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Dental caries and associated factors in preschoolers in a small city

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Abstract

Objective: this study seeks to understand the predominance and factors associated with dental caries in preschoolers. **Material and Methods:** it is a census, epidemiological study with an analytic and cross-sectional sample, including children from 4 to 6 years old, matriculated in public preschools in the city of Aiquara-BA. The sociodemographic data was obtained through home interviews with the parents/guardian of the child, while the dental condition data was obtained via a clinical examination of the mouth cavity of the preschoolers. The dfmt index was used to evaluate the dental condition of the children, with the codes and criteria used being those proposed by the World Health Organization. The data was tabulated in duplicate on a Microsoft Excel spreadsheet and following correction, was analyzed using the SPSS, STATA and PAST programs. Poisson regression analysis and Principal Component Analysis (PCA) were performed. **Results:** 148 children were evaluated of whom 79 (53.4%) were boys and 40 (27%), 39 (26.4%) and 69 (46.6%) were 4, 5, and 6 years old, respectively. The prevalence of dental caries disease in children of 4, 5 and 6 years old was 60, 64 and 70%, with a prevalence of 70% in boys and 61% in girls. **Conclusion:** associated factors were maternal marital status, low education level of parents, low birth weight and occlusions issues. In preschools in Aiquara-BA, the prevalence of dental caries disease is elevated, showing the need for more effective educational, preventive and curative measures in relation to mouth hygiene.

K**eywords:** Dental caries; Preschoolers; Public health.

Introduction

Dental caries is a chronic and multifactorial disease that tends to reach its greatest activity during childhood and adolescence.[1] The manifestation of this disease depends on the combination of factors directly related to host resistance, diet, oral microbiota present in the oral cavity, as well as socioeconomic and behavioral factors that affect children at an early age.[2] In addition, mediating factors such as insufficiency of dental treatment and the lack of preventive programs may be added.[3]

Epidemiological studies conducted since the 1980s reveal a reduction in the prevalence of caries in 12-year-olds in high- and middle-income countries.[4] However, in preschool children, there is stability and even slight increase.[5,6] Thus, the disease is not only a public health problem, but also a social problem[7,8] resulting from several transcending factors, its etiology and biological factors.[4]

Factors associated with dental caries are a widespread and multi-causal phenomenon, such as the strong involvement of parents or guardians, not only as transmitters of bacteria, but also as major multipliers of models, habits, values and attitudes toward their child,[9] changes occurred in the family dynamics that cause weaknesses in the structure of families making it difficult for children to be better assisted by their parents, especially single mothers, who find it difficult to adapt and well perform their multiple roles as a mother, professional, educator and socializing agent.[10]

In addition, biological variables such as low birth weight trigger repercussions on the craniofacial complex, interfering with bone development and occlusion issues, including changes in chronology and sequence of tooth eruption. It can also cause changes during the odontogenesis process, compromising tooth formation and mineralization, leading to hypoplastic enamel defects and increasing the risk of caries.[11]

Thus, considering the impact of caries disease in childhood, it is important to know the experience of dental caries in deciduous dentition, given that it can compromise the growth and development of the child, lead to aesthetic impact and functional disorders that can cause difficulty to sleep and smile, affecting self-esteem, generating isolation from social life and leading to urgent visits to the dentist.[12]

In Brazil there is a predominance of small cities with low income and social inequities, which leads to a higher prevalence of health problems. Due to this situation, municipal governments have limited services to primary care, with the aggravation of presenting enormous difficulty in attracting, hiring and maintaining health professionals. In general, they are cities with low social indicators and an unfavorable quality of life, resulting in less access to information and essential goods,[13] and less attention to oral health, especially in the North and Northeast of Brazil, when compared to other regions.[14]

Thus, the objective of this study is to show the prevalence and factors associated with dental caries disease in preschoolers living in a small city with low sociodemographic indicators.

