ORIGINAL ARTICLE

DENTAL CARIES EXPERIENCE IN 12-YEAR-OLD SCHOOLCHILDREN FROM ARARUNA, PARAÍBA, BRAZIL

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Highlights: (1) The CPO-D index at 12 years of age in the municipality of Araruna was higher than both national and state averages. (2) The decayed component showed the highest frequency within the CPO-D index. (3) Socioeconomic factors influence dental caries experience. (4) The consumption of retentive carbohydrates influences dental caries occurrence.

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DENTAL CARIES EXPERIENCE IN 12-YEAR-OLD SCHOOLCHILDREN FROM ARARUNA, PARAÍBA, BRAZIL

ABSTRACT

Objective: To identify the dental caries experience among 12-year-old schoolchildren from Araruna, Paraíba, Brazil, and its associated risk factors, including diet, oral hygiene, and socioeconomic conditions.

Methods: This was a cross-sectional observational epidemiological study conducted with a sample of 151 12-year-old schoolchildren enrolled in public and private schools in Araruna, Paraíba, Brazil. Socioeconomic data were obtained from school enrollment records, and structured questionnaires with closed-ended questions were administered to assess oral hygiene habits and dietary patterns. Clinical oral examinations were also performed. Data collection took place between July and October 2022. Statistical analyses were conducted using Microsoft Excel® and IBM SPSS Statistics® version 20.0.

Results: The sample comprised male (62; 41.1%) and female (89; 58.9%) schoolchildren, with a predominance of mixed-race individuals (93; 61.6%) and residents from urban areas (89; 58.9%). The mean CPO-D index (Decayed, Missing, and Filled Teeth) was 4.43. Among the variables analyzed, significant associations with dental caries experience were observed in children from families earning up to half the minimum wage (102; 93.1%), those who visited the dentist between 6 months and 1 year (96; 63.5%), those receiving government social assistance (93; 92.1%), and those consuming potentially cariogenic foods, including biscuits (106; 85.4%), breakfast cereals (18; 100%), yogurt/dairy beverages (88; 89.8%), and sweet popcorn/peanuts (111; 89.5%).

Conclusion: Dental caries experience in Araruna, Paraíba, Brazil, showed a high mean CPO-D index, with the decayed component being the most prevalent. The presence of dental caries, defined as CPO-D ≥ 1, was mainly influenced by socioeconomic factors and dietary patterns.

Keywords: Dental caries; Oral hygiene; Socioeconomic factors; Diet.

1 INTRODUCTION

Dental caries is a chronic, noncommunicable, biofilm- and sugar-dependent disease characterized by slow progression. Its earliest clinical sign is the presence of an active white

spot lesion on enamel. In the absence of adequate control and/or treatment, the lesion continues to progress and may ultimately lead to the destruction of dental structure[1-6].

Dental caries remains one of the most common oral health conditions worldwide, affecting individuals across all stages of life, and is therefore considered a major public health problem. It belongs to the group of noncommunicable chronic diseases and disproportionately affects socially and economically disadvantaged populations. Furthermore, dental caries shares a common risk fator with other chronic conditions such as diabetes and obesity, reinforcing the need for comprehensive population-based prevention and management strategies that address not only its clinical manifestations but also its underlying determinants[3-9].

Epidemiological surveys are essential for determining the prevalence of oral diseases, estimating treatment needs, and supporting the development of context-specific public health strategies[10-13]. Epidemiological data allow the identification of disease distribution within specific geographic areas, facilitate the planning, implementation, and evaluation of health interventions, provide insight into the overall effectiveness of oral health services, and enable comparisons across different time periods and populations[11,14-15].

National oral health surveys have demonstrated a substantial decline in CPO-D index values between 1986 and 2023. According to the SB Brasil 2023 survey, the mean CPO-D at 12 years of age was 1.84, placing Brazil within the low caries prevalence category, based on the World Health Organization classification, which defines this category as CPO-D values ranging from 1.2 to 2.6. This finding positions Brazil among the best-performing countries in the Americas and reflects significant progress in national oral health policies over recent decades[8,10,14,16].

The CPO-D index at 12 years of age is internationally recognized as the standard indicator for assessing dental caries status. Therefore, the present study aimed to determine the prevalence of dental caries among 12-year-old schoolchildren in the municipality of Araruna, Paraíba, Brazil, and to evaluate its association with risk factors, dietary habits, oral hygiene practices, and socioeconomic conditions.

