Influence of breastfeeding duration on the incidence of dental caries in preschoolers: a cohort study

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Abstract

Objectives: investigate the association between breastfeeding duration and the incidence of severe caries in preschoolers.

Methods: a cohort study was conducted with 132 pairs of mothers and children in the city of Diamantina, Brazil. Data collection was performed in 2 moments: when the children were between two and three years of age (baseline- 2013/2014) and after three years (T1- 2016/2017). In both moments, children were evaluated for dental caries (International Caries Detection and Assessment System - ICDAS) and a questionnaire was administered to the mothers addressing socioeconomic aspects and thee habits of children. The outcome evaluated was the incidence of severe caries (Dentin caries - ICDAS Codes 5 and 6). Data analysis involved descriptive statistics, chi-squared test and Poisson hierarchical regression with robust variance.

Results: children who breastfed for more than 24 months (RR = 2.24 CI95%= 1.23-4.08), those whose parents were separated (RR = 1.73 CI95%= 1.11-2.69), and those with established/severe caries (RR = 2.74 CI95%= 1.37-5.49) at baseline were at greater risk of incidence of severe caries after three years.

Conclusion: breastfeeding for more than 24 months is a risk factor for incidence of severe caries. In addition, family structure and established or severe baseline caries were associated.

Key words *Dental caries, Breast-feeding, Oral health, Longitudinal studies*

http://dx.doi.org/10.1590/1806-93042021000100012

Introduction

Dental caries is a common chronic disease in childhood and highly prevalent throughout the world.[1] Prevention and control of dental caries in primary teeth is challenging and this condition is considered a public health problem due to the high costs for society as well as the negative impact on the quality of life of affected children and their families.[2]

Breastmilk has all the components necessary to meet the nutritional and immunological needs of infants.[3] The act of breastfeeding also has benefits in terms of emotional aspects, health, growth, learning and the development of the functions of the stomatognathic system.[3,4] Moreover, breastfeeding offers health benefits for the mother, such as a greater spacing between childbirths as well as a lower risk of type 2 diabetes, breast cancer and ovarian cancer.[3,5,6] The World Health Organization[7] (WHO) and health authorities recommend that all infants be breastfed exclusively until six months of age, followed by the continuation of breastfeeding up to two years of age or more, complemented with other foods. Despite the benefits of breastfeeding, concerns have been raised regarding the impact of prolonged breastfeeding on the occurrence of dental caries.[8,9] However, there is limited evidence on this issue, as many of the studies investigating the association failed to control for confounding factors, such as food intake and oral hygiene. A prospective cohort study is the most adequate design for the determination of associations.[10]

Recent systematic review investigating the influence of prolonged breastfeeding on the occurrence of dental caries emphasize the need for further, well-planned, longitudinal studies that control for relevant confounding factors.[11] Investigating the association between prolonged breastfeeding and dental caries is of extreme importance, as the findings could contribute to national policies on infant and reduce the occurrence of caries in primary teeth. Considering the hypothesis that prolonged breastfeeding for more than 24 months may be associated with a higher incidence of severe caries, the aim of the present study was to investigate the association between breastfeeding duration and the incidence of dental caries in preschoolers.

Methods

This study received approval from the Human Research Ethics Committee of the Federal University of Vales do Jequitinhonha e Mucuri (UFVJM – Portuguese acronym), Brazil (certificate number: 1.921.084). All parents received clarifications regarding the objectives of the study and signed a statement of informed consent. The recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE statement) were used to guide the study and draft the manuscript.

The present three-year cohort study was nested in a previously published cross-sectional study.[12] The first study was conducted with a sample of 308 children selected randomly from National Child Vaccination Program list (2013 – 2014), provided by the municipal health department of Diamantina (baseline). Vaccination coverage rates in 2013 and 2014 were 97.00% and 102.19%, respectively.[13] The sample size calculation for the longitudinal study was performed based on the results of the pilot study and considering a 5% standard error, 95% confidence interval and 73% incidence of caries among the exposed participants (breastfeeding for more than two years). A minimum of 62 children were needed for each group, to which 10% was added (seven children per group) to compensate for possible dropouts, totaling 138 children (69 in each group). The children included in the longitudinal study were selected by drawing according to the exposure factor (breastfeeding for more than two years). Thus, two groups were formed: children who breastfed for more than two years and children who were breastfed for up to two years.

