

The prevalence of caries in the primary dentition and associated factors in children in the city of Parnaíba-Piauí

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Abstract

Aim: To evaluate the prevalence of caries in primary dentition in preschoolers in Parnaíba, Brazil and identify associated factors. **Material and Methods:** The sample studies were children in primary dentition aged between two and six years. Both the children and their parents or guardians agreed to the child's participation in the study. Those preschoolers with syndromes or special needs, those who did not tolerate the dental examination and those with a fixed orthodontic appliance were excluded. The questionnaire was completed by a parent or guardian of each child and the 360 children's teeth were examined, using the International Caries Detection and Assessment System (ICDAS). The data were dichotomized as presence of cavity related to caries - caries free and non-cavitated lesions (ICDAS 0, 1 and 2) and cavitated lesions (ICDAS ≥ 3). The presence of early childhood caries was determined and cavitation of the carious process was evaluated. Indications for necessary extraction of any primary teeth due to the carious process were noted. **Results:** The prevalence of caries in our sample of two to five-year-old children was 43.3% ($p < 0.05$), with no significant difference between ages or genders. The majority of children (84.6%) presented with caries in two or more teeth. Only 15.38% of these children had caries in a single tooth. The most commonly affected tooth was number 75, followed by teeth 55, 54 and 84. The prevalence of caries in preschoolers was found to be correlated with low socioeconomic status and poor quality of life. **Conclusion:** The prevalence of caries in preschool children was 43.3%. Several factors were associated with dental caries in primary dentition. Children with caries were unlikely to use dental floss or brush their tongues, were only taken for dental treatment when they experienced oral pain and had parents who did not consider brushing teeth after a meal to be important.

KEYWORDS: Dental Caries. Primary Dentition. Oral Hygiene.

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Received: 20/04/21

Accepted: 01/07/22

Published: 01/08/22

DOI: 10.36065/robrac.v31i90.1532

Introduction

Both national and international studies have found a significant reduction in caries among school-aged children in recent years¹. Whilst there has also been a reduction in pre-school children internationally, a relatively high incidence is still observed in Brazilian preschool children, especially those with poor living conditions². Therefore, in addition to studies investigating the biological and behavioral variables associated with preschool dental caries, there has been a growing interest in the socio-environmental determinants of this disease in young children^{1,2}.

Studying oral health in children up to five years of age is essential because caries in primary dentition are considered the strongest predictor of the disease in permanent dentition². Early diagnosis of caries is essential since treatment in the early stages is cheaper and less invasive^{3,4}.

Periodic epidemiological surveys on the prevalence of caries in children are vital. It is important to know the prevalence of this condition to stimulate the creation of public policies and alert dentists to the importance of prevention, early diagnosis, and minimization of damage. Children's awareness and education in oral health should begin with the first dentition⁵.

Early childhood caries is a public health problem affecting a large number of children, with a significant negative impact on their quality of life^{5,6}. Parnaíba is the second-most populous city in the state of Piauí. It is a relatively impoverished city with many of its residents on the minimum wage.

There has been no research on the prevalence of caries among preschoolers in this region so this study will provide valuable information⁶.

Early childhood caries (ECC) is defined by the American Academy of Pediatric Dentistry – American Academy of Pediatric Dentistry as the presence of one or more decayed teeth (with cavitated or non-cavitated lesions), absent (due to caries)

or filled in children of up to 71 months of age. In children under three years of age, any smooth tooth surface that is decayed (cavitated or not) is indicative of Severe Childhood Caries. It is also considered Severe Childhood Caries and, from 3 to 5 years of age, children have more than four, five and six affected surfaces in primary anterior teeth at 3, 4 and 5 years of age, respectively⁷.

Dental caries in childhood is an important issue since it affects the well-being, growth and quality of life of children and their families⁸. Internationally, there has been a decline in the prevalence of dental caries in children under five in both developed and developing countries. However, in 2010, its prevalence in Brazil remained high, at 46.6%^{8,9}. Although, epidemiological data on ECC are scarce, this high incidence is believed to persist in Brazil and parents and guardians display high levels of ignorance about oral health and the damage caused by caries⁹. In view of this, the objective of this research was to evaluate the prevalence of caries in primary dentition in preschoolers in Parnaíba, Brazil and identify associated factors.

Material and method

Ethical considerations

This was a cross-sectional study based on guideline Strobe/Equator, approved by the ethics and research committee (ERC) of the State University of Piauí (UESPI) (number: 3.289.718).

