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ORIGINAL ARTICLE

Maternal Education Level as a Risk Factor for Early Childhood Caries

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ABSTRACT

Objective: To determine the prevalence and risk factors associated with dental caries in Brazilian preschool children aged 2 to 5 years. **Material and Methods:** The following independent variables were evaluated: dental caries, dental trauma, and malocclusions. Data were analyzed using the Mann-Whitney test and Poisson regression ($p<0.05$). **Results:** The prevalence of dental caries in preschoolers was 55.1%. Child age, family income, maternal education, and tooth color alteration from trauma were significantly associated with dental caries ($p<0.05$). The final adjusted multivariate model showed a significant association between maternal education and dental caries; children of mothers with low education were 1.89 times more likely to have caries (PR: 1.89; 95%CI: 1.40-2.55) ($p<0.01$). Children with tooth color change from trauma were more likely to have dental caries (PR: 1.69; 95%CI: 1.22-2.34 ($p=0.001$). **Conclusion:** Child age, family income, maternal education, tooth discoloration and discoloration color are risk factors for the development of caries disease in children. Also, children of mothers with low educational levels have a higher chance of developing dental caries.

Keywords: Tooth Injuries; Dental Caries; Oral Health; Dental Care for Children; Epidemiology.

Introduction

Early childhood caries is defined as the presence of one or more decayed, lost, or restored surfaces on any primary tooth of a child under six years of age [1]. The chemical process of the lesions consists of an imbalance and rapidly alternating periods of tooth demineralization and remineralization, with demineralization predominating for a sufficiently long time, resulting in incipient carious lesions at certain anatomical predilection sites of teeth [2-4]. According to the literature, several factors have been associated with the onset of caries disease in children, including behavioral, environmental, biological and socioeconomic factors, eating habits, dental and family medical history, previous caries experience, lack of dental care, premature birth, high prevalence of enamel defects, protein deficiency, and salivary gland hypofunction [4-7].

Studies show that despite the decline in caries prevalence, especially in Brazil, the disease still affects more than half of children in Latin American and Caribbean in the 21st century [7]. There is no doubt that dental caries experience has a negative impact on children's oral health-related quality of life, both as perceived by children and parents [8,9]. Data from the last National Epidemiological Survey [10] revealed that 80.2% of 5-year-old Brazilian children had at least one tooth with a history of caries, indicating that dental caries is still a public health problem in Brazil due to its high prevalence [11].

Cariogenic lesions identified in the last national oral health survey in 2010 in 5-year-old children were due to a lack of restorative treatment. Several factors influence caries prevalence and lack of treatment in different regions of the country, including the large geographic extension, as Brazil is considered a continental country, the historical differences in the occupation process and economic development of Brazilian regions, as well as the unequal funding of public health at the beginning of the implementation of the Unified Health System (SUS) in Brazil. Studies show a certain social disadvantage in the North and Northeast regions and consequently worse oral health indicators, whereas the South and Southeast regions are at an advantage [10,12].

Determining the prevalence and risk factors for dental caries in different Brazilian regions is extremely important for epidemiology and clinical practice to develop preventive strategies [2,13,14]. Thus, the present study aimed to investigate the prevalence and risk factors associated with dental caries in preschoolers aged 2 to 5 years in a medium-sized city in southeastern Brazil.

Material and Methods

Ethical Requirements

This study was carried out in accordance with Resolution 466/12 of the National Health Council of Brazil and the Declaration of Helsinki, respecting ethical precepts. The study was approved by the Human Research Ethics Committee of the *Universidade Federal de Alfenas*, Brazil (CAAE: 15473713.2.0000.5142). Parents/caregivers signed an informed consent form and a statement of participation in the study.

In addition, this study was in compliance with STROBE (Strengthening the Report on Observational Studies in Epidemiology).

Study Design and Setting

This was a cross-sectional study carried out in the city of Alfenas, in the south of the state of Minas Gerais, southeastern Brazil. The study population consisted of healthy preschool children aged 2 to 5 years enrolled in public schools in the city. A random sample stratified by age and school was selected using the R software version 3.0.

In the first step of the sampling process, 16 public schools in Alfenas were randomly selected from the administrative district. The schools were divided into six sectors according to the proximity and geographic location of the city for the analysis.

