ORIGINAL ARTICLE

Early Childhood Caries in a Northeastern Brazilian Capital: Observations of Social Distinct Daycare Centers

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ABSTRACT

Objective: To investigate factors associated with the experience of dental caries in children in early childhood in two socially distinct centers in the city of São Luís, Maranhão, Brazil. **Material and Methods:** A cross-sectional study was conducted in two socially distinct daycare centers (private and public). The children were assessed regarding their caries experience, and their parents/guardians were prepared regarding socioeconomic information, parents/guardians' habits, and children's habits. Descriptive and inferential statistics were used. Association tests and multivariate analyses were performed to analyze independent variables and outcomes (type of daycare center and caries experience) using a p-value of 5%. **Results:** The sample consisted of 89 children aged up to 5 years of both sexes. The type of daycare center was associated with some socioeconomic data, such as family income (p<0.01) and parents' education (p=0.05). Data on oral hygiene and children's habits, such as breastfeeding, also remained associated with the type of daycare center. There was an association between income and DMFT (PR=8.48 - 95%CI 2.26;31.78). **Conclusion:** The socioeconomic profile of parents/guardians and breastfeeding were associated with the prevalence of caries in deciduous teeth in children aged 10 to 48 months.

Keywords: Oral Health; Dental Caries; Pediatric Dentistry.

Introduction

Oral health can be affected by numerous conditions, such as periodontal disease, dental caries, malocclusion, and dental trauma. These conditions generate discomforts in an individual, such as pain and early tooth loss, and consequently impact the quality of life [1-3]. In childhood, the parents' knowledge about their children's oral health is essential since, according to the Oral Health Brazil Project [4], about 53% of 5-year-old children present early childhood caries (ECC), and untreated caries in deciduous teeth being considered as one of the most prevalent oral conditions in the world population [5].

ECC is a multifactorial disease that is mainly related to sucrose consumption. According to the Bangkok statement [6], this illness affects school children, and it is characterized by the presence of at least one decayed tooth (with or without cavitation), tooth loss, or the existence of restoration in deciduous teeth. Studies show that more than 80% of children with decayed teeth remain untreated. It is believed that the low knowledge about oral health of parents or guardians can explain, in part, the high prevalence of this condition [7,8].

Although the oral health status of the Brazilian population has advanced positively in Brazil, 27% of children aged 18-36 months in the Northeast have at least one decayed tooth, and 60% of 5-year-old children present dental caries [4]. These data show the importance of preventive treatments and especially oral health education. As stated, the progression of caries disease tends to decrease with age, but the inequities in health in different regions of the country are one of the risk factors to be considered in this context [9,10].

In the early studies on Cariology, the main factors associated with dental caries were cariogenic diet, biofilm accumulation, host susceptibility, and time. Currently, the etiology of caries includes personal and environmental factors, such as education, access to fluoride, and socioeconomic status [9,11].

It is essential to understand how different social contexts in Brazil may be related to the presence of caries, especially in states in the northeast region. This is one of the unique studies carried out in Maranhão, which denotes the social inequality in the State reflected in the oral outcomes. Thus, the present work aimed to investigate the factors associated with dental caries experience in early childhood children in two socially distinct centers (a private and a public school) in the city of São Luís, Maranhão, Brazil.

Material and Methods

Study Design and Ethical Aspects

This cross-sectional study was approved by the Research Ethics Committee (Proc. # 61472016.1.0000.508). The sample was collected in two distinct daycare centers, which were randomly selected within the region with the highest and lowest per capita income in the city of São Luís, Maranhão, Brazil, according to data from the Brazilian Institute of Geography and Statistics (IBGE) (https://cidades.ibge.gov.br/brasil/ma/panorama).

The inclusion criteria included children up to 5 years old in daycare centers. Edentulous children were excluded from the study. Due to the age range of the children, their guardians who agreed to participate in the study signed an Informed Consent Form and then answered the questionnaires regarding their habits and their children's as well. The children were submitted to clinical examination to evaluate the presence of dental caries. The daycare center's children's guardians and caregivers received educational lectures covering early childhood caries and its etiological factors, prevention, dietary guidelines, and oral health.