Children with systemic diseases, such as cancer, respiratory diseases or other adverse health conditions that would interfere with the results were excluded. Moreover, the mother needed to be the main caregiver. Children not accompanied by their mothers during the data collection process were excluded from study.

Two examiners underwent training and calibration exercises prior to the examinations and pilot study. The training portion involving theoretical explanations and the analysis of images of different clinical situations of dental caries. For the calibration portion, the examiners and an experienced researcher performed clinical examinations of 30 children on two separate occasions separated by a one-week interval. The minimum Kappa coefficient was 0.85 for intra-examiner agreement and 0.86 for inter-examiner agreement.

In the first phase of the study (baseline), in the years 2013 and 2014, the selected mothers and children were asked to visit the pediatric dentistry clinic of the Federal University of Vales do Jequitinhonha e Mucuri for data collection.

Clinical data were collected with the child seated

on a children's dental stretcher, and mothers kept very young children when needed. The clinical exams were performed under artificial light following prophylaxis. All care with biosafety was taken as using personal protective equipment for the dentist and child and using sterile instruments.

Dental caries was diagnosed using the International Caries Detection and Assessment System (ICDAS).[14] The dental surfaces were first examined wet and examined a second time after drying with compressed air for five seconds. All surfaces were examined and classified as initial caries (ICDAS codes 1 or 2), established caries (ICDAS codes 3 or 4) or severe caries (ICDAS codes 5 or 6).

Non-clinical data were collected using a questionnaire administered to the mothers in interview form. An independent researcher applied the questionnaire to the mothers. The questionnaire addressed socioeconomic characteristics, such as parents' schooling [13 or more years of study (university education); ten to 12 years (high school); less than ten years (elementary school/middle school)],family income [using the Brazilian monthly minimum wage as reference (BMMW = R$724 at the time of the study) and dichotomized by median as > two times the BMMW or < two times the BMMW] , number of individuals who live on this income (one to three; four or five; six or more - categorized by tertiles) and family structure [nuclear (parents live together); non-nuclear (divorced parents)]. Data were also collected on children's characteristics (sex and age in months) and the following habits: breastfeeding duration categorizes according to the breastfeeding period recommended by WHO8 (up to two years or more than two years), bottle feeding duration (up to two years or more than two years), and whether the child's oral hygiene was performed by an adult (yes or no).

Data collection on food intake was performed by applying a food consumption frequency questionnaire.[15] The questionnaire consisted of 23 foods, with 15 possibilities of response to consumption: daily (one, two, three, four or five times a day); weekly (six, five, four, three, two or once a week); biweekly; monthly; rare and never. Frequency of habitual consumption of chocolate, candies, lollipops, soda and chewing gum was compiled into a single sugar consumption group and categorized according to the daily consumption frequency: “low sugar consumption” (0 or < Twice a day) and “high sugar consumption” (≥2 times a day).[16]

All mothers received counseling on the oral health of the children and those with treatment needs were referred to the pediatric dentistry clinic of the Federal University of Vales do Jequitinhonha e Mucuri.

Three years after baseline (T1) (2016 and 2017), the participants were contacted by telephone or home visits to schedule the reevaluations at the pediatric dentistry clinic of the Federal University of Vales do Jequitinhonha e Mucuri. The same examiners underwent training and calibrations exercises again prior to the reevaluation of the children. Children who participated in the calibration process were not included in the sample. The minimum Kappa coefficient was 0.86 for intra-examiner agreement and 0.86 for inter-examiner agreement.

A pilot study was conducted with 30 children to obtain results for the calculation of the follow-up sample. As no changes were made to the methods, the children in pilot study were included in the main study.