Material and Methods

This is a cross-sectional, using census data, analytical epidemiological study conducted with preschoolers aged between 4 and 6 years matriculated in public elementary schools in the city of Aiquara-BA. The city is located in the south-central region of the state of Bahia with an estimated population of 4,725 inhabitants in the year 2018, HDI (Human Development Index) of 0.583, Gini Index of 0.44, poverty percentage of 54.74%, with 82.0 % of families registered in the "Bolsa Família" program, which configures a government allowance. In this city, fluorine is added to the public water supply.[15]

Authorization for the study was obtained from the managers of the Municipal Health and Education Departments of Aiquara-BA. The research project was then submitted to the Ethics Committee on Research with Human Beings of the State University of Soutwest Bahia, which was approved (Approval Protocol N^0. 077/2018 - CEP / UESB).

The project was presented to the heads of public elementary schools from Aiquara-BA, and after careful analysis, the performance of the study was allowed. Then, a list with names, dates of birth, and address of parents of the children aged between 4 and 6 years old, was requested to the schools. Based on this information, all parents and/or guardians of the children were visited at home to sign the Informed Consent Form, authorizing the participation of their children in the study. Also, the parents answered a questionnaire that contained biopsychosocial questions and oral hygiene habits.

Subsequently, in the elementary schools where the child was registered, those whose parents / guardians agreed to participate in the study, and nodded their completion, had their oral cavity evaluated by a standardized dentist for the clinical diagnosis of dental caries in deciduous dentition (Kappa = 0.91). The clinical examination of the oral cavity was performed in a place with adequate natural light, using a flat #5 oral mirror and periodontal probe, a model proposed by the World Health Organization (WHO).[16]

During the clinical examination the child remained seated in front of the examiner and the codes and criteria proposed by the WHO were adopted for the diagnosis of caries disease in the primary dentition.[17] Data were registered on the clinical record by a trained note taker.

Dental caries in the primary dentition was measured using the decayed, missed and filled teeth index (dmft). Data were tabulated in duplicate in a Microsoft Excel spreadsheet and after corrections, were analyzed using SPSS (Statistical Package for the Social Sciences), version 21, STATA[a16] (Software for Statistics and Data Science) and PAST (Paleontological Statistics Software). Absolute and percentage values of categorical variables were obtained, as well as measures of central tendency and dispersion of numerical variables by descriptive statistics. The dependent variable was the experience of dental caries disease and was categorized into children without caries experience (dmft=0) and with caries experience (dmft ≥1).

To identify the covariates under investigation associated with caries disease, Chi-squared test (χ^2 test) was performed and the variables with *P*-value<0.20 were selected and included in the multiple Poisson regression analysis with robust variance. Stata 9.0 (Statacorp., College Station, United States) was used for analysis. The covariables remained in the final model, whose level of statistical significance was $P<0.05$. In addition, we chose to use Principal Component Analysis (PCA) and biplot through the Paleontological Statistics Software (PAST).

PCA analyzes a large number of variables and condenses the information obtained into a small set of variables, with the least possible loss of information. The biplot graphically represents the multidimensional data often associated with PCA analysis, so this representation allows to visualize in a plane the relationships and interrelationships between the rows and columns of the analyzed data, facilitating the identification of the factors associated with the diseases studied.[19,20]

Results

In 2018, there were 165 children aged 4 to 6 years matriculated in elementary schools in the city of Aiquara-BA. Twelve out of these did not participate in the study because the parents/guardians were not located at home after 3 visits, and five did not agree to the examination, even though the parents have authorized it. Therefore, 148 children participated in the study, with 79 (53.4%) being male, and the distribution of ages in 4, 5 and 6 years old counted with 40 (27%), 39 (26.4%) and 69 (46.6%) individuals, respectively. The average age was 5.19 years (SD ± 0.83) and the per capita family income below one minimum salary.

As observed in Table 1, those 6-year-old schoolchildren were more prevalent (69 - 46.6%), as well as children male (79 - 53.4%), non-white skin color (118 - 79.7%). With regard to the parent/guardian, most of them have single mother (86 - 58.1 %) who had no planned pregnancy (123 - 83.1), presented up to 8 years of schooling (82 - 55.4%), and were unemployed (102 - 68.9%).