Since this is a census study with a previously determined sample, all children enrolled in both daycare centers were invited to participate, and no sample calculation was necessary to perform this study.

Data Collection and Clinical Examination

A questionnaire prepared by the researchers containing 42 questions was applied to parents who agreed to participate. The questionnaire addressed socioeconomic issues (family income, education, and number of people living in the house), focusing on questions about children's oral health and habits. Data were collected on brushing, the onset and frequency of breastfeeding, nighttime bottle feeding, the first visit to the dentist, and fluoride toothpaste. The age and gender of the children were also investigated to characterize the sample.

Calibration of dental caries was performed using the *influx* method using images from the research team's photographic bank. Images of six children were evaluated twice with an interval of one week. An experienced examiner was used as a reference standard. After the analysis, the Kappa index value was 0.91 for the intra-examiner test and 1.00 for the inter-examiner test, which was considered an optimal score.

The exams were carried out in schools by a single researcher under natural lighting and using clinical instruments such as exploratory probes, children's mouth mirrors, mouth openers made with wooden spatulas, and personal protective equipment. Before the examination, the children were brushed with a soft-bristled toothbrush with a small head and fluoride toothpaste. The decayed, missing, and filled teeth (DMFT) were used to measure the oral condition. Although other caries assessment indices exist, such as the International Caries Detection and Assessment System (ICDAS), using a modified version of the DMFT under research conditions in such young children may be justified. In addition, initial carious lesion data were included.

In this study, it was adopted the modified DMFT index was based on the following codes: (0) healthy crown, (1) white spot, (2) decayed crown at enamel level, (3) decayed crown at dentin level, (4) restored but decayed crown, (5) restored crown without caries, (6) tooth lost due to caries, (7) tooth lost for other reasons: orthodontic, periodontal, traumatic or congenital, (8) unerupted tooth, (9) root remnant, and (10) trauma.

Statistical Analysis

Data was analyzed using the Statistical Package for Social Sciences (SPSS for Windows, version 21.0, SPSS Inc. Chicago, IL, USA). Descriptive and inferential statistics were used, with the descriptive analysis describing the sample (gender, age, sociodemographic data) through frequency and percentage. The chi-square test was applied to analyze the association between the independent variables and the outcomes, considered as the type of daycare and caries experience. Multivariate analysis was performed using the Poisson Regression Model with the Prevalence Ratio (PR) as a measure of association. Variables that showed $p < 0.20$ in the crude model were incorporated into the adjusted model. Variables with $p < 0.05$ were considered significantly associated with the outcome (caries experience). The confidence interval was 95%.

Results

A total of 89 children and their guardians participated in the study. Regarding the socioeconomic questionnaire, families with more than five minimum wages, with a number of people from 4-6 who studied over 8 years, were significantly associated with the private daycare center (Table 1).

Table 1. Univariate analysis between sociodemographic variables with the type of daycare in the 10-48 months age groups.

Sociodemographic Data	Type of Day Care		Total	p-value
	Public N (%)	Private N (%)	N (%)	
Sex				
Female	16 (42.1)	22 (57.9)	38 (100.0)	0.77[Y]
Male	23 (45.1)	28 (54.9)	51 (100.0)	

Age Group				
Up to 36 months	14 (36.8)	24 (63.2)	38 (100.0)	0.25^{Y}
Over 36 months	25 (49)	26 (51)	51 (100.0)	
Family Income				
Up to 2 MW	33 (94.3)	2 (5.7)	35 (100.0)	< 0.01^{Y}
Above 2 to up to 5 MW	4 (40)	6 (60)	10 (100.0)	
Above 5 MW	0 (0.0)	42 (100)	42 (100.0)	
Number of People/Residence				
Up to 3 people	12 (28.6)	30 (71.4)	42 (100.0)	0.01**
From 4 to 6 people	23 (53.5)	20 (46.5)	43 (100.0)	
From 7 to 10 people	4 (100.0)	0 (0.0)	4 (100.0)	
Parents' Education				
Up to 8 years	3 (100.0)	0 (0.0)	3 (100.0)	0.05**
Over 8 years	36 (42.4)	49 (57.6)	85 (100.0)	

MW = Minimum wage; **Chi-square test for trend; ^{Y}Test Pearson's chi-square test.