Study population/sample/inclusion criteria/exclusion criteria

The sample size was calculated based on the size of the target population: children between two and five years old enrolled in preschool in the city of Parnaíba in 2018 totaled 4.087. The city does not have fluoridated water. Thus, the required sample size was 360 participants. To allow for the possibility of withdrawal, the sample was expanded to 400. This minimum number of participants was considered sufficient considering the proposed

analyses, the sampling error of 5%, and the 95% of confidence level¹⁰. The questionnaire was distributed to 400 parents, however, 40 did not respond or did not want their children to participate in the research. Thus, the final sample size was 360. The prevalence of dental caries used for sample size calculation was found in the study by Assunção *et al.*⁸ (2015).

From a total of 6 public and 8 private schools, letters of consent were obtained from the principals of two public schools (A1) and two private schools (A2) chosen by lot of the schools and the classrooms, to ensure equal numbers of children from four schools, distributed throughout the districts of Parnaíba.

This research was guided by the ethical principles for research with human participants provided by Resolution nº 466/12 (CNS/MS). Two researchers explained to the children that they were going to look at, and photographed their teeth. Both the child and parent were assured that the child's participation was not mandatory, and they could withdraw at any time without any harm or consequence. Parents or guardians then signed informed consent forms and the children signed the terms of assent with fingerprints.

The inclusion criteria were: children in primary dentition, between two and five years of age, who consented to participation and whose parents or guardians also gave consent. Preschoolers with syndromes or special needs, who did not tolerate the dental examination, who had a fixed orthodontic appliance, or mixed dentition were excluded.

Pilot study

To standardize the diagnosis of dental caries, clinical training of examiners was carried out at the UESPI children's dental clinic in Parnaíba, PI. As a pilot study, the methodology was tested in a pilot study on a separate sample of 30 children. The questionnaire was completed by a parent or guardian of each child

and the children's teeth were examined, using the International Caries Detection and Assessment System (ICDAS). The data were dichotomized as presence of cavity related to caries - caries free and non-cavitated lesions (ICDAS 0, 1 and 2) and cavitated lesions (ICDAS ≥ 3). The pilot did not indicate the need for any changes to the methodology.

In addition, 10% of the main study sample (n=36) were examined twice, once by each of the two researchers, with an interval of two weeks between examinations, to determine intra-examiner and inter-examiner agreement. The kappa values obtained for these were 0.85 and 0.87, respectively.

Data collection/ collection period/instruments

The survey was conducted from February to July 2018. The questionnaire was sent to the parents or guardians of the children to determine factors associated with dental caries (Figure 1). The questionnaire gathered the children's personal and socioeconomic data, oral hygiene practices, and information on their parents' education. After one week, the free and informed consent form and the completed questionnaires were collected. Using age-compatible language, the clinical examination was explained to the children. The children's dental examinations took place at their schools. They were examined by two pediatric dentistry professors under artificial light using a flat mouth mirror and a WHO dental probe. Each child was examined by two researchers.

The children were examined individually, in the knee-knee position, with their head in the researcher's lap and their trunk and legs in the lap of another survey participant. The observed data were recorded by an annotator on the children's individual records and odontograms. Caries activity is a concept that reflects the mineral balance, in terms of net mineral loss, net mineral gain, or stasis over time. Caries active implies caries initiation/progression; caries inactive implies caries arrest/regression^{11,12}.

The index ICDAS II for caries diagnosis was used. It has seven categories, the first for healthy teeth (code 0); enamel-only caries (white / brown lesion (codes 1 and 2, respectively); caries that extends to the enamel without exposed dentin (codes 3 without visible dentin and 4, with dark dentin shadow seen through doe-samel); caries with exposed dentin (codes 5 to half of the dental surface and 6, in addition to the half of the dental surface).

Before the clinical examination, a gauze slightly moistened with filtered water was used to remove oral debris and bio-film, after toothbrushing with fluoride dentifrice to remove possible debris and/or biofilm. Proximal tooth surfaces were also flossed for better surface evaluation. A visual-tactile examination was used, observing the texture, brightness and coloring of the lesions to differentiate active from inactive lesions. WHO dental probe was also delicately used to feel the local texture and to remove remaining debris and biofilm.