2 METHODS

A cross-sectional design was employed to analyze the prevalence of dental caries among 12-year-old schoolchildren in the municipality of Araruna, Paraíba, Brazil, with risk factors such as diet, oral hygiene, and socioeconomic conditions taken into consideration. Data collection was conducted between July and October 2022.

2.1 Study population and sample

The study population was defined as 306 12-year-old children enrolled in public and private schools in Araruna, Paraíba, Brazil, as determined from data obtained from the Municipal Department of Education. The sample size was calculated considering a 95% confidence level and a 5% margin of error, yielding a minimum sample of 137 participants. An additional 10% was incorporated to account for potential sample losses, resulting in a final sample of 151 schoolchildren.

2.2 Ethical considerations

This study was conducted in accordance with the ethical principles established by Resolution No. 466/12 of the National Health Council of the Brazilian Ministry of Health. The study was registered in the National Research Ethics Information System (SISNEP) and approved by the Research Ethics Committee of the State University of Paraíba, Campina Grande, Paraíba, Brazil (approval number: 5,539,255).

Written informed consent was obtained from all parents or legal guardians through the signing of the Informed Consent Form. The participants were informed about the nature, objectives, and procedures of the study, and written assent was subsequently obtained through the signing of the Assent Form prior to participation.

2.3 Data collection

2.3.1 Pilot testing

A pilot study was conducted in August 2022 with 5% of the sample to allow the dietary questionnaire, which was based on the study by Motta et al.[17], and the oral hygiene questionnaire developed by the research team to be assessed and adjusted. Two examiners and two recorders were included in the pilot study; however, no prior calibration was performed.

2.3.2 Socioeconomic data collection

Following authorization from parents or guardians, socioeconomic data were collected from school enrollment records between September and October 2022. A standardized socioeconomic form based on the family socioeconomic questionnaire from the SB Brasil 2020 national oral health survey[16] was used for this purpose.

2.3.3 Questionnaire application

Data on dietary habits and oral hygiene practices were obtained through face-to-face interviews conducted individually with the participants in a private room at the school. Questions were posed using clear and accessible language, and neutrality was maintained to avoid response bias. Data collection was carried out on previously scheduled dates to minimize disruption to school activities and only after written informed consent and assent had been obtained.

2.3.4 Clinical oral examination

Clinical examinations were performed at the schools in open areas under natural light between September and October 2022 to assess the CPO-D index. Standard biosafety protocols were followed, and appropriate personal protective equipment, including gloves, caps, masks,

and protective eyewear, was worn by all examiners. Sterilized dental mirrors (PRISMA®, São Paulo, SP, Brazil) and WHO periodontal probes (GOLGRAN®, São Paulo, SP, Brazil) were used. Cotton rolls were employed for tooth isolation, and sterile gauze was used for drying. Clinical findings were recorded using a standardized examination form based on the CPO-D assessment protocol from the SB Brasil 2020 survey[16].

2.4 Statistical methods

Descriptive statistical analysis was performed to characterize the sample. Pearson's chi-square test (or Fisher's exact test, when appropriate) was used to evaluate associations between the investigated variables. Data were processed and analyzed using Microsoft Excel® and IBM SPSS Statistics® version 20.0. A 95% confidence interval and a significance level of 5% ($p < 0.05$) were adopted.

3 RESULTS

The calculated sample size was achieved, and a total of 151 schoolchildren participated in the study. Table 1 presents the descriptive data of the CPO-D index for the sample (n = 151) of 12-year-old schoolchildren. The mean CPO-D was 4.43, which is considered high, with the decayed component representing the largest contribution, showing a mean of 3.91 affected teeth.

Table 1 – Mean CPO-D index among 12-year-old schoolchildren from Araruna, Paraíba, Brazil.

Variable	N	Mean
CPO-D	151	4,43
Decayed	151	3,91
Filled	151	0,41
Missing	151	0,11
Total	**151**	

Source: Prepared by the authors, 2024.

Table 2 presents the socioeconomic and demographic characteristics of the study sample. A higher proportion of female schoolchildren (89; 58.9%) was observed compared with males (62; 41.1%). Most participants resided in urban areas (89; 58.9%). Regarding socioeconomic status, the majority of families reported a monthly income of up to half the minimum wage (102; 67.5%), and 66.9% (n = 101) received government social assistance. Additionally, most mothers had an educational level up to elementary school (81; 53.6%).