The children were submitted to new oral clinical examinations for the evaluation of dental caries using the same criteria employed at the baseline evaluation. The incidence of severe caries was recorded when a child had new severe caries that were not present at baseline (incidence of severe caries - yes or no). The same questionnaire used at baseline was also administered to the mothers again. Data analysis was performed using the Statistical Package for the Social Sciences (SPSS para Windows, version 22.0, SPSS Inc., Chicago, USA) and involved descriptive analysis. Comparisons of the baseline characteristics of those lost and those followed up were performed using chi-square test and Cohen’s effect size (w) was also calculated. The chi-squared test was used to compare proportions of socioeconomic characteristics, child’s characteristics, child’s habits and clinical aspects, according the incidence of severe caries. Univariate and multiple Poisson regression analyses with robust variance using a hierarchical approach. For such, the variables were grouped into distal to proximal determinants. The categories were socioeconomic factors, child's characteristics, child's habits and clinical factors (in that order) (Figure 1). Poisson regression analysis with robust variance was performed for each level. Only explanatory variables with a p-value ≤ 0.20 were selected for the multivariate analysis. Explanatory variables with a p-value < 0.05 after adjustments for variables on the same or previous levels were selected for the final model. Relative risk (RR) and respective 95% confidence intervals (CI) were calculated. In addition, the main independent variable (duration of breastfeeding) was adjusted for each independent variable in another

analysis model.

Results

A total of 132 children (95.6%) participated through to the end of the study. The main reasons for dropouts were the change of address and change of telephone number (Dropouts: 6 children= 4.4%) (Figure 1). Mean age 34.9 ± 9.5 months at baseline was 69.1 ± 7.2 months at the follow-up evaluation. Among the children evaluated, 53.0% were girls. The incidence of severe caries was 33.3%. All children had access to fluoridated water and used fluoride toothpastes (≥1000 ppm) at both baseline and follow-up. Table 1 shows baseline characteristics between follow-up and dropout participants. There were no differences between children who remained in the study and those who were lost during the follow-up. The magnitude of the statistical difference (Cohen's effect size) was small.

Table 2 presents the descriptive data of the sample and comparison of proportions of socioeconomic factors, child's characteristics, child's habits and clinical aspects, according to the incidence of severe caries. There were statistically significant associations between the incidence of severe caries and breastfeeding duration and the baseline variables: dependent on family income, family structure, age and dental caries at baseline.

In the multivariate analysis (Table 3), children who breastfed for more than 24 months (RR = 2.24 CI95%= 1.23 to 4.08), those who lived with separated parents at baseline (RR = 1.73 CI95%= 1.11 to 2.69), those with initial caries at baseline (RR = 2.14 CI95%= 1.06 to 4.31) and those with established/severe caries at baseline (RR = 2.74 CI95%= 1.37 to 5.49) were at greater risk of the incidence of severe caries at follow-up.

Breastfeeding for more than 24 months remained significantly associated with the incidence of severe caries after the adjustments by levels (Table 3) and after the adjustment of each variable individually (Table 4).

Discussion

The present study investigated the association between prolonged breastfeeding and severe caries in preschoolers. This study highlighted the incidence of severe caries (ICDAS 5 and 6), due to its potential to impact children's quality of life.[12] The main findings demonstrate that children who were breastfed for more than 24 months were at greater risk of the incidence of severe dental caries independently of sugar intake or oral hygiene.

These findings are supported by recent evidence affirming an association between breastfeeding duration and dental caries.[9,16] However, few of these studies had a prospective design or controlled for important determinant factors, such as diet and oral hygiene.[16,17] Some studies report that breastfeeding up to 12 months of age is a protective factor against the occurrence of caries.[17] Other studies report a greater risk of caries when breastfeeding is performed for a longer period of time (12 to 24 months) as well as when breastfeeding is performed at night and with a high frequency.[8,16] According to the World Health Organization[7] the minimum period for complementary breastfeeding is 24 months, which is why this period was adopted as the cutoff point in the present study. Studies that have used the same cutoff point confirm our findings.[9,16]

The plausibility of this association may reside in the bioavailability of breastmilk and its nutritional composition, as mature breastmilk is composed of approximately 7% sugars.[8] In vitro and in situ studies have shown that human milk has the potential to induce the demineralization of tooth enamel and supplementation with sugar exponentially enhances its cariogenic potential.[18,19,20] The cariogenic potential of breastmilk is reported to be higher than that of bovine milk, but lower than that found in baby formulas.[21]

Important factors that should be taken into consideration are breastfeeding frequency and timing. The lack of an investigation of these variables is a limitation of the present study. Frequent breastfeeding can increase the cariogenic potential; breastfeeding at night also has this effect due to the reduction in salivary flow during sleep.[22] Studies have shown an association between breastfeeding and dental caries when the feeding pattern is established by free demand with successive feedings during the day, long feeding periods and frequent nighttime feeding, causing the buildup of milk on the surface of the teeth, which, together with the reduction in salivary flow and inadequate oral hygiene, can lead to the emergence of caries.[23]