***Student's personal data:**

- 1- Gender: () Male () Female
- 2- Age: () 2 years () 3 years () 4 years () 5 years () 6 years
- 3- Breed: () White () Black () Brown
- 4- School: () Public () Private

***Socioeconomic data**

- 5- Family income: () 1 salary () 2-3 salary () 4 or more
- 6- Number of people in the residence: () 2-4 people () 5-7 people () more than 7

*** Education of parentes or guardians**

7- Father's schooling

- () from 1st to 4th grade of elementary school () from 5th to 8th grade of elementar school () high school () University education () Specialization () did not study () do not know

8-Mother's schooling

- () from 1st to 4th grade of elementary school () from 5th to 8th grade of elementar school () high school () University education () Specialization () did not study () do not know

***Oral hygiene data**

- 9- How many daily brushings does the child perform? () Once () Twice () 3 times () more than 3 times () not once
- 10- How long does it take on average to brush the teeth? () Up to 30s () 1 minute () 2 minutes () more than 2 minutes
- 11- Do you mother/father or guardian consider it important to brush after all meals? () Yes () No
- 12- Does the child usually rinse with water after brushing () Yes () No
- 13-Brush the surface of the tongue after oral hygiene () Yes () No
- 14- Brushing happens: () Individually () Performed by adult () Supervisioned
- 15- What does the child use when brushing? () Uses toothbrush and toothpaste () Uses only toothbrush () Uses toothbrush, paste and dental floss
- 16- How long does the toothbrush change? () Every 6 months () Each year () More than year
- 17- How often does the child go to the dentist? () Once a year () 2 times per year () Only when the tooth hurts
- 18- The child eats candies between meals? () Yes () No

FIGURE 1 - Personal data and predisposing factors for early childhood caries

Only primary caries were considered. The presence of caries active was diagnosed when there were opaque or white spots lesions near the gingiva margin, rough enamel lesions in areas that retain dental plaque, such as the cervical or occlusal regions or smooth surfaces. These could be soft and wet in dentin and white discoloration in enamel. Caries inactive could be dark, dry and hard in dentin or brown discoloration in enamel without dental plaque coverage¹¹. The clinical examination evaluated the carious lesion activity, whether the lesions resulted from ECC, with the presence of one or more decayed in any primary tooth of a child under age of 6¹² and whether extraction of primary teeth due to the carious process was indicated, based on the AAPD Policy on Early Childhood Caries^{13,14}.

The diagnosis of ECC was confirmed by the questionnaire applied to parents, due to the frequent consumption of carbohydrates, especially sugars, and inadequate to absent oral hygiene in small children. If caries were diagnosed, the child was referred to the Clinical School of Dentistry (CSD) of UESPI for treatment and, if necessary, radiographic examination by the researchers.

Statistical analysis

SPSS v. 25 statistical program was used to generate descriptive statistics (percentages and frequencies), analyze association between categorical variables using the chi-square test and compare average ages using the t-test. The significance level was set at $p \leq 0.05$. Logistic regression was performed to assess the factors associated with ECC.

Results

The majority of children with caries were brown (54.5%), followed by black (29.5%) and white (16%). The average age of A1 children was 4.5 years and the average age of A2 children was 4.3 years. Regarding gender, From A1, there were 85 female and 75 male children. From A2, there were 90 children of each gender.

The majority of children were brown (47.2%, n=170), followed by black (30.5%, n=110), and white (21.8%, n=80). The vast majority (80.27%, n=289) of the children came from one-income families. One hundred and sixty four children (45.5%) lived in a house with five, six or seven people.

The prevalence of caries in children in primary dentition was found to be 43.3%, with ICDAS between 3 and 6. In 15.38%, of the children with caries, only one tooth was affected, while the majority (84.6%) presented with caries in two or more teeth. The teeth in which caries were observed were numbers 51, 52, 53, 54, 55, 61, 62, 63, 64, 65, 74, 75, 81, 82, 84, and 85. A chi-square test ($p < 0.01$) showed that, in 17.5% of the children with caries, the tooth most affected was tooth 75, followed by tooth 55 (in 12.5%), 54 (in 10.8%) and 84 (in 10.3%) with ICDAS 5 and 6. All affected molars had inactive caries in dentin. These are dark in color, hard and painless. Affected upper and lower incisors had active caries with ICDAS 3 and 4 (18.9% of the children with caries). These appeared in children between two and four years old. The lesions were soft, wet, painful and discolored in dentin. Between the ages of 4 to 5 years inactive caries in dentin were also found in the first two lower molars, four second molars with ICDAS 5 and 6. However active caries had been found in lower canines and upper incisors with ICDAS 3 and 4.

