

# Dental Caries and Visual Acuity of Students in a Town in West Amazon

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**Aim:** The aim of this study was to assess the epidemiological profile for dental caries in primary school students in the public education system in Barcelos, as well as to verify its association with the visual acuity assessed. **Methods:** This is an observational and cross-sectional study of 1,102 students aged 6 to 17 registered in primary school in the public education system. The evaluation of dental caries complies with the method informed by the World Health Organization, on the school patio in natural light and were carried out by a previously calibrated team (Kappa inter-rater from 0.70 to 0.89). Visual acuity was assessed using the Snellen optometric scale. For the analysis, when the normality hypothesis was accepted by means of the Shapiro-Wilk test, average and standard deviation (SD) were calculated and the parametric tests t-student and Analysis of Variance – ANOVA – were applied. When the normality hypothesis was rejected Mann-Whitney and Kruskal-Wallis non-parametric tests were applied. For the analysis of categorical variables, the Pearson chi-square test was applied.

**Results:** 1,102 students took part in the tests, of whom 556 (50.5%) were male. The prevalence of dental caries found was 72.1% in students aged 6 to 11 and 65.7% in students aged 12 to 17. The study found an association between Visual Acuity (<0.8) and dental caries in students aged 6 to 11 ( $p=0.023$ ), and between females and dental caries in students aged 12 to 17 ( $p=0.025$ ). **Conclusion:** This study suggests the need for wider oral health coverage in the town of Barcelos in order to provide better access to children and adolescents to restoration treatments so as to prevent the worsening of oral health conditions. Health promotion actions for awareness and the prevention of dental caries must be created taking into account the risk factors found in Barcelos.

**Keywords:** Dental Caries. DMF Index. Visual Acuity.

## Introduction

Distribution and severity of oral conditions vary in different parts of the world and this is also true for different geographic conditions within the same country or region<sup>1</sup>. According to a survey conducted in 2010, the Northern region of Brazil has a particularly high prevalence of dental caries, especially in the interior towns of the state of Amazonas<sup>2</sup>.

Health motivation and education are powerful tools to promote oral health among the population as they generate improvements in the quality of life. These need to be included in awareness programs as early as possible and school age is a conducive time to work on health motivation as it helps to acknowledge the importance of prevention<sup>3</sup>.

Vision is one of the main factors in the learning process and alterations in visual acuity can account for poor performance in school<sup>4</sup>, especially low visual acuity which can hinder learning among schoolchildren<sup>5</sup>.

The promotion of health, particularly visual health, is essential and should include projects of preventive health in order to reach all children<sup>6</sup>. Treatment and correction of visual disorders which lead to visual efficiency, create good conditions for better learning<sup>7</sup>.

With regards to functional limitation and school performance, the quality of life is lower among children with dental caries when compared to those without any lesion<sup>8</sup>. Individual and collective preventive actions aimed at preschoolers along with early diagnosis must be carried out to allow for health improvements among the population<sup>9</sup>.

This study aims to assess the epidemiological profile for dental caries in primary school students in the public school system in the urban area of Barcelos, Amazonas, as well as to verify its association with visual acuity results.

## Materials and methods

This study was approved by the Research Ethics Committee of the School of Health Sciences/University of the State of Amazonas (Opinion Number. 197/2012), and was conducted in the town of Barcelos, inner state of Amazonas.

This is an observational and cross-sectional study of students aged 6 to 17 who were regularly registered in primary school (years 1 to 9) in the public school system in the urban area of Barcelos. Not included in this study were students who were not registered in primary school, who wore fixed orthodontic braces, who were older than 17, who did not present written authorization from the parents, who were absent on the day of testing, and those who did not agree to take the test.

Barcelos' urban area has 7 public primary schools (4 municipal and 3 state schools), with a total of 2,439 students (674 in municipal schools and 1,765 in state schools). 2,439 Terms for Free and Clarified Consent (TFCC) were distributed to students who fit the testing criteria. Only 1,102 TFCCs were signed and returned in agreement to take part in the study, accounting for a response rate of 45.2%.