The risk of the incidence of severe caries was greater among children who lived in a non-nuclear family (separated parents). This finding is in agreement with the results of studies investigating determinants of early childhood caries.[24] Family structure is considered an important determinant of oral health status in children.[25] As children are dependent on their parents for the control of diet and hygiene,[26] it is possible that single parents have greater difficulty maintaining the oral health of their children due to

Figure 1

Hierarchical conceptual framework used in the Poisson regression analysis.

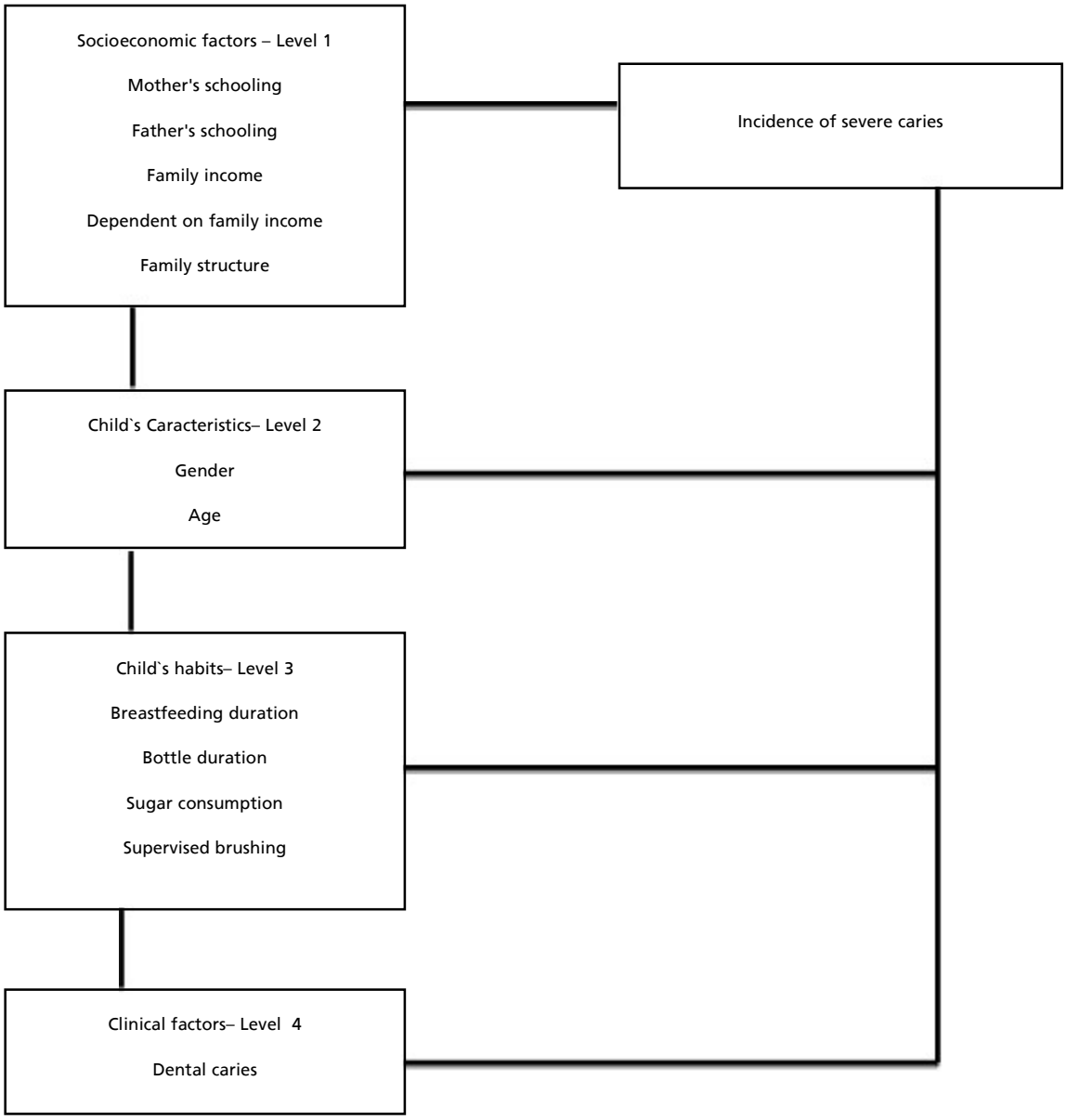

Table 1

Baseline characteristics compared between follow-up and dropout of participants.