Regarding the type and period of children feeding, Table 2 presents that children who breastfed for less than six months (p=0.03) and fed in a bottle for more than 19 months (p=0.01) were associated with private centers. In addition, regarding the children's oral care, only the introduction of brushing (p=0.02) presented an association with the type of daycare center.

Table 2. Univariate analysis between oral care variables and children's habits with the type of daycare center in the 10-48 months age groups.

Variables	Type of Day Care		Total	p-value
	Public N (%)	Private N (%)	N (%)	
Children's Habits				
Breastfeeding				
Less than 6 months	7 (25.0)	21 (75.0)	28 (100.0)	0.03**
7 to 12 months	5 (31.3)	11 (68.8)	16 (100.0)	
13 to 18 months	11 (61)	7 (38)	18 (100.0)	
More than 19 months	14 (73.7)	5 (26.3)	19 (100.0)	
Never breastfed	1 (14.0)	6 (85.0)	7 (100.0)	
Night breastfeeding				
Up to 2 times	9 (32.1)	19 (67.9)	28 (100.0)	0.18**
Three times	8 (36.4)	14 (63.6)	22 (100.0)	
Above 3 times	19 (63.3)	11 (36.7)	30 (100.0)	
Free demand	2 (25.0)	6 (75.0)	8 (100.0)	
Feeding bottle				
Never used	9 (47.4)	10 (52.6)	19 (100.0)	
Less than 6 months	5 (83.3)	1 (16.7)	6 (100.0)	0.01**
7 to 12 months	14 (93.3)	1 (6.7)	15 (100.0)	
13 to 18 months	1 (11.1)	8 (88.9)	9 (100.0)	
More than 19 months	10 (26.3)	28 (73.7)	38 (100.0)	
Still in use	0 (0.0)	2 (100.0)	2 (100.0)	
Bottle at night				
Up to 2 times	13 (31.0.)	29 (69.0)	42 (100.0)	0.06**
Three times	4 (80.0)	1 (20.0)	5 (100.0)	
Above 3 times	3 (60.0)	2 (40.0)	5 (100.0)	
Never used	19 (52.8)	17 (47.2)	36 (100.0)	
Children's oral care				
1st visit to the dentist				
Before tooth eruption	0 (0.0)	2 (100.0)	2 (100.0)	0.08**
After the first year	4 (28.6)	10 (71.4)	14 (100.0)	
After 12 months	6 (46.2)	7 (53.8)	13 (100.0)	
Not applicable	29 (49.2)	30 (50.8)	59 (100.0)	
Daily brushing				

Don't brush	0 (0.0)	1 (100.0)	1 (100.0)	0.28**
1 to 2 times	29 (51.8)	27 (48.2)	56 (100.0)	
Three times	1 (12.5)	7 (87.5)	8 (100.0)	
Above 3 times	9 (39.1)	14 (60.9)	23 (100.0)	
Start of brushing				
Before tooth eruption	5 (19.2)	21 (80.8)	26 (100.0)	0.02**
After the first teeth	24 (50.0)	24 (50.0)	48 (100.0)	
After 12 months	10 (76.9)	3 (23.1)	13 (100.0)	
Not started yet	0 (0.0)	1 (100.0)	1(100.0)	
Toothpaste/fluoride				
500 ppm	2 (11.8)	15 (88.2)	17 (100.0)	0.55**
1100 ppm	25 (65.8)	13 (34.2)	38 (100.0)	
1450 ppm	2 (100.0)	0 (0.0)	2 (100.0)	
No fluoride	6 (26.1)	17 (73.9)	23 (100.0)	
I didn't know how to answer	1 (100.0)	0 (0.0)	1 (100.0)	

**Chi-square test for trend.

The dental caries experience is markedly in the public daycare centers, concentrating the most decayed teeth shown in Table 3. On the other hand, no restored teeth were verified at the private daycare center.