The evaluation of dental caries complies with the method informed by the World Health Organization<sup>10</sup>, and was carried out between November 2012 and December 2013 on the school patio in natural light. There were seven evaluating teams, each made up of a final-year Odontology student and an annotator previously trained by a University of the State of Amazonas lecturer who participated in the research and is experienced in epidemiological surveys. The training followed the recommendations made by WHO and consisted of theoretical sessions (4 hours) and practical training (8 hours). The Kappa inter-rater coefficient for deciduous and permanent dentition varied between 0.70 and 0.89 and showed good reproducibility.

All 1,102 students attended talks about brushing, the intelligent use of sugar and the prevention of dental caries. The epidemiological exam complied with the WHO's standardization for measuring carries experience in populations and used "Decayed, Missing, Filled Teeth (DMFT) index", "Decayed, Missing, Filled Teeth (dmft) index" and the need for treatment<sup>10</sup>. The calculation of the Significant Caries Index (SCI Index) was conducted according to Souza et al.<sup>11</sup> (2013).

Visual acuity was evaluated using the Snellen optometric scale and school performance was assessed using the average scores from the previous school year<sup>12</sup>.

Because it is a municipality with no private schools, and having a low Human Development Index (HDI) of 0.500, it was decided not to collect socioeconomic information<sup>13</sup>. Therefore, only age and sex were collected.

Data are presented in tables calculating the simple and absolute frequencies for categorical data. For the analysis of quantitative data, when the normality hypothesis was accepted by means of the Shapiro-Wilk test, average and standard deviation (SD) were calculated and the parametric tests t-student and Analysis of Variance – ANOVA – were applied. When the normality hypothesis was rejected, the median and quartiles (Q) were calculated and Mann-Whitney and Kruskal-Wallis non-parametric tests were applied. For the analysis of categorical variables, the Pearson chi-square test was applied.

The software used for data analysis was the Epi. Info. Version 7.2 distributed for free by the North American Center for Disease Control and Prevention – CDC. The significance level for the application of statistic tests was 5%.

## Results

1,102 students aged 6 to 17 took part in this study, of which 556 (50.5%) were male. The prevalence of dental caries found in these students from the public school system in Barcelos, Amazonas, was high of 72.1% (406 students) in students aged 6 to 11 and 65.7% (354 students) in students aged 12 to 17 (Tables 1 and 2).

Table 1 shows a higher average of dental caries index (dmft) for ages 6 and 7 is 4.23 teeth ( $\pm$  2.98) and 4.37 teeth ( $\pm$  3.15) respectively, thus indicating that 84.20% and 82.50% of these students presented dental caries experience (dmft $\geq$ 1) and only 15.8% and 17.5% of these students were free of caries (dmft=0). There was also a greater average for the decayed component at all ages (Table 1).