Table 2 shows the covariates that reached statistical significance ($P\leq0.20$) and were selected to be included in the adjusted analysis. Also, according to this table, 75% (111) of mothers are responsible for child care, followed by other family members, such as grandparents and uncles 25% (37). The maternal figure 87.2% (129) is also responsible for instructing oral hygiene habits through teeth brushing. In addition, all caregivers reported that they perform oral hygiene on a daily basis, with teeth brushing frequency 66.9% (99) up to twice a day, and 33.1 (49) three or more

Table 1. Sociodemographic characterization of children from Aiquara, Bahia, Brazil, 2018 (n=148).

Variable	Category	Caries experience				*P*
		Yes		No		
		N	%	n	%	
Gender	Male	55	59.1	24	43.6	0.068
	Female	38	40.9	31	56.4	
Age (n = 148)	4 years old	24	25.8	16	29.1	0.243
	5 years old	21	22.6	18	32.7	
	6 years old	48	51.6	21	38.2	
Address	Urban Zone	57	61.3	34	61.8	0.949
	Rural Zone	36	38.7	21	38.2	
Child's skin color	White	22	23.7	8	14.5	0.183
	Non White	71	76.3	47	85.5	
Maternal marital status	Single	50	53.8	36	65.5	0.164
	Married	43	46.2	19	34.5	
Mother's schooling	< 8 years	54	58.1	28	50.9	0.397
	>8 years	39	41.9	27	49.1	
Father's schooling	< 8 years	72	77.4	35	63.6	0.070
	>8 years	21	22.6	20	36.4	
Employed mother	No	69	74.2	33	60	0.071
	Yes	24	25.8	22	40	
Employed father	No	26	28	13	23.6	0.564
	Yes	67	72	42	76.4	
Government allowance	No	15	16.1	14	25.5	0.167
	Yes	78	83.9	41	74.5	
Planned pregnancy	No	81	87.1	42	76.4	0.092
	Yes	12	12.9	13	23.6	
Prenatal care	No	3	3.2	2	3.6	0.894
	Yes	90	96.8	53	96.4	
Dental prenatal care	No	80	86	48	87.3	0.830
	Yes	13	14	7	12.7	
Nutritional orientation	No	44	47.3	25	45.5	0.827
	Yes	49	52.7	30	54.5	
Breastfeeding orientation	No	31	33.3	14	25.5	0.314
	Yes	62	66.7	41	74.5	
Childbirth delivery type	Natural	42	45.2	28	50.9	0.499
	Cesarean surgery	51	54.8	27	49.1	
Prematurity	No	86	92.5	53	96.4	0.339
	Yes	7	7.5	2	3.6	
Low birth weight	No	80	86	54	98.2	0.015
	Yes	13	14	1	1.8	
Birth order	First	49	52.7	31	56.4	0.665
	Last	44	47.3	24	43.6	
Family arrangement	Up to 3 people	41	44.1	21	38.2	0.482
	Four or more	52	55.9	34	61.8	

Table 2. Habits of oral hygiene and associated factors with dental caries in children from Aiquara, Bahia, Brazil, 2018 (n=148)