Table 3. Frequency distribution and association of children concerning caries experience, number of decayed and restored teeth, and type of daycare center.

	Type of Day Care		Total	
Oral Data	Public N (%)	Private N (%)	N (%)	p-value
DMFT index				
DMFT = 0	22 (32.8)	45 (67.2)	67 (100.0)	< 0.01$^\Upsilon$
DMFT ≥ 1	17 (77.3)	5 (22.7)	22 (100.0)	
Decayed teeth				
No decayed teeth	23 (33.3)	46 (66.7)	69 (100.0)	< 0.01$^\Upsilon$
≥ 1	16 (80.0)	4 (20.0)	20 (100.0)	
Restored teeth				
No teeth restored	38 (43.2)	50 (56.8)	88 (100.0)	0.43*
≥ 1	1 (100.0)	0 (0.0)	1 (100.0)	

$^\Upsilon$Test Pearson's chi-square test; *Fisher's exact test.

Regarding the association of children with and without dental caries experience, according to the independent variable, children in the private daycare center had no decayed teeth (p < 0.01) (Table 4). In addition, almost 50% of the children with decayed teeth presented a family income of up to two minimum wages. In comparison, 94.2% of children with a family income above five minimum wages had no decayed teeth. Furthermore, breastfeeding habit was associated with caries experience (p=0.01). It was observed that 92.9% of the children who breastfed up to 6 months did not present caries, while 42.1% of the children who breastfed above 19 months had caries experience.

Table 4. Distribution of frequency and association of children with and without experience of dental caries according to independent variables.

	Decayed Teeth		Total	
Independent Variables	Yes N (%)	No N (%)	N (%)	p-value
Type of daycare				
Public	16 (41.0)	23 (59.0)	39 (100.0)	<0.01*
Private	4 (8.0)	46 (92.0)	50 (100.0)	
Income				
Up to 2 MW	16 (45.7)	19 (54.3)	35 (100.0)	<0.01*

Above 2 MW	3 (5.8)	49 (94.2)	52 (100.0)	
Sex			
Female	7 (18.4)	31 (81.6)	38 (100.0)	0.42
Male	13 (25.5)	38 (74.5)	51 (100.0)	
Age			
Up to 36 months	6 (15.8)	32 (84.2)	38 (100.0)	0.19
Over 36 months	14 (27.5)	37 (72.5)	51 (100.0)	
Parents' education			
Up to 8 years	1 (25.0)	3 (75.0)	4 (100.0)	0.90**
8 more years	19 (22.4)	66 (77.6)	85 (100.0)	
Breastfeeding			
Under 6 months	2 (7.1)	26 (92.9)	28 (100.0)	0.01**
7 to 12 months	2 (12.5)	14 (87.5)	16 (100.0)	
13 to 18 months	7 (38.9)	11 (61.1)	18 (100.0)	
Over 19 months	8 (42.1)	11 (57.9)	19 (100.0)	
Never breastfed	1 (14.3)	6 (85.7)	7 (100.0)	
Feeding bottle			
Under 6 months	2 (33.3)	4 (66.7)	6 (100.0)	0.19**
7 to 12 months	6 (40.0)	9 (60.0)	15 (100.0)	
13 to 18 months	1 (11.1)	8 (88.9)	9 (100.0)	
Over 19 months	5 (13.2)	33 (86.8)	38 (100.0)	
Never used	6 (31.6)	13 (68.4)	19 (100.0)	
Still in use	0 (0.0)	2 (100.0)	2 (100.0)	
Night breastfeeding			
Did not breastfeed	1 (12.5)	7 (87.5)	8 (100.0)	0.22**
Up to 3x	9 (18.0)	41 (82.0)	50 (100.0)	
Above 3x	10 (33.3)	20 (66.7)	30 (100.0)	
Night bottle			
Never used	10 (27.8)	26 (72.2)	36 (100.0)	0.21**
Up to 3x	10 (21.3)	37 (78.7)	47 (100.0)	
Above 3x	0 (0.0)	5 (100.0)	5 (100.0)	

MW: Minimum Wage; *Fisher's exact test; **Chi-square test for trend.