**Table 1.** Distribution according to sex, age and dmft of schoolchildren in Barcelos – AM, 2013.

Age (years)	Sex	n	dmft	Free of caries	Components					
					decayed		missing		filled	
					Average± SD	f <sub>i</sub> (%)	Average± SD	f <sub>i</sub> (%)	Q <sub>1</sub> - Med - Q <sub>3</sub>	f <sub>i</sub> (%)
6	Female	22	4.36 ± 2.92	5 (22.7)	3.77 ± 2.69	16 (72.7)	0.0-0.0-0.0	3 (13.6)	0.0-0.0-0.0	3 (13.6)
	Male	35	4.14 ± 3.06	4 (11.4)	3.97 ± 3.09	31 (88.6)	0.0-0.0-0.0	4 (11.4)	0.0-0.0-0.0	2 (5.7)
	Σ	57	4.23 ± 2.98	9 (15.8)	3.89 ± 2.91	48 (84.2)	0.0-0.0-0.0	7 (12.3)	0.0-0.0-0.0	5 (8.8)
	p		0.788*		0.805*		0.719**		0.278**	
7	Female	32	4.37 ± 2.52	3 (9.4)	3.84 ± 2.62	28 (87.5)	0.0-0.0-0.5	8 (25.0)	0.0-0.0-0.0	6 (18.7)
	Male	48	4.37 ± 3.54	11 (22.9)	3.81 ± 3.33	36 (75.0)	0.0-0.0-1.0	13 (27.1)	0.0-0.0-0.0	1 (2.1)
	Σ	80	4.37 ± 3.15	14 (17.5)	3.82 ± 3.05	66 (82.5)	0.0-0.0-1.0	21 (26.3)	0.0-0.0-0.0	7 (8.7)
	p		0.999*		0.964*		0.693**		0.278**	
8	Female	62	3.40 ± 2.91	14 (22.6)	2.85 ± 2.44	47 (75.8)	0.0-0.0-0.0	15 (24.2)	0.0-0.0-0.0	6 (9.7)
	Male	51	3.82 ± 3.18	11 (21.6)	3.43 ± 3.17	39 (76.5)	0.0-0.0-0.0	8 (15.7)	0.0-0.0-0.0	3 (5.9)
	Σ	113	3.59 ± 3.03	25 (22.1)	3.11 ± 2.80	86 (76.1)	0.0-0.0-0.0	23 (20.3)	0.0-0.0-0.0	9 (8.0)
	p		0.469*		0.278*		0.262**		0.523**	
9	Female	46	3.02 ± 2.61	13 (28.3)	2.59 ± 2.45	32 (69.6)	0.0-0.0-0.0	6 (13.0)	0.0-0.0-0.0	4 (8.7)
	Male	60	3.58 ± 2.94	10 (16.7)	3.12 ± 2.82	48 (80.0)	0.0-0.0-0.0	11 (18.3)	0.0-0.0-0.0	6 (10.0)
	Σ	106	3.33 ± 2.80	23 (21.7)	2.89 ± 2.67	80 (75.5)	0.0-0.0-0.0	17 (16.0)	0.0-0.0-0.0	10 (9.4)
	p		0.309*		0.313*		0.445**		0.900**	
10	Female	60	1.97 ± 2.11	19 (31.7)	1.85 ± 1.94	41 (68.3)	0.0-0.0-0.0	2 (3.3)	0.0-0.0-0.0	4 (6.7)
	Male	41	2.20 ± 2.15	12 (29.3)	1.90 ± 2.10	28 (68.3)	0.0-0.0-0.0	3 (7.3)	0.0-0.0-0.0	6 (14.6)
	Σ	101	2.06 ± 2.12	31 (30.7)	1.87 ± 1.99	69 (68.3)	0.0-0.0-0.0	5 (4.9)	0.0-0.0-0.0	10 (9.9)
	p		0.598*		0.898*		0.362**		0.182**	
11	Female	52	1.08 ± 1.62	27 (51.9)	0.89 ± 1.60	23 (44.2)	0.0-0.0-0.0	-	0.0-0.0-0.0	3 (5.8)
	Male	54	1.00 ± 1.45	28 (51.8)	0.91 ± 1.35	24 (44.4)	0.0-0.0-0.0	1 (1.8)	0.0-0.0-0.0	4 (7.4)
	Σ	106	1.04 ± 1.53	55 (51.9)	0.94 ± 1.47	47 (44.3)	0.0-0.0-0.0	1 (0.9)	0.0-0.0-0.0	7 (6.6)
	p		0.797*		0.799*		0.326**		0.780**	
6 - 11	Female	274	2.77 ± 2.67	81 (29.6)	2.42 ± 2.42	187 (68.2)	0.0-0.0-0.0	34 (12.4)	0.0-0.0-0.0	26 (9.5)
	Male	289	3.14 ± 3.03	76 (26.3)	2.81 ± 2.91	206 (71.3)	0.0-0.0-0.0	40 (13.8)	0.0-0.0-0.0	22 (7.6)
	Σ	563	2.96 ± 2.87	157 (27.9)	2.62 ± 2.69	393 (69.6)	0.0-0.0-0.0	74 (13.1)	0.0-0.0-0.0	48 (8.5)
	n		0.240*		0.091*		0.601**		0.413**	

f<sub>i</sub>= simple absolute frequency; SD = standard deviation; Med = Median; Q<sub>i</sub>= quartiles; \* *t-student*Test; \*\* *Mann-Whitney* non-parametric test.

Table 2 shows a higher average of dental caries index (DMFT) for ages 16 and 17 is 3.64 teeth (± 3.43) and 3.61 teeth (± 3.12) respectively, thus indicating that 75% and 83.90% of these students presented dental caries experience (DMFT≥1) and only 25% and 16.1% of these students were free of caries (DMFT=0). There was also a greater average for the Decayed component at all ages, and it shows a proportional DMFT average increase with age.