Variable	Category	Caries experience				*P*
		Yes		No		
		N	%	n	%	
Natural breastfeeding	No	4	4.3	1	1.8	0.419
	Yes	89	95.7	54	98.2	
Breastfeeding period	< 6 months	43	46.2	29	52.7	0.692
	>6 months	47	50.5	25	45.5	
Bottle feeding	No	9	9.7	4	7.3	0.617
	Yes	84	90.3	51	92.7	
Bottle feeding period	Up to one year	20	23.8	13	25.5	0.861
	>1 year	64	76.2	38	74.5	
Night-time bottle feeding	No	17	18.3	7	12.7	0.376
	Yes	76	81.7	48	87.3	
Cleaning after bottle feeding	No	53	67.7	33	68.8	0.671
	Yes	23	30.3	15	31.3	
Tooth brushing after sugar intake	No	83	89.2	50	90.9	0.746
	Yes	10	10.8	5	9.1	
Who takes care of the children	Mother	74	79.6	37	67.3	0.095
	Others	19	20.4	18	32.7	
Supervised tooth brushing	No	28	30.1	19	34.5	0.575
	Yes	65	69.9	36	65.5	
Who taught to brush teeth	Mother	85	91.4	44	80	0.045
	Others	8	8.6	11	20	
Dental flossing	No	78	83.9	49	89.1	0.379
	Yes	15	16.1	6	10.6	
Dental flossing frequency	Up to twice	13	86.7	5	83.3	0.668
	Three or more times	2	13.3	1	16,7	
Who taught to flossing	Mother	10	66.7	5	83.3	0.526
	Others	5	33.3	1	16.7	
Treated water	No	64	68.8	36	65.5	0.673
	Yes	29	31.2	19	34.5	
Dental appointment	No	51	54.8	40	72.7	0.031
	Yes	42	45.2	15	27.3	
Dental appointment reason	Prevention	1	2.4	3	20	0.011
	Toothache	41	97.6	12	80	
Dental appointment frequency	Up to twice	26	61.9	10	66.7	0.093
	Three or more times	16	38.1	5	33.3	
Occlusion issues	Present	71	68.9	32	31.1	0.020
	Absent	22	48.9	23	51.1	

times. Regarding the frequency of candy consumption, parents reported that 38.1% (56) consumed up to twice a day and 61.9% (91) three times or more.

The prevalence of caries disease in children aged 4 years, 5 years and 6 years was 60%, 64% and 70%, respectively, being 70% in males and 61% in females. The average dmft in children aged 4 to 6 years was 2.7 (SD ± 2.84), and at 4 years 2.2 (SD ± 2.88), at 5 years 2.8 (SD ± 3.03) and 6 years 2.9 (SD ± 2.74). The mean dmft in boys aged between 4 and 6 years old was 2.94 (SD ± 2.66) and in girls 2.33 (SD ± 2.78). Still according to gender, it was found that the mean dmft index in boys aged 4, 5 and 6 years was 2.5 (SD ±

2.73), 2.6 (SD ± 2.70), and 3.2 (SD ± 2.64), respectively, and in girls 2.0 (SD ± 2.98), 2.4 (SD ± 2.52), and 2.5 (SD ± 2.89).

When analyzing the composition of the dmft index according to age, it was identified that at 4 years of age, regarding teeth affected by caries, 21.1% (n = 57) were decayed, 15.2% (n = 14) filled and 47.6% (n = 20) missed; at 5 years 33.9% (n = 92) decayed, 12% (n = 11) filled and 19.1% (n = 8) missed; and at 6 years 45% (n = 122) were decayed, 72.8% (n = 67) filled and 33.3% (n = 14) missed.

Regarding the need for dental treatment in children aged between 4 and 6 years, it was found that 26.9% (n = 73) required surface restoration, 61.3% (n = 166) restoration of two or more surfaces and 11.8% (n = 32) tooth extraction. At 4, 5 and 6 years of age, respectively, 21.1% (n = 12), 22.8% (n = 21) and 32.8% (n = 40) required restoration of 1 surface; 70.2% (n = 40), 69.6% (n = 64) and 50.8% (n = 62) require restoration of 2 or more surfaces; 8.8% (n = 5), 7.6% (n = 7) and 16.4% (n = 20) required tooth extraction.

Table 3, presents the final Poisson regression model after adjusted analysis, which shows that in children living in Aiquara-BA, the variables that remained associated with dental caries were maternal marital status, low birth weight,

Table 3. Multiple Poisson Regression (PR) with Confidence Interval (CI95%) analysis for association test between dmft and covariates under investigation. Aiquara, Bahia, Brazil, 2018.