Subjects

A sample of 17% of the studied population (321 children) was considered sufficient to have a representative sample with a confidence level of 95%, according to Muniz and Abreu [15]. To account for possible dropouts, the sample size was increased to a total of 361 children.

Some participants were excluded from the sample. The main reasons were: non-acceptance by guardians (n = 24) and change of school (n = 5). Thus, an additional sample (12.46% of the population) was selected to replace the 29 excluded cases. After randomization and clinical examination, the following inclusion criteria were applied: healthy children aged 2 to 5 years with primary or mixed dentition and who had not received orthodontic treatment.

Data Collection

Parents answered a questionnaire on demographic and socioeconomic characteristics [16]. An intraoral examination was performed on each participant by a calibrated examiner (intra-examiner Kappa 0.92) and under natural light.

Dental Caries

Caries activity was assessed using the decayed, missing or filled primary teeth (dmf-t index) according to the World Health Organization [17].

Dental Trauma

Dental trauma was classified into three groups: injuries to hard dental tissue and pulp (enamel fracture, enamel and dentine fracture, complicated coronary fracture), injuries to hard dental tissue, pulp, and alveolar process (corono-radicular fracture, root fracture, alveolar fracture), and periodontal injuries (subluxation, intrusive dislocation, extruded luxation, lateral dislocation, avulsion) [17]. The presence of dental trauma color consequences was also evaluated [18].

Malocclusion

The presence of severe overbite, anterior open bite, and accentuated protrusion were recorded and classified by type of malocclusion [19].

Statistical Analysis

The Statistical Package for Social Sciences software (SPSS, version 25.0; SOSS Inc., Chicago, IL, USA) was used for data analysis. First, descriptive analysis was performed. Then, the Mann-Whitney and Kruskal-Wallis tests were used to select variables with a p-value ≤ 0.2. Afterward, Poisson regression with robust variance was performed to assess the association of dental caries and independent variables. Finally, variables were tested in the multivariate model, and the prevalence ratios (PR) and 95% confidence interval (95%CI) were calculated. Explanatory variables with a p-value <0.05 were selected for the final models.

Results

A total of 321 children participated in this study (91.0%). The children's age ranged from 2 to 5 years, and 54.6% were boys and 45.4% were girls. The prevalence of dental caries, dental trauma, and malocclusions was 55.1%, 15.3%, and 53.6%, respectively.

Table 1 shows the descriptive and bivariate analysis of the association between dental caries and socio-economic and demographic indicators. Child age, household income, maternal education, dental discoloration due to trauma and color of discoloration were the variables that showed a significant association with dental caries ($p<0.05$).

Table 1. Descriptive and bivariate analysis of the association between dental caries and socio-economic demographic indicators.

Variables	Dental Caries		p-value
	Yes N (%)	No N (%)	
Child's sex[a]			
Male	93 (52.5)	82 (56.9)	0.73
Female	84 (47.5)	62 (43.1)	
Child's age[b]			
2 years	17 (9.6)	31 (21.5)	0.01*
3 years	35 (19.8)	32 (22.2)	
4 years	57 (32.2)	34 (23.6)	
5 years	68 (38.4)	47 (32.6)	
Child's school[b]			
Sector 1	36 (20.3)	39 (27.1)	0.16
Sector 2	46 (26.0)	33 (22.9)	
Sector 3	18 (10.2)	24 (16.7)	
Sector 4	20 (11.3)	6 (4.2)	
Sector 5	44 (24.9)	33 (22.9)	
Sector 6	13 (7.3)	9 (6.3)	
Household income[a]			
≤1 BRL/month	50 (28.2)	34 (23.6)	0.04*
>1 BRL/month	126 (71.2)	110 (76.4)	
Missing	1 (0.6)	-	
Mother's schooling[a]			
≤ 8 years of study	109 (61.6)	71 (49.3)	0.001*
> 8 years of study	60 (22.9)	71 (49.3)	
Missing	8 (4.5)	2 (1.4)	
Father's schooling[a]			
≤ 8 years of study	93 (52.5)	66 (45.8)	0.14
> 8 years of study	48 (27.1)	55 (38.2)	
Missing	36 (20.3)	23 (16.0)	
Mothers work out home[a]			
Yes	104 (58.8)	96 (66.7)	0.10
No	65 (36.7)	46 (31.9)	
Missing	8 (4.5)	2 (1.4)	
Fathers work out home[a]			
Yes	134 (75.7)	113 (78.5)	0.88
No	7 (4.0)	7 (4.9)	
Missing	36 (20.3)	24 (16.7)	
Mothers' salary[a]			
≤1 BRL/month	80 (45.2)	62 (43.1)	0.08
>1 BRL/month	39 (22.0)	42 (29.2)	
Missing	58 (32.8)	40 (27.8)	
Fathers' salary[a]			
≤1 BRL/month	45 (25.4)	30 (20.8)	0.14
>1 BRL/month	91 (51.4)	83 (57.6)	