There were no significant differences ($p=0.19$) in ECC rates between genders or ages among two to six-year-olds ($p=0.11$). However, there was a significant difference ($p < 0.05$) in these rates between the children from public and private schools, with a higher prevalence in public schools ($p < 0.01$). Figure 2 shows the distribution of ECC in the sample by gender and school type.

Table 1 shows the factors that predispose children to ECC and the association of these factors with caries lesions. This is displayed as frequency data and chi-square test results. A statistically significant association ($p < 0.01$) was found between the presence of caries and whether a child's parent or guardian regarded brushing teeth after meals as important.

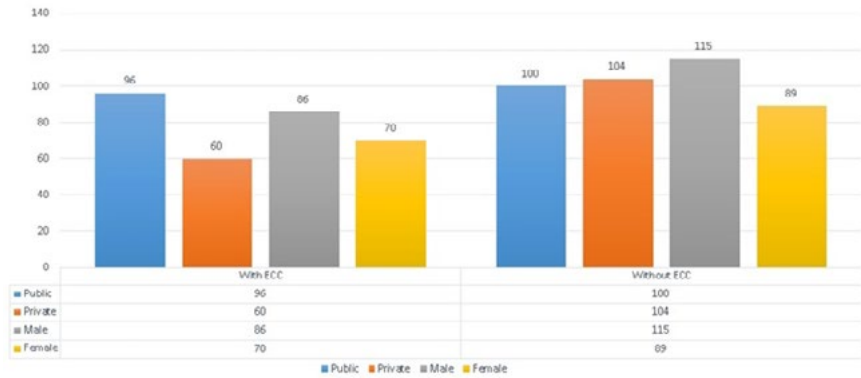


FIGURE 2 - Percentage distribution of children according to gender and school with ECC or without ECC.

TABLE 1 - Distribution of predisposing factors associated with dental caries

Predisposing factors		(Children with ECC)	(Children without ECC)	Total	X ² p valor
Daily brushing	Once	22	25	47	3.42 0.18
	Twice	72	78	150	
	3 times	62	101	163	
Time to brush your teeth	Up to 30s	14	15	29	1.94 0.38
	1 minut	91	108	199	
	2 minuts	51	81	132	
The manager consider important to brush after a meal	No	26	15	41	7.59 0.01*
	Yes	130	189	319	
Child cheeks with water after brushing	No	34	36	70	0.97 0.32
	Yes	122	168	290	
Child brushes his tongue	Sometimes	5	2	7	13.01 0.01*
	No	10	1	11	
	Yes	141	201	342	
Brushing	Individual	21	13	34	5.39 0.06
	By an adult	118	170	288	
	Supervised	17	21	38	
Child uses when brush	Toothbrush and paste	115	112	227	20.47 0.01*
	Toothbrush, paste and dental floss	29	83	112	
	Only toothbrush	12	9	21	
Tooth brush chang time	6 months	137	184	321	2.67 0.26
	Once a year	10	15	25	
	More than year	9	5	14	
Frequency going to the dentist	Once a year	37	87	124	25.73 0.01*
	Twice a year	8	26	34	
	Toothache	111	91	202	
Eat candies between meals	No	12	23	35	1.29 0.26
	Yes	144	181	325	

Footnote: X² chi-square test; *p ≤ 0.05

The majority of those who did not consider it important, in the group of children with ECC, had children with cavities (n=26) and the majority of those who considered it important, in the group of children without ECC, did not (n=189). There was also a significant association ($p<0.01$) between the presence of caries and failure to brush the surface of the tongue. Almost all children who did not brush the tongue (n=10) were diagnosed with caries.

There was a statistically significant association ($p<0.01$) with caries and home dental care practices. Using a toothbrush, toothpaste and dental floss demonstrably minimized cavities, while those using only a toothbrush and toothpaste showed an increased incidence of cavities. Finally, there was a significant negative association ($p<0.01$) between caries and the frequency with which children visited their dentist. Most children with ECC only visited their dentist when they experienced toothache (n=111). However, those who visited their dentist for check-ups once or twice a year did not have caries. Although the finding was not quite significant ($p=0.06$), it was observed that children who use only a toothbrush, without paste or floss had more caries than those using all three and those using a brush and paste.

Most fathers (50.5%) and mothers (55.5%) of children with caries had fewer than eight years of schooling, with only 5% of fathers and 7% of mothers having remained in education until their graduation, with 16-years of schooling.

With the logistic regression test, public school children were more likely to have early caries, due to a higher frequency of poor oral hygiene habits ($OR>1$).