Variables and categories	N	%	*P*	PR (IC95%)
Children's skin color				
White	30	20.3	0.196	1.29 (0.64 – 1.09)
Non White	118	79.7		
Maternal marital status				
Sigle	86	58.1	0.041	2.04 (1.00 – 1. 59)
Married	62	41.9		
Father's schooling				
Up to 8 years	107	72.3	0.081	1.74 (0.54 – 1.03)
More than 8 years	41	27.7		
Employed mother				
Yes	46	31.1	0.202	1.28 (0.63 – 1.10)
No	102	68.9		
Government allowance				
Yes	119	80.4	0.685	0.41 (0.73 – 1.60)
No	29	19.6		
Planned pregnancy				
Yes	25	16.9	0.175	1.36 (0.49 – 1.13)
No	123	83.1		
Low birth weight				
Yes	14	9.5	0.018	2.37 (1.04 – 1.63)
No	134	90.5		
Dental appointment				
Yes	57	38.5	0.009	2.62 (1.08 – 1.71)
No	91	61.5		
Who takes care of the child				
Mother and Father	111	75	0.909	0.11 (0.70 – 1.47)
Others (grandparents, uncles, day care centers)	37	25		
Who taught to brush teeth				
Mother	129	87.2	0.040	2.01 (0.32 – 0.98)
Others (grandparents, uncles, day care centers)	19	12.8		
Occlusion issues				
Present	103	69.6	0.025	2.24 (1.04 – 1.93)
Absent	45	30.4		

and presence of occlusion issues. In the model analyzed, the variable about who taught how to brush teeth remains as a protection factor.

In the PCA, (Figure 1), the variables: parental education, birth weight and bottle-feeding at night were associated with dental caries disease and explain 62% of this variation. The first component, parents' education level (23.7%) reveals that children with parents presenting less than 8 years of schooling had higher dmft index. The second component (low weight - 20.2%) indicates that children born with low weight had a higher prevalence of caries. The third component, bottle-feeding at night (18.1%) is opposite to the dmft index and parents' education level, indicating that the higher the parents' education the lower the dmft.