Table 2 – Socioeconomic and demographic characteristics of the study sample.

Variable	N	%
Sex		
Male	62	41,1
Female	89	58,9
Skin color		
White	47	31,1
Black	11	7,3
Mixed race	93	61,6
Area of residence		
Urban	89	58,9
Rural	62	41,1
Number of household residents		
Up to 3 persons	35	23,2
4 persons	70	46,4
5 or more	46	30,5
Monthly family income		
Up to ½ minimum wage	102	67,5
Between ½ and 1 minimum wage	22	14,6
More than 1 minimum wage	27	17,9
Government social assistance		
Yes	101	66,9
No	50	33,1
School grade		
6th grade	70	46,4
7th grade	81	53,6
Mother's educational level		
Illiterate	3	2,0
Incomplete elementary school	58	38,4
Complete elementary school	23	15,2
Incomplete high school	18	11,9
Complete high school	40	26,5
Higher education	9	6,0
Total	**151**	**100**

Source: Prepared by the authors, 2024.

Table 3 presents the distribution of oral hygiene–related variables among the study participants. Most schoolchildren (136; 90.1%) reported having visited a dentist at least once, with 43.7% (n = 66) reporting dental visits every six months. Additionally, 96.0% (n = 145) had received oral hygiene instructions from a health professional or caregiver. Regarding oral hygiene practices, 92.1% of participants reported brushing their teeth at least twice daily (n = 139). However, 64.2% (n = 97) reported using non-fluoridated toothpaste.

Table 3 – Distribution of oral hygiene characteristics among the study sample.

Variables	n	%
Have you ever visited a dentist?		
Yes	**136**	**90.1**
No	**15**	**9.9**
Frequency of dental visits		
Every 6 months	**66**	**43.7**
Annually	**48**	**31.8**
More than 2 years	**21**	**13.9**
Never visited a dentist	**16**	**10.6**
Received oral hygiene instructions		
Yes	**145**	**96.0**
No	**6**	**4.0**
Source of oral hygiene instruction		
Dentist at dental office	**49**	**32.5**
Dentist at school	**24**	**15.9**
Parents or guardians	**34**	**22.5**
More than one source	**38**	**25.2**
Brush teeth daily		
Yes	**145**	**96.0**
No	**6**	**4.0**
Frequency of toothbrushing per day		
Once	**12**	**7.9**
Twice	**70**	**46.4**
Three or more times	**69**	**45.7**
Own toothbrush		
Yes	**151**	**100**
Frequency of toothbrush replacement		
Monthly	**45**	**29.8**
Every 3 months	**73**	**48.3**
Every 6 months or more	**33**	**21.9**
Use of fluoridated toothpaste		
Yes	**54**	**35.8**
No	**97**	**64.2**
Use of dental floss		
Yes	**69**	**45.7**
No	**82**	**54.3**
Frequency of flossing		
After every brushing	**20**	**13.2**
Once daily	**16**	**10.6**
Occasionally	**33**	**21.9**
Use of mouthwash		
Yes	**57**	**37.7**
No	**94**	**62.3**
Total	**151**	**100**

Source: Prepared by the authors, 2024.

Table 4 shows the association between dental caries experience and socioeconomic and oral hygiene variables. A higher prevalence of caries experience (CPO-D ≥ 1) was observed primarily among schoolchildren from families with a monthly income of up to half the minimum wage (95; 93.1%) and among those receiving government social assistance (93; 92.1%). Although most participants had received oral hygiene instructions (125; 87.4%), caries experience remained highly prevalent. Regarding oral hygiene behaviors, 46.4% of participants reported brushing their teeth twice daily, 31.8% reported annual dental visits, and 21.9% reported replacing their toothbrush every six months or longer.

Table 4 – Association between dental caries experience and socioeconomic and oral hygiene variables.

