0	
1 to 3 MW	97	87.4	56	91.8	41	82.0	
Above 3 MW	9	8.1	2	3.3	7	14.0	

¹Caries experience refers to children with DMFT index ≥ 1 . MW = Minimum Wages. SD = standard deviation.

Table 3. Association of behavioral variables and habits with experience of severe childhood caries.

Variables	Total		Caries experience ¹				p-value
			No	Yes			
	n	%	n	%	n	%	
Medical follow-up during prenatal period							0.28
No	24	21.6	16	26.2	8	16.0	
Yes	87	78.4	45	73.8	42	84.0	
Oral hygiene orientation during prenatal period							0.42
No	92	82.9	49	80.3	43	86.0	
Yes	19	17.1	12	19.7	7	14.0	
Oral hygiene orientation							0.02*
No	105	94.6	55	90.2	50	100	
Yes	6	5.4	6	9.8	0	0	
Knowledge of fluoride							0.54
No	41	36.9	21	34.4	20	40.0	
Yes	70	63.1	40	65.6	30	60.0	
Knowledge of caries							0.51
No	80	72.1	46	75.4	34	68.0	
Yes	31	27.9	15	24.6	16	32.0	
Use of fluoride							0.80
No	91	82.0	50	82.0	41	82.0	
Yes	20	18.0	11	18.0	9	18.0	

¹Caries experience refers to children with DMFT index ≥ 1 .

In the multivariate analysis, Poisson regression was used to analyze the exposure variables associated with the outcome (caries experience), observing in the three multivariate models proposed that increasing age statistically increased the number of carious deciduous teeth in the sample (p

<0.0001) and that consumption of sweets and candies, considering the influence of other variables included in the adjustment, also increases the incidence of carious deciduous teeth (Table 4).

Table 4. Poisson regression analysis between independent variables and DMFT index.

Variables	Model 1	p-value	Model 2	p-value	Model 3	p-value
	IRR (CI95%)		IRR (CI95%)		IRR (CI95%)	
Age (months)	1.04 (1.02-1.07)	<0.0001*	1.04 (1.02-1.07)	<0.0001*	1.05 (1.03-1.07)	<0.0001*
Schooling (4-8 years)	-	-	1.34 (0.88-2.03)	0.160	-	-
Schooling (above 8 years)	-	-	0.59 (0.24-1.44)	0.248	-	-
Consumption of sweets	-	-	-	-	1.46 (1.11-1.92)	0.006*
Sleeps while feeding	-	-	-	-	1.32 (0.97-1.78)	0.071
Sweetened bottle	-	-	-	-	0.78 (0.60-1.02)	0.074

Model 1: Age. Model 2: Adjusted for age and schooling. Model 3: Adjusted for age and nutritional variables (consumption of sweets, habits of sleeping while feeding and use of sugar in the bottle). * Statistically significant. IRR = incidence rate ratio.

Discussion

Dental caries is a multifactorial disease that requires the interaction of certain causal factors, as well as social, economic and cultural factors for its development and evolution [11-13].

Eating habits have been recognized as a fundamental factor in the caries process. The high frequency of sugar consumption in the form of sweets between meals found in this study showed a significant association ($p < 0.05$) in the occurrence of severe childhood caries (70%), as observed in research with children in Brazil [14] and South Korea [15]. The consumption of cariogenic foods offered by mothers to children between meals may represent a risk factor for the occurrence of severe childhood caries [5,13]. But in a study conducted in Northeastern Brazil, no association was found between cariogenic diet and the occurrence of severe childhood caries [7].