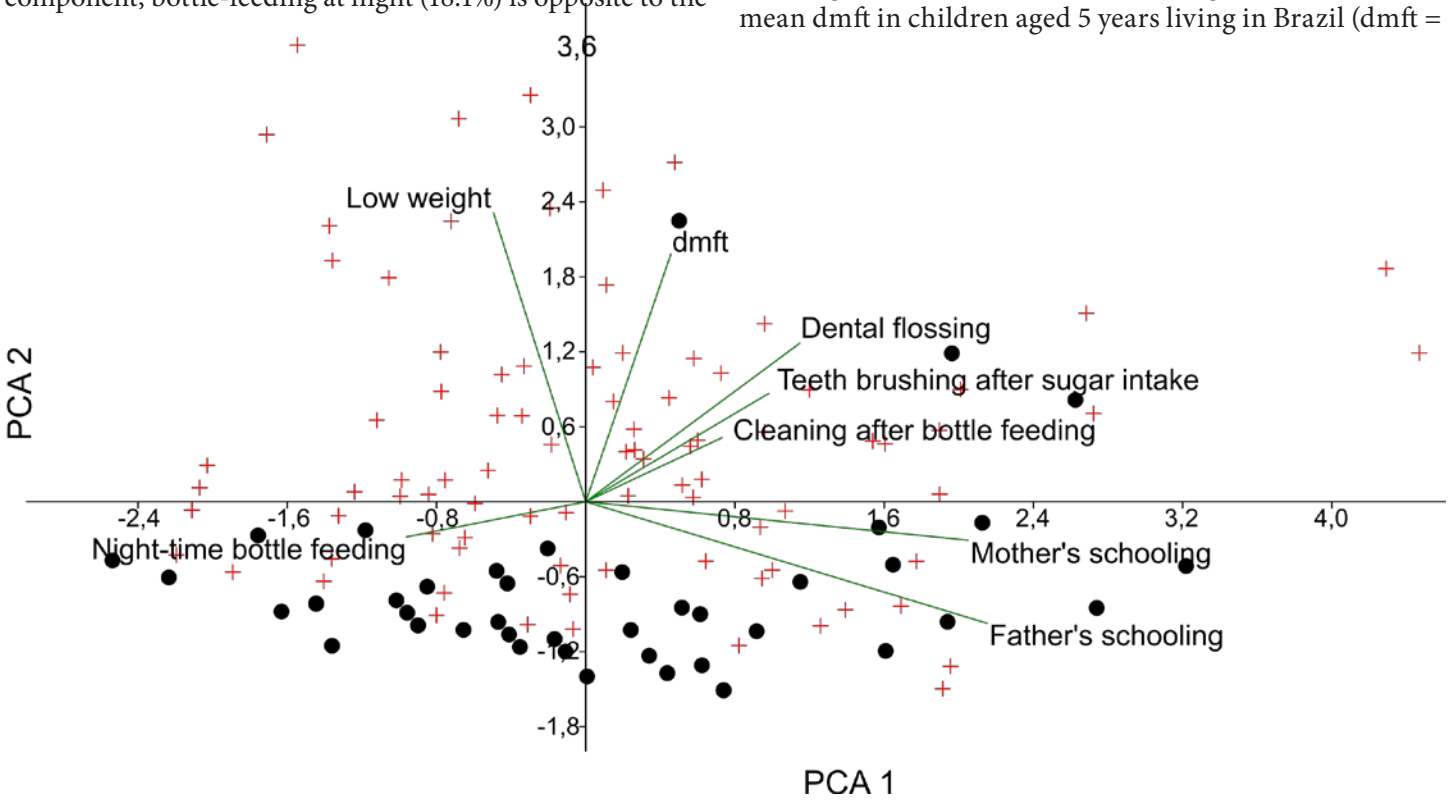

Figure 1. Scatter graphic from principal component and biplot analysis relating dmft to sociodemographic variables. Aiquara, Bahia, Brazil, 2018.

Discussion

In children aged between 4 and 6 years living in Aiquara-BA, the prevalence of dental caries in deciduous dentition is high. The variables associated with dental caries in the Multiple Poisson Regression Analysis were: maternal marital status, birth weight, occlusion issues and who taught the child to brush teeth, while in the PCA were: parental education, birth weight and bottle-feeding at night.

In the present study, the high prevalence of dental caries may be related to the fact that it is a small city in northeastern of Brazil, with low social indicators, such as the Gini index of 0.44, poverty percentage of 54.7%[15] with 82% families dependents on the government allowance and registered in public schools.[16] Studies show that socioeconomic and behavioral factors influence the prevalence of caries disease in children[2-5] as the family allowance[21] and being matriculated in the public school system, possibly representing a group in social vulnerability.[9]

The average dmft values of children aged from 4 to 6 years old living in Aiquara-BA are classified as high, as well as those at 5 year of age (dmft = 2.8), which is one of the index ages of the WHO. Corroborating, we identified the mean dmft in children aged 5 years living in Brazil (dmft = 2.4), Northeast Region (dmft 2.8) and cities in the interior of Bahia (dmft = 3.5). Thus, it is evident that the presence of approximately 3 primary teeth with cavities per child reflects a severity of caries disease in this age group.[22]

In children from Aiquara-BA, the number of healthy teeth in the deciduous dentition was higher in relation to teeth with caries disease, however, this is not indicative of a good oral health condition. When assessing the dmft index components, a predominance of the decayed teeth was observed in children living in Aiquara-BA (66.9%). In Brazil, the Northeast and small cities of the state of Bahia, the decayed component corresponded to 80%, 88% and 92%.[22] Other studies conducted in cities in the interior of Bahia also identified a high percentage of the decayed component of dmft, such as in Uibai-BA with

87.6%,[23] and in Salvador-BA with studies showing 85%[24] and 94.17%[10] of decayed teeth. These values suggest that the lack of knowledge on the part of caregivers about the importance of deciduous dentition care[21] and that the lower access to dental care in this group triggered this situation.[12]