Variables	Caries-free (CPO-D = 0)	Caries experience (CPO-D ≥ 1)	Total	p-value
Monthly family income				<0.001[1]*
Up to ½ minimum wage	7 (6.9%)	95 (93.1%)	102	
½ to 1 minimum wage	7 (31.8%)	15 (68.2%)	22	
>1 minimum wage	8 (29.6%)	19 (70.4%)	27	
Government social assistance				0.001[1]*
Yes	8 (7.9%)	93 (92.1%)	101	
No	14 (28.0%)	36 (72.0%)	50	
Skin color				0.940[1]
White	7 (14.9%)	40 (85.1%)	47	
Black	1 (9.1%)	10 (90.9%)	11	
Mixed race	14 (15.1%)	79 (84.9%)	93	
Sex				0.340[1]
Male	7 (11.3%)	55 (88.7%)	62	
Female	15 (16.9%)	74 (83.1%)	89	
Area of residence				0.059[1]
Urban	17 (19.1%)	72 (80.9%)	89	
Rural	5 (8.1%)	57 (91.9%)	62	
Ever visited a dentist				0.886[1]
Yes	20 (14.7%)	116 (85.3%)	136	
No	2 (13.3%)	13 (86.7%)	15	
Frequency of dental visits				0.787[1]
Every 6 months	9 (13.6%)	57 (86.4%)	66	
Annually	9 (18.8%)	39 (81.3%)	48	
>2 years	2 (9.5%)	19 (90.5%)	21	
Never	2 (12.5%)	14 (87.5%)	16	
Received oral hygiene instructions				0.016[2]*
Yes	18 (12.6%)	125 (87.4%)	143	
No	4 (50.0%)	4 (50.0%)	8	
Toothbrushing frequency				0.911[1]

	Once daily	2 (16.7%)	10 (83.3%)	12
	Twice daily	10 (14.3%)	60 (85.7%)	70
	≥3 times daily	10 (14.5%)	59 (85.5%)	69
Dental floss use				0.367[1]
	Yes	12 (17.4%)	57 (82.6%)	69
	No	10 (12.2%)	72 (87.8%)	82

[1]Pearson's chi-square test; [2]Fisher's exact test; *Statistically significant association ($p < 0.05$).
Source: Prepared by the authors, 2024.

Table 5 presents the association between dietary habits and dental caries experience. Participants with CPO-D ≥ 1 showed significantly higher consumption of potentially cariogenic foods, including biscuits (106; 85.4%), breakfast cereals (18; 100%), yogurt/dairy beverages (88; 89.8%), and sweet popcorn/peanuts (111; 89.5%).

Table 5 – Association between dietary habits and dental caries experience.

Variables		Caries-free (CPO-D = 0)	Caries experience (CPO-D ≥ 1)	Total	p-value
Consumed biscuits					0.004[1]*
	Yes	12 (10.2%)	106 (89.8%)	118	
	No	10 (30.3%)	23 (69.7%)	33	
Consumed breakfast cereals					0.049[2]*
	Yes	0 (0%)	18 (100%)	18	
	No	22 (16.5%)	111 (83.5%)	133	
Consumed yogurt/dairy beverages					0.039[1]*
	Yes	10 (10.2%)	88 (89.8%)	98	
	No	12 (22.6%)	41 (77.4%)	53	
Consumed sweet popcorn/peanuts					0.005[2]*
	Yes	13 (10.5%)	111 (89.5%)	124	
	No	9 (33.3%)	18 (66.7%)	27	

[1]Pearson's chi-square test; [2]Fisher's exact test; *Statistically significant association ($p < 0.05$).
Source: Prepared by the authors, 2024.

4 DISCUSSION

The SB Brasil 2023 national oral health survey reported a mean CPO-D index of 1.84 in the Northeast region, 2.30 in the state of Paraíba, and 3.28 in João Pessoa, the state capital[11]. The municipality of Araruna substantially exceeded all these estimates, recording a mean CPO-D of 4.43, which highlights the urgent need for targeted public health interventions to address dental caries in this population.

The decayed component predominated within the CPO-D index, and 9.9% (n = 15) of the adolescents reported never having visited a dentist. These findings underscore the importance of evaluating access to dental care services and the organization of oral health care delivery, dimensions that the present study did not assess. Beyond implementing oral health promotion and caries prevention strategies, ensuring access to dental treatment remains essential, particularly when disease has already been established.

The educational level of parents and caregivers constitutes an important factor within the multifactorial framework of dental caries. Although no statistically significant association emerged for this variable, more than 50% of the participants' mothers had not completed education beyond elementary school, and their children presented caries experience (CPO-D ≥ 1). De Castilho[18] emphasized that maternal educational level shapes health-related behaviors, and that higher educational attainment plays a crucial role in promoting appropriate oral health practices among children, including toothbrushing habits, dietary guidance, and especially sugar consumption control.