**Table 2.** Distribution according to sex, age and DMFT of schoolchildren in Barcelos – AM, 2013.

Age (years)	Sex	n	DMFT	Free of Caries	Components					
					Decayed		Missing		Filled	
					Average± SD	f <sub>i</sub> (%)	Average± SD	f <sub>i</sub> (%)	Q <sub>1</sub> - Med - Q <sub>3</sub>	f <sub>i</sub> (%)
12	Female	65	1.25 ± 1.40	26 (40.0)	0.95 ± 1.15	34 (52.3)	0.0-0.0-0.0	9 (9.7)	0.0-0.0-0.0	5 (7.7)
	Male	93	1.18 ± 1.45	44 (47.3)	0.98±1.35	42 (45.2)	0.0-0.0-0.0	10 (15.4)	0.0-0.0-0.0	4 (4.3)
	Σ	158	1.21±1.42	70 (44.3)	0.97±1.27	76 (48.1)	0.0-0.0-0.0	19 (12.0)	0.0-0.0-0.0	9 (5.7)
	p		0.785*		0.905*		0.704**		0.360**	
13	Female	79	1.61 ± 1.54	26 (32.9)	1.06 ± 1.27	40 (50.6)	0.0-0.0-0.0	15 (18.9)	0.0-0.0-0.0	15 (18.9)
	Male	65	1.46 ± 1.98	27 (41.5)	1.15 ± 1.89	32 (49.2)	0.0-0.0-0.0	9 (13.8)	0.0-0.0-0.0	5 (7.7)
	Σ	144	1.54 ± 1.75	53 (36.8)	1.10±1.58	72 (50.0)	0.0-0.0-0.0	24 (16.7)	0.0-0.0-0.0	20 (13.9)
	p		0.620*		0.734*		0.766**		0.054**	
14	Female	61	2.20 ± 2.15	17 (27.9)	1.36 ± 1.54	37 (60.6)	0.0-0.0-1.0	17 (27.9)	0.0-0.0-0.0	8 (16.7)
	Male	48	1.92 ± 1.93	16 (33.3)	1.43 ± 1.81	26 (54.2)	0.0-0.0-0.0	10 (20.8)	0.0-0.0-0.0	15 (24.6)
	Σ	109	2.07 ± 2.05	33 (30.3)	1.39±1.65	63 (57.8)	0.0-0.0-0.0	27 (24.8)	0.0-0.0-0.0	23 (21.1)
	p		0.482*		0.811*		0.232**		0.266**	
15	Female	38	2.23 ± 2.12	8 (21.1)	1.39 ± 1.81	22 (57.9)	0.0-0.0-1.0	13 (34.2)	0.0-0.0-0.0	6 (15.8)
	Male	23	2.13 ± 2.05	7 (30.4)	1.70 ± 1.98	14 (60.9)	0.0-0.0-1.0	7 (30.4)	0.0-0.0-0.0	2 (8.7)
	Σ	61	2.19 ± 2.08	15 (21.7)	1.51±1.87	36 (59.0)	0.0-0.0-1.0	20 (32.8)	0.0-0.0-0.0	8 (13.1)
	p		0.848*		0.546*		0.229**		0.402**	
16	Female	15	4.73 ± 3.43	1 (6.7)	2.73 ± 2.94	12 (80.0)	0.0-1.0-2.0	9 (60.0)	0.0-0.0-2.0	4 (26.7)
	Male	21	2.86 ± 3.29	8 (38.1)	2.14 ± 3.15	10 (47.6)	0.0-0.0-0.0	5 (23.8)	0.0-0.0-0.0	3 (14.3)
	Σ	36	3.64 ± 3.43	9 (25.0)	2.39±3.03	22 (61.1)	0.0-0.0-1.0	14 (38.9)	0.0-0.0-0.0	7 (19.4)
	p		0.107*		0.573*		0.032**		0.307**	
17	Female	14	3.71 ± 3.62	3 (21.4)	1.50 ± 2.24	7 (50.0)	0.0-0.5-3.0	7 (50.0)	0.0-0.0-1.0	5 (35.7)
	Male	17	3.53 ± 2.76	2 (11.8)	2.65 ± 2.62	12 (70.6)	0.0-0.0-1.0	6 (35.3)	0.0-0.0-1.0	6 (35.3)
	Σ	31	3.61 ± 3.12	5 (16.1)	2.13±2.49	19 (61.3)	0.0-0.0-1.0	13 (41.9)	0.0-0.0-1.0	11 (35.5)
	p		0.873*		0.206*		0.189**		0.833**	
12-17	Female	272	2.02 ± 2.18	81 (29.8)	1.26±1.61	152 (55.9)	0.0-0.5-1.0	71 (26.1)	0.0-0.0-0.0	50 (18.4)
	Male	267	1.74 ± 2.09	104 (38.9)	1.36±1.94	136 (50.9)	0.0-0.0-0.0	46 (17.2)	0.0-0.0-0.0	28 (10.5)
	Σ	539	1.89 ± 2.14	185 (34.3)	1.31±1.78	288 (53.4)	0.0-0.0-0.0	117 (21.7)	0.0-0.0-0.0	78 (14.5)
	p		0.135*		0.522*		0.007**		0.060**	