Among the factors associated with dental caries disease in children from Aiquara-BA, the birth weight of the child was the variable that showed the highest association with dental caries disease (PR = 2.37), as well as was found in the PCA as the second component (20.2%). Corroborating this finding, we identified a study conducted in Salvador-BA, in which 1109 children from public day care centers were evaluated, and the multivariate analysis showed an association between low birth weight and time to the development of caries. These findings suggest a higher risk of caries in children with low birth weight compared to children born with regular weight.[25]

This higher occurrence of dental caries in children born with low weight may be due to changes in dental structures. Low birth weight can determine enamel fragility (hypoplasia, hypocalcification and imperfect amelogenesis), predisposing to formation of sites that adhere and colonize cariogenic bacteria, increasing caries susceptibility, and these children have less thick and fragile enamel due to eating conditions, bottle-feeding with greater sucrose exposure, and inadequate oral hygiene habits.[26]

Moreover, children with low birth weight have reduced immune function, and this may result in early colonization of cariogenic microorganisms, as well as changes in tooth eruption chronology, which aggravate the risk of caries. Malnutrition, present in many low birth weight children, can produce changes in the salivary glands, reducing salivary flow, its composition and the buffering capacity of saliva.[27]

Another variable that in the adjusted analysis was positively associated with caries disease in schoolchildren from Aiquara-BA was the maternal marital status (PR = 2.04). It is perfectly possible that a situation of compromised family structure negatively affects the mother's action in providing basic child care, such as dental hygiene. The adoption of habits such as hygiene of the oral cavity of the child during the night may be strongly influenced by the maternal condition, as well as the family environment.[28]

Children need careful oral hygiene instruction, which is often done with the help of their parents or guardians. In this study, single mothers (PR = 2.01) were responsible for teaching how to brush their teeth. Single mothers take on their own responsibilities for raising their children, as well as taking care of their professional life, working hours and facing financial difficulties. Even when well-informed, routine and lack of time interfere with child oral health care. Mothers who take care of their children alone feel more physically and psychologically burdened. Thus, they transfer this responsibility, including teeth care, to the child or other family member who does not properly perform this task. It is necessary to break this cycle so that the population acquires knowledge about the evolutionary course of caries disease becoming able to prevent it effectively.[28]

Furthermore, in this study, the regression model shows that malocclusion remained associated with dental caries disease (PR = 2.24). The absence of dental alignment increases the degree of difficulty in dental hygiene, and consequently increases the risk of dental caries. In a study conducted with children aged between zero and five years old, the authors identified an association between misalignment of teeth and dental caries, due to the greater difficulty in cleaning the oral cavity. The deciduous teeth must be kept healthy for the support and integrity of the dental arch, thus allowing the eruption of successor permanent teeth. Depending on the region where premature loss of primary teeth occurs, migration of adjacent teeth may occur, and thus cause dental crowding.[29]

In addition, the PCA identified that the educational level of parents or guardians is associated with dental caries. Children whose parents only attended elementary school had a greater index of dental caries disease. Low education is a variable with high discriminatory power for caries disease, negatively influencing oral health values and behaviors that are transmitted from parents to children.[7,8,10] In the lower income groups, the family can only respond to the most serious problems, seeking for health professional only when the symptom is aggravated or in cases of emergency.[12]

As this is a cross-sectional study, the findings of this study should be carefully analyzed, mainly because the report of low weight was obtained from the interview with parents/guardians and may be subject to memory bias. Despite these limitations, this study suggests that developmental and nutritional variables at birth and during life may be important predictors of the development of dental caries in infants. In this sense, longitudinal studies are necessary to better understand the relationship between dental caries and low birth weight on the occurrence of this condition.

Conclusion

The preschoolers from Aiquara-BA have a high prevalence of dental caries, and as associated factors were parents' low level of education, maternal marital status, low birth weight and occlusions issues. Therefore, in children aged between 4 and 6 years oled living in Aiquara-BA, oral health prevention and promotion measures should be implemented at all levels of health care aiming at the adequacy of the health care network.

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