With regard to breastfeeding, 78% of children with caries experience had no such practice, which characterizes the lack of any association between this variable and caries prevalence ($p > 0.05$), similar to a retrospective cohort study [17], which also found no association between prolonged breastfeeding and the occurrence of severe childhood caries. However, other studies [12,15,18] have reported that children who have the habit of unrestricted use of the bottle, wake up to feed, sleep while sucking foods containing sugar in its composition or added, are more prone to developing severe childhood caries [19]. Although the increased use of nocturnal bottle, coupled with early weaning, is considered a predisposing factor for severe childhood caries, the findings of this research did not examine the association between bottle use and the occurrence of caries ($p > 0.05$), since 70% of children who had caries did not have this habit. Reinforcing this finding, other studies [7,13,15], also found no significant association between daily frequency of use of bottle containing fermentable carbohydrates and the occurrence of severe childhood caries.

Caries is a disease that can be prevented, provided there is early intervention and families at risk receive oral hygiene guidance [1-3,9-12]. In the present study, a statistically significant relationship between oral hygiene guidance received by mothers and the occurrence of severe childhood caries ($p < 0.05$) was found, and in 100% of children with caries experience, mothers received no oral hygiene guidance (67%). Those who received it had children free from caries. Among them, 21% received guidance from pediatricians and 9% from the dentist at some point in life.

Regarding the beginning of oral hygiene, favorable responses such “as soon as the baby is born and after the eruption of teeth for the child to grow in a healthy oral environment” were reported by mothers. However, although mothers reported that they brush their teeth daily and their children two or three times a day with the aid of diaper soaked in water while babies, and with toothbrush and toothpaste after the eruption of teeth, it was found that this care was not being performed correctly, which interfered with the presence of visible plaque and in the gingival bleeding index. These results, as those found in literature [7,9,10,11,13], showed the influence of preventive methods used by mothers in the development of the disease. Regarding the use of fluoride, of the 50 children with caries experience, 82% had never used it; however, no association between the use of fluoride and the occurrence of caries was found ($p > 0.05$).

The prevalence of severe childhood caries varies from 12 to 46%, and the age range from 1 to 3 years is the most affected [7,10,11,15,19,20]. The multivariate analysis used in this study showed that the prevalence of dental caries increased significantly by 45%, which is higher than the value found in the study carried out in João Pessoa (Brazil), Piracicaba (Brazil) and Salvador (Brazil) (43.7%, 23.6% and 17.6%) respectively [7,10,29]. The increasing number of erupted teeth, changing eating habits and oral hygiene practices may explain, at least in part, the increase in the number of lesions [13,17,22]. It is noteworthy that the criteria for caries diagnosis used in this study were similar to those used in other studies, according to criteria established by WHO [6].

Since severe childhood caries is a multifactorial disease, demographic and socio-behavioral factors such as level of maternal education and family income, were also analyzed. This study did not show any association between maternal education and the occurrence of severe childhood caries ($p > 0.05$). Of mothers assessed, 91% had 5-11 years of schooling, confirming the findings in literature [13,21,27]. It is noteworthy that maternal education was considered a predictor factor of severe childhood caries in several studies [20,23-25], suggesting a greater possibility of children with DMFT zero when mothers were older, with more education and higher professional occupation [26,27].

Regarding family income, 97% of families had 1-3 minimum wages. No statistical significance was found in relation to this variable and the occurrence of severe childhood caries ($p > 0.05$), which results are similar to other studies that also found no association [7,13]. However, some studies have found a statistically significant relationship between occurrence of severe childhood caries and low income level [15,22,24,28]. According to these authors, the higher the income level, the lower the incidence of severe childhood caries.

The analysis of the results showed that mothers need to receive guidance on the promotion of oral health so that they can implement preventive measures on caries in the first year of life for their children. Thus, if parents are informed of the likely negative effects of using nocturnal bottle with sugary liquids, poor hygiene, importance of balanced diet, fluoride use and oral hygiene care, as well as the need to visit the dentist at the time of eruption of the first deciduous teeth, it will become easier to prevent the development of bad habits and consequently the establishment of severe childhood caries.

Conclusion

The frequent exposure to sugars in the form of sweets between meals, lack of orientation of mothers on the oral hygiene care and increasing age were determinant factors for the occurrence of severe childhood caries.

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