Missing	41 (23.2)	31 (21.5)	
Dental trauma[a]			
Present	28 (15.8)	21 (14.6)	0.46
Absent	149 (84.2)	123 (85.4)	
Dental trauma color consequences[a]			
Present	46 (26.0)	19 (13.2)	0.001*
Absent	131 (74.0)	125 (86.8)	
Which color alterations[b]			
Yellow	27 (15.3)	9 (6.3)	0.002*
Gray	20 (11.3)	10 (6.9)	
None	130 (73.4)	125 (86.8)	
Dental malocclusions[a]			
Present	93 (52.5)	79 (54.9)	0.36
Absent	84 (47.5)	65 (45.1)	

[a]Mann-Whitney test; [b]Kruskal-Wallis test; *p<0.05.

Table 2 shows the final multivariate adjusted models indicating a significant association between maternal education and dental caries. Children of mothers who had 8 years or less of study were more likely to have caries (PR: 1.89; 95% CI: 1.40-2.55) (p<0.01). In addition, children with dental discoloration due to trauma had a 1.69 times higher chance of having dental caries (PR: 1.69; 95% CI: 1.22-2.34) (p=0.001).

Table 2. Univariate and multivariate logistic not adjusted and adjusted regression analysis of factors associated with dental caries in children.

Variables	PR (95%CI)[c] Not adjusted	p-value	PR (95%CI)[c] Adjusted	p-value
Child's age[b]				
2 years	0.52 (0.26-1.05)	0.07		
3 years	1.03 (0.67-1.58)	0.87		
4 years	1.05 (0.75-1.46)	0.75		
5 years	1			
Child's school[b]				
Sector 1	0.74 (0.36-1.52)	0.42		
Sector 2	0.95 (0.48-1.90)	0.90		
Sector 3	0.73 (0.34-1.58)	0.43		
Sector 4	1.39 (0.63-3.08)	0.41		
Sector 5	1.21 (0.60-2.44)	0.59		
Sector 6	1			
Household income[a]				
≤1 BRL/month	1.57 (1.13-2.18)	0.007		
>1 BRL/month	1			
Mother's schooling[a]				
≤ 8 years of study	1.98 (1.46-2.68)	<0.01	1.89 (1.40-2.55)	<0.01
> 8 years of study	1		1	
Father's schooling[a]				
≤ 8 years of study	1.15 (0.79-1.68)	0.44		
> 8 years of study	1			
Mothers work out home[a]				
Yes	0.77 (0.56-1.06)	0.11		
No	1			
Mothers' salary[a]				
≤1 BRL/month	1.64 (1.13-2.40)	0.009		
>1 BRL/month	1			
Fathers' salary[a]				
≤1 BRL/month	1.45 (1.00-2.10)	0.04		
>1 BRL/month	1			
Dental trauma color consequences[a]				
Present	1.78 (1.28-2.47)	0.001	1.69 (1.22-2.34)	0.001
Absent	1		1	
Which color alterations[b]				

Yellow	1.83 (1.25-2.68)	0.002
Gray	1.68 (1.03-2.74)	0.03
None	1	

[a]Mann-Whitney test; [b]Kruskal-Wallis test; [c]Model adjusted for: child's age, child's school, household income, which color alteration, mothers' salary, fathers' schooling, household income, mothers work out and fathers' salary.

Discussion

This study assessed socioeconomic and demographic factors for dental caries in preschool children and provided some new information that add to the current knowledge about risk factors on early childhood caries: child age, household income, maternal schooling, trauma-related discoloration, and color of discoloration. Besides, children of mothers who had 8 years or less of study and children with dental discoloration from trauma had a higher risk of early childhood caries.