Variables	Follow-ups		Dropouts		Cohen's effect size**	*p**
	n	%	n	%		
Mother's schooling (years)					0.030	0.729
≥13	47	35.6	2	33.3		
10-12	72	54.5	3	50.0		
0-9	13	9.9	1	16.7		
Father's schooling (years)					0.036	0.670
≥13	32	24.2	1	16.7		
10-12	63	47.7	3	50.0		
0-9	37	28.0	2	33.3		
Family income (minimum wage)					0.038	0.660
≥ 2	56	42.4	2	33.3		
< 2	76	57.6	4	66.7		
Dependent on family income (individuals)					0.009	0.916
1 to 3	41	31.1	2	33.3		
4 or 5	68	51.5	3	50.0		
6 or more	23	17.4	1	16.7		
Family structure					0.039	1.000
Nuclear	78	73.6	5	83.3		
Non-nuclear	28	26.4	1	16.7		
Gender					0.022	1.000
Female	73	55.3	3	50.0		
Male	59	44.7	3	50.0		
Age (years old)					0.016	0.851
2	83	62.9	4	66.7		
3	49	37.1	2	33.3		
Sugar consumption					0.012	1.000
Low consumption	70	53.0	3	50.0		
High consumption	62	47.0	3	50.0		
Supervised brushing					0.008	1.000
Yes	108	81.8	5	83.3		
No	24	18.2	1	16.7		
Dental caries					0.041	0.633
Absence of caries	59	44.7	3	50.0		
Initial caries	36	27.3	2	33.3		
Established/severe caries	37	28.0	1	16.7		

* Chi-square test; ** Effect size based on Cohen's w: 0.1 for small; 0.3 for medium; 0.5 for large.

Table 2

Descriptive data of the sample and comparison of proportions of socioeconomic characteristics, child's characteristics, child's habits and clinical factors, according the incidence of severe caries.

	Incidence of severe caries				*p**
	No		Yes		
	n	%	n	%	
Socioeconomic variables					
Mother's schooling at baseline (years)					0.062*
≥ 13	37	78.7	10	21.3	
10-12	43	59.7	29	40.3	
0-9	8	61.5	5	38.5	
Father's schooling at baseline (years)					0.107*
≥ 13	26	81.3	6	18.8	
10-12	39	61.9	24	38.1	
0-9	23	62.2	14	37.8	
Family income at baseline (minimum wages)					0.059*
≥ 2	42	75.0	14	25.0	
< 2	46	60.5	30	39.5	
Dependent on family income at baseline (individuals)					0.031*
1 to 3	25	61.0	16	39.0	
4 or 5	42	61.8	26	38.2	
6 or more	21	91.3	2	8.7	
Family structure at baseline					0.011*
Nuclear	72	72.7	27	27.3	
Non-nuclear	16	48.5	17	51.5	
Characteristics of the child					
Gender					0.173*
Female	45	61.6	28	38.4	
Male	43	72.9	16	27.1	
Age at baseline (months)					
Average (DP)	33.3 (8.6)		37.9 (10.3)		0.014**
Child's habits					
Breastfeeding duration (months)					<0.001*
Up to 24	55	83.3	11	16.7	
More than 24	33	50.0	33	50.0	
Bottle duration (months)					0.448*
Up to 24	52	64.2	29	35.8	
More than 24	36	70.6	15	29.4	
Sugar consumption at baseline					0.388*
Low consumption	49	70.0	21	30.0	
High consumption	39	62.9	23	37.1	
Supervised brushing at baseline					0.632*
Yes	73	67.6	35	32.4	
No	15	62.5	9	37.5	
Clinical factors					<0.001*
Dental caries at baseline					
Absence of caries	50	84.7	9	15.3	
Initial caries	23	63.9	13	36.1	
Established/severe caries	15	40.5	22	33.3	

* Chi-square test; ** Mann-Whitney Test.