Table 5 illustrates the role of family income in the dental caries experience. After variables adjustment, children with income up 2 minimum wages showed 8.48 higher prevalence to present dental caries than their counterparts (p=0.02).

Table 5. Poisson Regression Analysis of exposure variables and outcome in children.

Variables	PR Unadjusted (CI 95%)	p-value	PR Adjusted (CI 95%)	p-value
Type of daycare				
Public	5.128 (1.863-14.11)	0.002	0.762 (0.278-2.090)	0.59
Private	1		1	
Income				
Up to 2 MW	7.924 (2.493-25.182)	<0.001	8.484 (2.264-31.789)	0.02
Above 2 MW	1		1	
Parents' education				
Up to 8 years	1.118 (0.196-6.391)	0.900	1.209 (0.442-3.306)	0.71
8 more years	1		1	
Sex				
Female	0.723 (0.319-1.636)	0.436	0.902 (0.408-1.992)	0.80
Male	1		1	
Age				
Over 36 months	1.739 (0.736-4.105)	0.207	1.548 (0.755-3.173)	0.23
Up to 36 months	1		1	
Breastfeeding				
Never been breastfed	0.445 (0.070-2.851)	0.393	2.145 (0.333-13.807)	0.42
< 6 months	0.223 (0.055-0.896)	0.034	0.389 (0.088-1.717)	0.21
≥ 6 months	1		1	

Bottle Feeding				
≥ 6 months	0.594 (0.257-1.369)	0.221		
< 6 months	1.056 (0.285-3.916)	0.936		
Never used	1			
Night breastfeeding				
Above 3x	0.375 (0.056-2.512)	0.312	0.340 (0.052-2.237)	0.26
Less than or equal to 3x	0.540 (0.248-1.176)	0.121	0.716 (0.363-1.410)	0.33
Never been breastfed at night	1		1	

Discussion

The association between oral health and socioeconomic status has already been described in the literature, and this study corroborates this fact. A systematic review [12] identified the main factors for developing dental caries in children and adolescents. Among these factors, the socioeconomic level, biological factors, behavioral factors, oral hygiene habits, and the oral health status of mothers stand out. In the present study, such an association was also observed [5,12]. Another study corroborates the results of this research, where low maternal education and low family income were associated with diseases in early childhood, including dental caries [13].

Table 1 shows that family income was associated with the type of daycare center, indicating that children who studied at the public daycare center came from families with lower incomes. In addition, children from public daycare also had larger family arrangements. Regarding oral health, large family arrangements may be a risk factor for the occurrence of ECC since this family model presents more significant obstacles regarding oral health care, especially in cases where the socioeconomic level is low. One of the challenges faced by this family model is the lack of oral health education that would facilitate the identification of oral problems in the early stages and the lack of access to preventive care [10,14,15].

This study also highlights the differences between children's oral health care in public and private daycare. It was observed that the introduction of oral hygiene habits in children from private daycare happened even before tooth eruption. In contrast, most of the children from the public daycare had the habit introduced after the first year of life (Table 2). This finding can be justified because children with low socioeconomic levels have restricted access to information and dental care, either due to the low knowledge of those responsible, lower purchasing power, or the lack of access to public prevention policies [7,16].