f<sub>i</sub>= simple absolute frequency; SD = standard deviation; Med = median; Q<sub>i</sub>= quartiles; \* *t-student* Test; \*\* *Mann-Whitney* non-parametric test; The value of p in italic bold indicates the statistic difference at a level of 5% significance.

Association has been found between visual acuity (<0.8) and the experience of dental caries (dmft≥1) for ages 6 to 11 (p=0.023) (Table 3).

For the significant carries index (SiC), the average values are 6.39 for children aged 6 to 11 and 4.22 for children aged 12 to 17, which shows an uneven distribution of this condition in this town (Tables 4 and 5).

**Table 3.** Distribution of dental caries in schoolchildren according to school performance, visual acuity, sex and school in Barcelos, Amazonas, 2013.

Variables	dmft in schoolchildren aged 6 to 11					DMFT in schoolchildren aged 12 to 17								
	≥ 1		< 1		Total	OR	p*	≥ 1		< 1		Total	OR	p*
	f <sub>i</sub>	%	f <sub>i</sub>	%				f <sub>i</sub>	%	f <sub>i</sub>	%			
School performance						1.35	0.277						0.96	0.853
Dropouts or transferred	73	78.5	20	21.5	93			58	64.4	32	35.6	90		
Satisfactory	281	73.0	104	27.0	385			256	65.5	135	34.5	391		
Total	354	74.0	124	25.9	478			314	65.3	167	34.7	481		
Visual Acuity						0.44	0.023						0.76	0.451
Low (< 0.8)	17	54.8	14	45.2	31			19	59.4	13	40.6	32		
Normal (≥ 0.8)	354	73.6	127	26.4	481			319	65.9	165	34.1	484		
Total	371	72.5	141	27.5	512			338	65.5	178	34.5	516		
Sex						1.18	0.388						0.66	0.025
Male	213	73.7	76	26.3	289			163	61.0	104	39.0	267		
Female	193	70.4	81	29.6	274			191	70.2	81	29.8	272		
Total	406	72.1	157	27.9	563			354	65.7	185	34.3	539		
Schools						1.07	0.797						1.24	0.377
State	63	73.3	23	26.7	86			303	66.4	153	33.6	456		
Municipal	343	71.9	134	28.1	477			51	61.4	32	38.6	83		
Total	406	72.1	157	27.9	563			354	65.7	185	34.3	539		

f<sub>i</sub> = simple absolute frequency; \* Pearson chi-square test; The value of p in italic bold indicates the statistically significant association at a level of 5%; OR = odds ratio.

**Table 4.** Distribution of schoolchildren by age according to dmft index average, one-third of students with high severity (SiC) and two-thirds with low dental caries severity and standard deviation in Barcelos, Amazonas, 2013.

Age	n	dmft Average ± SD	SiC	Low experience
6	57	4.23 ± 2.98	7.55	2.34
7	80	4.38 ± 3.16	7.92	2.57
8	113	3.59 ± 3.03	7.00	1.87
9	106	3.34 ± 2.80	6.54	1.76
10	101	2.06 ± 2.12	4.53	0.80
11	106	1.04 ± 1.53	2.68	0.22
Total	563	2.96 ± 2.87	6.39	1.24

SD = standard deviation.

**Table 5.** Distribution of schoolchildren by age according to DMFT Index average, one-third of students with high severity (SiC) and two-thirds with low dental caries severity and standard deviation in Barcelos, Amazonas, 2013.