The prevalence of dental caries was 55.1%, which was similar to other studies conducted in Brazil [2,7,20-22]. For example, a study in the city of São Paulo, Brazil, found a caries prevalence of 57.7% [7]. Another study carried out in Goiânia found a prevalence of 54% [20]. On the other hand, a study conducted in Porto Alegre, Brazil, found a prevalence of 43% [20] and a study carried out in Manaus found an even higher caries prevalence of 64.6% [22]. The former two studies discuss the strong association between low social status, low maternal education, and difficult access to dental services with a high prevalence of caries. The studies indicate that children in the southern region of Brazil have a higher social level, higher maternal education, and easier access to dental services than in the rest of the country, which is reflected in studies with a lower prevalence of dental caries in children [5,7,20-22].

The prevalence of untreated caries found in our study was similar to the Brazilian average (76.1%), as reported in the last National Oral Health Survey in 2010. The historical differences in the occupation and economic development of Brazilian regions, as well as the unequal financing of public health system at the beginning of the Unified Health System (SUS) implementation in Brazil, partly explain the social disadvantage of the North and Northeast regions compared to the South and Southeast regions of the country [12]. Despite the better oral health indicators of the region where this study was conducted and the persistent historical demographic differences of Brazilian regions, early childhood caries is a disease that needs attention in terms of prevention and treatment to reduce socio-organizational and geographic barriers to health services [6,10,12,22,23].

In general, the results of sociodemographic factors related to caries disease confirmed the literature. Studies show a significant association between maternal education and dental caries, indicating that children of mothers with up to 8 years of education have higher rates of caries. According to previous studies, mothers with lower education tend to have greater difficulty accessing health-related information and preventive strategies for caries control, making them more neglectful of their own oral health and even more so with their children [24-26]. Therefore, parental education, especially maternal education, is an important factor in the risk and prevalence of caries disease [27]. On the other hand, our study shows that paternal education does not affect dental caries [23,24].

An intriguing result of the present study was the positive and significant association between tooth decay, dental trauma, and dental trauma color consequences in deciduous teeth, as previous research shows this association only in permanent teeth [25,28]. This can be explained by the high prevalence of both dental caries and dental trauma in the studied population. Indeed, children aged 2-5 years are more susceptible to falls and dental trauma in anterior teeth [24]. As a consequence, dental color alterations due to trauma in anterior primary teeth and caries are expected to have a similar prevalence in this age group.

In this study, age was an important factor in the onset and prevalence of caries, with a positive and significant association. This indicates that older children tend to have higher rates of caries, as shown in a 2016 study, in which age was also associated with caries disease in preschool children [29,30]. Importantly, these caries rates can be even higher when associated with other predicted behavioral factors, such as lack of information and the mother's age [29].

In our study, family income directly affected the rate of caries in young children, which is in line with the [31]. The lower the income of a family, the greater the probability of childhood carious lesions. A study conducted with 5,189 children aged 6 years in Rotterdam, the Netherlands, found a higher prevalence of caries in children of parents with low family income [32] and that lower family income was a strong predictor of the prevalence of severe caries in children [27,32]. The cost of primary dental care is a possible cause of this association, as the literature indicates that adults with low income tend to visit the dentist less often, which could lead to the conclusion that their children do not visit the dentist either. This supports two main reasons for poor oral health: financial reasons and lack of access to knowledge about the importance of oral health care [32].

This study is of great relevance to the literature, as it was a randomized cross-sectional study that allowed us to assess the prevalence of caries and establish a relationship between the possible variables. However, the study also has limitations, such as sample loss due to children changing schools and refusal to participate in the research, and variations between examiners. To reduce these potential limitations, the researchers explained the study to parents confidently and in understandable and clear language. The data from the examiners were also submitted to the Kappa test to assess inter-examiners variations and obtain more reliable results. Finally, further studies are needed to identify the main variables related to caries, so that public policies and prevention programs can be targeted to reduce the incidence of dental caries in preschool children and improve access to oral health services for guardians and minors.

Conclusion

The prevalence of dental caries in a sample of children in Minas Gerais, southeastern Brazil, was high. Child age, family income, maternal education, and dental discoloration due to trauma were risk factors for dental caries in these children. Children with lower maternal education levels and color alterations on a front primary tooth due to trauma also had a higher risk of developing dental caries.

Authors' Contributions

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

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None.

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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