Table 3

Poisson hierarchical regression not adjusted and adjusted to assess the association between baseline independent variables and the incidence of severe caries injuries.

Variables	N	%	Unadjusted RR (CI95%)	*p*	Model 1 RR (CI95%)	*p*	Model 2 RR (CI95%)	*p*	Model 3 RR (CI95%)	*p*	Model 4 RR (CI95%)	*p*
Socioeconomic factors												
Mother's schooling at baseline (years)												NS
≥ 13	47	35.6	1		1							
10-12	72	54.5	1.89 (1.02-3.51)	0.043	1.31 (0.60-2.86)	0.496						
0-9	13	9.8	1.80 (0.74-4.36)	0.188	1.27 (0.46-3.52)	0.650						
Father's schooling at baseline (years)												NS
≥ 13	32	24.2	1		1							
10-12	63	47.7	2.03 (0.92-4.46)	0.077	1.53 (0.63-3.67)	0.345						
0-9	37	28.0	2.01 (0.87-4.63)	0.098	1.34 (0.48-3.72)	0.579						
Family income at baseline				0.093		0.669						NS
≥ 2	56	42.4	1		1							
< 2	76	57.6	1.57 (0.92-2.68)		1.15 (0.61-2.14)							
Dependent on family income at baseline (individuals)												NS
1 to 3	41	31.1	1		1		1					
4 or 5	68	51.5	0.98 (0.60-1.59)	0.935	1.04 (0.64-1.67)	0.881	0.99 (0.61-1.59)	0.990				
6 or more	23	17.4	0.22 (0.05-0.88)	0.033	0.25 (0.06-0.94)	0.041	0.07 (0.07-1.01)	0.266				
Family structure at baseline				0.007		0.009		0.003		0.005		0.014
Nuclear	99	75.0	1		1		1		1		1	
Non-nuclear	33	25.0	1.88 (1.19-2.99)		1.83 (1.16-2.88)		1.97 (1.26-3.08)		1.89 (1.21-2.96)		1.73 (1.11-2.69)	
Child's characteristics												
Gender				0.182				0.177				NS
Female	73	55.3	1				1					
Male	59	44.7	0.70 (0.42-1.17)				0.72 (0.44-1.16)					
Age at baseline (months)												
Average (DP)	34.9 (9.5)		1.03 (1.01-1.05)	0.004			1.03 (1.01-1.05)	0.008	1.02 (0.99-1.04)	0.153		NS

Unadjusted RR= Unadjusted relative risk; RR =Relative Risk; CI =Confidence Interval.
Model 1 Adjusted by Socioeconomic factors; Model 2 Adjusted by Child's characteristics and variables of previous levels; Model 3 Adjusted by Child's habits for variables of previous levels; Model 4 Adjusted by Clinical factors for variables of previous levels.

continue

Table 3 **concluded**

Poisson hierarchical regression not adjusted and adjusted to assess the association between baseline independent variables and the incidence of severe caries injuries.

Variables	N	%	Unadjusted RR (CI95%)	*p*	Model 1 RR (CI95%)	*p*	Model 2 RR (CI95%)	*p*	Model 3 RR (CI95%)	*p*	Model 4 RR (CI95%)	*p*
Child's habits												
Breastfeeding duration (months)				< 0.001						0.002		0.008
Up to 24	66	50.0	1						1		1	
More than 24	66	50.0	3.00 (1.66-5.41)						2.62 (1.42-4.84)		2.24 (1.23-4.08)	
Bottle duration (months)				0.455								
Up to 24	81	61.4	1									
More than 24	51	38.6	0.82 (0.49-1.37)									
Sugar consumption at baseline				0.389								
Low consumption	70	53.0	1									
High consumption	62	47.0	1.23 (0.76-2.00)									
Supervised brushing at baseline				0.624								
Yes	108	81.8	1									
No	24	18.2	1.15 (0.64-2.07)									
Clinical factors												
Dental caries at baseline												
Absence of caries	59	44.7	1								1	
Initial caries	36	27.3	2.36 (1.12-4.97)	0.023							2.14 (1.06-4.31)	0.032
Caries established/severe	37	28.0	3.89 (2.01-7.52)	<0.001							2.74 (1.37-5.49)	0.004

Unadjusted RR= Unadjusted relative risk; RR =Relative Risk; CI =Confidence Interval.
Model 1 Adjusted by Socioeconomic factors; Model 2 Adjusted by Child's characteristics and variables of previous levels; Model 3 Adjusted by Child's habits for variables of previous levels; Model 4 Adjusted by Clinical factors for variables of previous levels.