Discussion

Based on data collected from 360 children, we found the rate of caries in primary dentition to be 43.3%. This corroborated the data of Rihs *et al.*² (2007) from five-year-old children and that of Ardenghi *et al.*³ (2013) with children of 0 to 36 months, who found

ECC rates of 40.5% and 48.2%, respectively. However, a study carried out in Belém-PA, with a sample in similar conditions to this study, observed a slightly lower prevalence of caries, 32.9%⁸.

Most came from families living on one minimum wage, especially public school children. Another study found that high prevalence rate of childhood dental caries was an independent factor of socioeconomic status of families¹⁵. In addition, other authors found that the presence of visible plaque accumulation and reported consumption of sugared drinks were associated with prevalence of caries experience in preschool children¹⁶⁻²⁰.

The incisors showed active caries, probably because of poor oral hygiene and more prolonged exposure to breastmilk, associated with the frequent consumption of carbohydrates, especially sugars. According to some authors salivary flow and swallowing frequency decrease during sleep, allowing sweet liquid around the teeth to stagnate, initiating a continuous process of loss of minerals¹⁸.

All molars with ECC presented chronic caries, probably due to their location in the oral cavity, causing difficulty in accessing the toothbrush for cleaning by the child, corroborating the findings of other authors who observed a significant relationship of curative treatments in deciduous molars in the age group from 25 to 36 months⁸.

There was a significant association between caries disease and children's dental care practices, demonstrating that habitual use of a toothbrush, toothpaste and dental floss minimizes cavities. The purpose of brushing and flossing is to eliminate and/ or displace the plaque that is constantly forming on the surface of teeth. Previous studies have found that the use of fluoridated toothpaste is lower in low-income individuals and communities in Brazil. In combination with inadequate access to affordable dental services for this population, this results in a greater number of caries lesions¹⁶⁻²⁰.

We found a significant difference in the prevalence of caries between young children attending public and private preschools, with a higher prevalence in public schools (n=96). Children who attend public schools and preschools are generally from lower-income families. The majority of children with cavities in our study came from one-income families (90.4%) and lived with house with five, six or seven people (45.5%), further reducing the household's per capita income.

Since income and education levels tend to be positively associated, low-income parents were less knowledgeable about oral hygiene. Therefore, there was also an association between the presence of caries and parent/ guardian recognition of the importance of brushing teeth after a meal. The majority of parents who did not consider it important to brush after a meal had children with ECC (n=26) and the majority of those who considered it important were parents of children without ECC (n=189).

Some authors have pointed out that there is a negative association between social development indexes and caries levels, both for primary and permanent dentition, emphasizing social deprivation, income inequality, and social cohesion as relevant contributors to socioeconomic differences in the distribution of caries across the population^{4,21}.

These observations are supported by the findings of previous studies that have evaluated population data from databases and found negative correlations between the prevalence of caries and socioeconomic status, human development index (HDI) and level of family education^{20,21}. A systematic review and meta-analysis found the incidence of ECC significantly higher in children with a history of dental caries. The factors identified as related to a higher prevalence of caries were underprivileged socioeconomic status, lower education levels, and poor oral hygiene maintenance²². With the exception of the latter, the contribution of these factors to caries should be regarded as a global issue.

We found no significant difference in the prevalence of caries between genders. This was in accord with the findings of Rihs *et al.*² (2007) who also found no gender differences, even though the boys showed worse oral conditions and were likely to wait longer before seeking treatment, necessitating more complex procedures.

Most parents of children in this study had fewer than eight years of schooling. It may be inferred that lower educational levels influence the lack of knowledge about the importance of oral health. This supposition is supported by previous research showing that children of poorly educated mothers were more likely to have severe caries in childhood because those mothers were more likely to offer their children sugary liquids and less likely to encourage oral hygiene after meals²³⁻²⁴.

The data indicates a correspondence between increasing educational levels of parents and decreasing percentages of children with caries. The literature tends to focus primarily on the education level of mothers and its relationship to children's oral health level because mothers are most often the primary caregiver, so responsible for their child's oral hygiene^{6,25-29}.

It was found that most children with ECC only visit the dentist when they experience toothache (n=111). However, most of those who visit once or twice a year for routine check-ups do not need to visit for toothache as it is unlikely to occur. Peres *et al.*²¹ (2012) found that only 33.2% of children under six had ever seen a dentist. Yet dental surgeons, higienists and oral health politics are essential to the prevention and control of childhood caries. Similarly, a survey on the access and use of health services in Brazil found only a small percentage (18.1%) of children under five had ever consulted a dentist²³.