A well-established body of literature confirms the association between dental caries and socioeconomic conditions[19]. The present study identified significant associations between caries experience and both family income ($p < 0.001$) and receipt of government social assistance ($p = 0.001$). Moreover, 67.5% of families reported a monthly income of up to half the minimum wage, and 66.9% received social assistance benefits, suggesting that a substantial proportion of the sample lived under conditions of social vulnerability. These findings reinforce the importance of developing preventive policies tailored to socially vulnerable populations.

Corrêa-Faria et al.[20] also identified a significant association between dental caries and family income, while Piovesan et al.[21] recognized parental income and education level as the socioeconomic variables most strongly associated with dental caries occurrence. In the same vein, Shou and Uitenbroek[22] and Verrips et al.[23] demonstrated that higher parental educational attainment promotes greater access to health information and healthier oral health behaviors among children.

The majority of participants (64.2%) reported not using fluoridated toothpaste, which represents another concerning finding. Given the age of the participants, however, they may have been unaware of the specific type of toothpaste used at home, and this result therefore

warrants cautious interpretation. Obtaining such information directly from parents or caregivers would likely have yielded more reliable data.

Although schools may not regard themselves as directly responsible for health care delivery, they play a critical role in health promotion. The Brazilian School Health Program (*Programa Saúde na Escola*) had not been implemented in the study region at the time of data collection, which highlights the importance of intersectoral, community-based health initiatives that bring together schools, health care teams, local government, and the broader community.

Previous studies have demonstrated higher caries prevalence among students attending public schools compared with those attending private schools ($p < 0.0001$)[24]. Given that the majority of the sample in Araruna attended public schools, school-based public health interventions take on particular relevance. Strengthening the School Health Program, established in 2007 by the Ministries of Health and Education to promote health and improve quality of life among public school students represents a key strategy for this municipality[25].

Despite reporting adequate oral hygiene practices and regular dental visits, the participants presented a high CPO-D index, suggesting that dietary habits may play a critical role in caries experience. The literature indicates that food consistency influences cariogenic potential, with retentive solid foods posing a higher risk due to their prolonged retention on tooth surfaces, which facilitates bacterial metabolism within the dental biofilm[26–28].

In the present study, several retentive foods showed significant associations with caries experience, including biscuits, breakfast cereals, yogurt/dairy beverages, and sweet popcorn/peanuts. In contrast, non-retentive sugary foods, such as soft drinks, sweetened juices, and coffee with sugar, did not demonstrate significant associations with caries experience.

Filho et al.[26] found that more than 90% of preschool children consumed foods rich in extrinsic sugars and identified a positive association between non-dairy sugar consumption frequency and caries experience ($p < 0.01$). Similarly, Moura et al.[27] evaluated schoolchildren aged 10 to 14 years, recorded a caries prevalence of 66.6%, and noted that cereals, biscuits, and soft drinks ranked among the most frequently consumed foods, while only 44.9% of participants reported brushing their teeth after snacks.

In a study conducted in João Pessoa, Moura et al.[27] recorded a mean CPO-D index of 1.49 at 12 years of age and identified statistically significant associations between CPO-D and both

socioeconomic factors (p = 0.022) and dietary habits (p = 0.050), supporting the multifactorial nature of dental caries and corroborating the findings of the present study.

The growing consumption of ultra-processed foods with low nutritional value and high sucrose and fat content poses an increasing public health concern. Promoting healthy dietary habits from early childhood is essential for proper growth and development, as well as for the prevention of both oral and systemic diseases. Identifying collective risk factors for dental caries is fundamental for understanding the health–disease process across different social contexts and for guiding effective public health interventions[27–30].

This study carries limitations inherent to its cross-sectional design, which precludes causal inference. Longitudinal studies are needed to better elucidate the temporal relationships between risk factors and dental caries. Furthermore, the reliance on self-reported data from adolescents may have introduced reporting bias, although this approach is widely adopted in epidemiological research.

5 CONCLUSION

The studied population was characterized by a high mean CPO-D index, with the decayed component being the most prevalent. Considering caries experience defined as CPO-D ≥ 1, socioeconomic factors and dietary habits were the variables most strongly associated with this outcome.

These findings highlight the importance of assessing dental caries within a broader contextual framework, including its associated risk factors. Such an approach is essential for guiding the development and implementation of more effective and targeted oral health programs and public health policies.

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DENTAL CARIES EXPERIENCE IN 12-YEAR-OLD SCHOOLCHILDREN FROM ARARUNA, PARAÍBA, BRAZIL

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