Table 4

Unadjusted Poisson regression model adjusted for breastfeeding at 24 months and sociodemographic variables, bottle use, sucrose intake, and dental caries at baseline.

Breastfeeding up to 24 months (reference) x Breastfeeding for more than 24 months	RR (CI95%)	*p*
Unadjusted	3.00 (1.66-5.41)	≤0.001
Adjusted for sex	2.94 (1.63-5.31)	≤0.001
Adjusted for age	2.69 (1.43-5.07)	0.002
Adjusted for mother´s schooling	2.83 (1.53-5.22)	≤0.001
Adjusted for father´s schooling	2.81 (1.49-5.30)	0.001
Adjusted for family income	2.86 (1.53-5.34)	0.001
Adjusted for dependent on family income	2.93 (1.66-5.19)	≤0.001
Adjusted for family structure	2.97 (1.67-5.28)	≤0.001
Adjusted for tooth brushing	3.04 (1.68-5.51)	≤0.001
Adjusted for bottle	3.01 (1.65-5.49)	≤0.001
Adjusted for sugar consumption	3.05 (1.72-5.42)	≤0.001
Adjusted for dental caries at baseline	2.27 (1.23-4.21)	0.009
Adjusted for all variables	2.17 (1.21-3.88)	0.009

RR= Relative Risk; CI=Confidence Interval.

the impossibility of sharing tasks and the less time available for meeting care needs. However, other social determinants, such as parental education and family income, did not remain associated with the incidence of severe caries during follow-up as expected. The association between socioeconomic characteristics and dental caries were showed in many studies.[27] Although these variables were included in the multivariate analysis, they were not associated with the incidence of caries after adjustment for other factors, thus indicating that in this sample, proximal determinants have a greater explanatory effect for an increase in caries.

Some expected associations were not found in the present study, such as the association between the incidence of severe caries and sugar intake or supervised tooth brushing. The effect of these variables on the incidence of caries may have been attenuated by the access that all children had to fluoride in both drinking water and toothpastes. Studies have demonstrated that exposure to fluoride attenuates the cariogenic effect of a diet rich in sugar.[28] Moreover, it has been reported that the daily use of a fluoride toothpaste seems to be more important than the emphasis on the complete removal of bacterial plaque.[29]

However, access to fluoride did not exert an influence on the association between breastfeeding duration and dental caries. In contrast to the present findings, a recent study[30] investigated the effect of exposure to fluoridated water on the association between breastfeeding duration and caries and concluded that early life exposure to fluoridated drinking water attenuated the potential cariogenic effect of the lack of breastfeeding or prolonged breastfeeding (more than 24 months).

In conclusion, the results show that breastfeeding for more than 24 months was a risk factor for the incidence of severe dental caries in the population studied, as well as other factors such as the presence of caries in the first two years of life and non-nuclear family structure. It is important to exercise caution when extrapolating the results found in the present study because some important variables such as the frequency of breastfeeding and the habit of breastfeeding at night were not statistically controlled in the present study. The present results highlight the importance of health education focused on children at tender age and can be used for the establishment of educational and preventive measures, always seeking balance between the benefits and inherent risks of the attitudes adopted. Together with such measures, dentists, pediatricians and nutritionists should encourage breastfeeding in accordance with the recommendations of the World Health Organization,[7] given the benefits of this practice regarding the health of children. Counseling should be based on the individual risk of each patient and in accordance with the values and circumstances of his/her family.

Author's contribution

Barroso HH, Mourão PS and Ramos-Jorge J participated in the elaboration and critical review of the study's intellectual content. Gomes RL, Almeida MTP, Silva TS performed research planning, study design, acquisition and analysis of study data, bibliographic research. Ramos-Jorge ML and Fernandes IB are responsible for all aspects of the study and writing of the article. All authors approved the final version the article.

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Received on February 7, 2020

Final version presented on December 11, 2020

Approved on December 30, 2020