Age	n	DMFT Average ± SD	SiC	Low experience
12	158	1.21 ± 1.43	2.89	0.36
13	144	1.54 ± 1.75	3.48	0.57
14	109	2.07 ± 2.05	4.44	0.90
15	61	2.20 ± 2.08	4.50	1.07
16	36	3.64 ± 3.43	7.42	1.75
17	31	3.61 ± 3.12	7.20	1.90
Total	539	1.88 ± 2.14	4.22	0.71

SD = standard deviation.

Of the schoolchildren aged 6 to 11, 80.8% showed the need for treatment. Most of them (58.1%) needed restoration of 1 surface and 34.1% needed extraction (Table 6). Among children aged 12 to 17, 58.9% of them showed the need for treatment. 36.4% needed restoration of 1 surface and 22.4% needed extraction (Table 7)

**Table 6.** Frequency and averages of the need for treatment for dental caries in deciduous dentition for ages 6 to 11 in Barcelos, Amazonas, 2013.

Age	n	No Need	Restoration of 1 Surface	Restoration of 2 or more Surfaces	Pulp Treatment plus restoration	Extraction	Needs Total *
		n (%)	n (%)	n (%)	n (%)	n (%)	Average±SD
6	57	8 (14.0)	34 (59.6)	36 (63.2)	5 (8.8)	23 (40.4)	1.74 <sup>a</sup> ± 0.97
7	80	14 (17.5)	39 (48.8)	52 (65.0)	9 (11.2)	28 (35.0)	1.61 <sup>a</sup> ± 1.11
8	113	25 (22.1)	63 (55.8)	53 (46.9)	8 (7.1)	43 (38.0)	1.48 <sup>ab</sup> ± 1.04
9	106	17 (16.0)	65 (61.3)	57 (53.8)	9 (8.5)	39 (36.8)	1.61 <sup>a</sup> ± 1.00
10	101	20 (19.8)	63 (62.4)	40 (39.6)	5 (5.0)	28 (27.7)	1.35 <sup>ab</sup> ± 0.89
11	106	24 (22.6)	63 (59.4)	30 (28.3)	5 (4.7)	31 (29.2)	1.22 <sup>ab</sup> ± 0.92
Total	563	108 (19.2)	327 (58.1)	268 (47.6)	41 (7.3)	192 (34.1)	1.48 ± 0.99

SD = standard deviation; \* ANOVA; Different letters indicate the average's statistic difference at a level of 5% by means of the *Tukey* test.

**Table 7.** Frequency and averages of the need for treatment for dental caries in deciduous dentition for ages 12 to 17 in Barcelos, Amazonas, 2013.

Age	n	No Need	Restoration of 1 Surface	Restoration of 2 or more Surfaces	Pulp Treatment plus restoration	Extraction	Needs Total *
		n (%)	n (%)	n (%)	n (%)	n (%)	Average±SD
12	158	65 (41.1)	62 (39.2)	29 (18.4)	1 (0.6)	36 (22.8)	0.85 <sup>ab</sup> ± 0.83
13	144	68 (47.2)	46 (31.9)	34 (23.6)	2 (1.4)	27 (18.8)	0.78 <sup>a</sup> ± 0.86
14	109	45 (41.3)	37 (33.9)	22 (20.2)	5 (4.6)	26 (23.8)	0.88 <sup>ab</sup> ± 0.89
15	61	25 (41.0)	18 (29.5)	20 (32.8)	2 (3.3)	13 (21.3)	0.93 <sup>ab</sup> ± 0.92
16	36	14 (38.9)	18 (50.0)	12 (33.3)	5 (13.9)	9 (25.0)	1.22 <sup>ab</sup> ± 1.19
17	31	10 (32.3)	15 (48.4)	9 (29.0)	4 (12.9)	10 (32.3)	1.26 <sup>ab</sup> ± 1.15
Total	539	227 (41.1)	196 (36.4)	126 (23.4)	19 (3.5)	121 (22.4)	0.89 ± 0.92

SD = standard deviation; \* ANOVA; Different letters indicate the average's statistic difference at a level of 5% by means of the *Tukey* test.

## Discussion

The present study evaluated the occurrence of dental caries in relation to visual acuity in children and adolescents in the town of Barcelos, in the state of Amazonas. Despite the decrease of dental caries in the country in the past years, different regions of the country remain unequal and the higher DMFT index is still in the north region of the country, as noted by the national survey SB 2010<sup>2</sup>.