Moreover, families with low purchasing power are also more susceptible to a diet rich in sucrose and carbohydrates, maintaining an unfavorable nutritional status and increasing the risk of systemic and oral diseases. Notably, the early introduction of sugar is one of the problems related to the risk of ECC [17]. These data may justify the finding in this study, which points out that children with low socioeconomic power had higher DMFT experience and decayed teeth (Table 3). Still, more studies are needed regarding income with food and ECC. It is known that in Brazil, children under two years of age already consume foods with sugar, presenting a higher risk of developing ECC. The consumption of these foods is associated with prolonged and nocturnal breastfeeding, which may be another factor associated with caries disease [17-20].

Health agencies and professionals recommend Natural breastfeeding; according to the WHO, exclusive breastfeeding is indicated up to 6 months of age, and breast milk alone does not have cariogenic activity. However, the consumption of bottles with liquids that contain sugar in the composition has a significant weight in the incidence of caries in children because, in addition to sucrose, free demand and high frequency of nighttime breastfeeding may favor the accumulation of biofilm [20,21]. Moreover, during the night, the salivary flow tends to reduce. In addition to the absence of brushing, it favors the demineralization of teeth and does not allow

remineralization by saliva. Thus, children with the habit of nighttime breastfeeding have higher risks against caries disease [20-22].

Table 4 shows that the type of daycare, income, and prolonged breastfeeding were associated with carious lesions. These data align with a previous study, in which similar results were obtained, where associations were observed between caries and dietary practices such as high frequency of breastfeeding, use of a night bottle with sugar, and breastfeeding for more than 12 months [23]. In all analyses in this study, including the regression analysis (Table 5), income was the most prominent variable since it was associated with the type of daycare, caries disease, and DMFT ≥ 1. This finding is consistent with another study that showed that family income is a risk factor for ECC [24,25].

In summary, previous studies have already associated socioeconomic characteristics such as low education with caries [26]. In contrast to the findings, a study showed no association between caries and family income; however, low schooling was associated with caries, thus requiring designs of more longitudinal studies that can prove or not such an association [27]. Other studies have not shown such a relationship. Therefore, there is a need for further investigation regarding the relationship between low parental education and ECC [28-30].

This research presents the limitations of a cross-sectional study, such as not allowing the establishment of a causal relationship (cause-effect) since the associated factors and the outcomes are not evaluated simultaneously. In addition, the sample size may lead to selective survival bias. Using questionnaires as the main instrument to assess potential associated factors may generate a response bias caused by the tendency of responses to change to a socially desirable pattern.

This study presented some differences, such as using a detailed questionnaire prepared by the authors to understand the oral characteristics of children from different social contexts and using regression to analyze the relationship between socioeconomic status and oral health of preschool children. In addition, data from the Brazilian Institute of Geography and Statistics and the Human Development Index were used, which denoted the disparities of the studied city. In addition, it was observed that despite being the capital of a Brazilian state, there is a limited number of daycare centers.

However, this study has great relevance since it helps to determine the prevalence of ECC in different social groups, addressing the disparities of access and knowledge about oral health and confirming the need for collective actions, especially in regions where individuals are more susceptible to worse oral health conditions. Given the findings of this study, it is necessary to implement strategies for caries control, especially in social contexts of people with low income [31-33].

It is already known that sugar is related to caries and different systemic diseases; therefore, public policies involving the control of sugar consumption should be encouraged. These strategies should include actions related to oral hygiene guidelines, with individual and population-level interventions being necessary, mainly comprising the sociocultural identity of the country [33,34]. The conscientious use of fluoride in the water supply and toothpaste are also resources for caries control [31,33,34].

Furthermore, public policies that provide access to dental treatment with preventive and curative measures are essential. It is necessary to encourage educational programs aimed at the prevention and provision of health services that should occur mainly since pregnancy [35]. Moreover, actions aimed at oral health education and intervention should also be encouraged.

Conclusion

The presence of ECC in children aged 10-48 months was associated with socioeconomic status. This study reinforces the importance of public policy focusing on preventing oral diseases and actions to reduce the inequities in Brazil.

Authors' Contributions

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All authors declare that they contributed to a critical review of intellectual content and approval of the final version to be published.

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Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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