This study identified a demographic profile of children likely to develop ECC. Such children are most often from low-income families with many people resident in their household, most

have inadequate oral hygiene habits, a sugary diet and poorly educated parents. Rodrigues²⁹ (2019) has suggested that oral health teams should prioritize the development of preventative strategies for children at high risk of ECC to reduce the prevalence of dental caries in children under seven.

It is essential to raise parents' awareness of oral hygiene and healthy diet (including breastfeeding) from the child's first year of life if the prevalence of ECC is to be reduced and dental health maintained into adulthood³⁰⁻³³.

The early diagnosis of ECC from white spots is important to contain the progression of carious lesions. However, primary prevention measures should be further encouraged. The delimitation of areas with a higher risk of caries and a greater need for public access to dental treatment should assist in the formulation of policies and management of resources by public health services to address this issue³². Furthermore ECC has a negative impact on oral health-related quality of life of both preschoolers and their families³⁴.

As a study limitation, it is worth mentioning that the sample had low socioeconomic status, whose parents had little education and knowledge of preventive measures against ECC. Lectures on preventive measures against caries were held in schools. It is suggested that other studies comparing preschool children from different social classes be carried out to investigate the prevalence of ECC. Furthermore both ICDAS codes 1 and 2 indicate demineralisation of enamel, which require preventative measures to avoid caries progression²⁹. It is known that the ICDAS code 1 is detected only after drying with compressed air. This, the lack of the detection of the first visual change in enamel may have underestimated the prevalence of caries in this study. However, including early signs of enamel lesions overestimates the severity of caries.

Conclusion

The prevalence of caries in children aged two to six was 43.3%, with no significant differences between ages or genders. Several factors were associated with dental caries in primary dentition. Children with caries were unlikely to use dental floss or brush their tongues, were only taken for dental treatment when they experienced oral pain and had parents who did not consider brushing teeth after a meal to be important.

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A prevalência da doença cárie na dentição decídua e fatores associados em crianças do município de Parnaíba-Piauí

Resumo

Objetivo: Avaliar a prevalência de cárie na dentição decídua em pré-escolares de Parnaíba, Brasil e identificar fatores associados. **Material e Métodos:** Os estudos amostrais foram crianças em dentição decídua com idade entre dois e seis anos. Tanto as crianças quanto seus pais ou responsáveis concordaram com a participação da criança no estudo. Foram excluídos os pré-escolares com síndromes ou necessidades especiais, aqueles que não toleraram o exame odontológico e aqueles com aparelho ortodôntico fixo. O questionário foi preenchido por um dos pais ou responsável de cada criança e os dentes de 360 crianças foram examinados, usando o International Caries Detection and Assessment System (ICDAS). Os dados foram dicotomizados em presença de cavidade relacionada à cárie - lesões livres de cárie e não-cavidades (ICDAS 0, 1 e 2) e lesões cavitadas (ICDAS ≥ 3). Foi determinada a presença de cárie precoce da infância e cavitação do processo carioso foi avaliado. Indicações para extração necessária de quaisquer dentes decíduos devido ao processo de cárie foram anotadas. **Resultados:** A prevalência de cárie em nossa amostra de crianças de dois a cinco anos foi de 43,3% ($p < 0,05$), sem diferença significativa entre idades ou gêneros. A maioria das crianças (84,6%) apresentou cárie em dois ou mais dentes. Apenas 15,38% dessas crianças apresentavam cárie em um único dente. O dente mais acometido foi o número 75, seguido pelos dentes 55, 54 e 84. A prevalência de cárie em pré-escolares foi correlacionada com baixo nível socioeconômico e má qualidade de vida. **Conclusão:** A prevalência de cárie em pré-escolares foi de 43,3%. Vários fatores foram associados à cárie dentária na dentição decídua. Crianças com cárie não usavam fio dental ou escovavam a língua, só eram levadas para tratamento odontológico quando sentiam dor oral e tinham pais que não consideravam importante escovar os dentes após as refeições.

PALAVRAS-CHAVE: Cárie Dentária. Dentição primária. Higiene oral.

How to cite this paper

Lira ALS, Fontenele MKV, Sousa FJ, Sousa FDC, Ribeiro CKC, Ferreira LEG. The prevalence of caries in the primary dentition and associated factors in children in the city of Parnaíba-Piauí. Rev Odontol Bras Central 2022; 31(90): 147-165. DOI: 10.36065/robrac.v31i90.1532