In this context, the present study was conducted in a small town in the state of Amazonas, in northern Brazil, which has no fluoridation of water supplies and the average DMFT index found for children aged 12 to 17 was 1.89 ( $\pm$  2.14), with 1.21 ( $\pm$  1.42) for age 12 and 3.61 ( $\pm$  3.12) for age 17. Thus, a low dental carries index was found in children aged 12, as determined by the World Health Organization<sup>2,14</sup>. In comparison, a study conducted in Monte Negro, Rondônia, showed an average DMFT of 3.41 for age 12 and 5.96 for ages 15 to 19<sup>15</sup>. In Belém do Pará, the averages found were 3.76 for age 12 and 6.40 for age 17<sup>16</sup>. The SB Brasil 2010<sup>2</sup> survey found a DMFT of 2.07 for age 12 and 4.25 for ages 15 to 19, which shows that the average DMFT increases with age<sup>2,15,16</sup>. This study also showed greater prevalence of the decayed component of the DMFT index as well as the need for tooth restoration, which is supported by other studies<sup>2,15-18</sup>, and suggests the need for increased actions of health promotion, dental care for permanent dentition and even the inclusion of dental caries prevention in education and health promotion.

In ages 6 to 11, the average dmft found was 2.96 ( $\pm$  2.87), which, if analyzed separately by age, shows that the percentage of children aged 6 that are free from dental caries is only 15.8%. The World Health Organization established that for the year 2000, 50% of the population aged 5 and 6 should be free of dental caries<sup>14</sup>. It is clear, therefore, that this percentage is far below the target set by WHO. These results also suggest that children younger than 6 in the town of Barcelos have limited access to dental care in infancy. Therefore, according to Moura et al.<sup>19</sup> (2010), the need for early intervention in young children is essential to avoid the disease and health education is the most effective way to prevent and control the development of dental caries.

Despite the fact that Barcelos does not have a fluoridated water supply and has limited access in general to oral health services, this study found a low prevalence of dental caries, which can be explained by the access children have to educational and preventive actions carried out in collaboration with professionals from the local health department and from the University of the State of Amazonas, or even to other ways of access to fluoride, such as toothpaste. According to Ricomini Filho et al.<sup>20</sup> (2012), the fluoride in toothpaste and the access people have to this product contribute to the control of dental caries. While the decrease in the prevalence of dental caries in Brazilian children is well documented, the literature on the distribution of the disease in towns in the Amazon region is scarce, especially in places where public water supply is not fluoridated<sup>18</sup>.

The SiC Index found in this study denotes an uneven distribution of the disease with the major incidence concentrated in a smaller part of the students (one third). This finding is supported by other studies, such as Costa et al.<sup>21</sup> (2016), which found a DMFT index of 1.17 and a Significant Caries Index of 3.16, and the study made by Hildebrand Silva et al.<sup>22</sup> (2014), which found a dmft of 2.00 and a SiC Index of 4.00. Rosa et al.<sup>9</sup> (2014) suggests that preventive and educational actions be directed to this segment of the population.

The results show an increase in dmft and DMFT of over 200% in the group with high dental caries experience (SiC Index) and a drop in the dmft and DMFT averages as low as 42% in the group of students with low incidence of dental caries (2/3). Ardenghi et al.<sup>23</sup> (2013) evaluated the influence of social inequalities at individual and contex-



tual levels upon the experience of non-treated dental caries in children in Brazil and found a prevalence of untreated dental caries was 48.2% and the worst indices were found in the north and northeast regions and that inequalities in the prevalence of non-treated dental caries persist and affect children with deciduous dentition. Such event can be explained by the limited access children have to dental care in health units, for according to Moura et al.<sup>19</sup> (2010), service to preschoolers require more time and qualification of professionals who often refuse to look after children in the belief that milk teeth need no treatment because they will be replaced anyway.

A significant association between visual acuity and the incidence of dental caries has been found in children aged 6 to 11 for deciduous dentition. Vision is regarded as the most influential sense for the integration of human beings into the environment, accounting for 85% of its sensorial information. Also, motor and cognitive development can be directly affected by visual deficiencies in the first months of life<sup>24</sup>, and people with visual deficiency develop knowledge acquisition by hearing and feeling.

Biofilm removal by brushing of teeth and flossing is still considered the most important and most effective prevention against oral diseases. Moreira Neto et al.<sup>4</sup> (2014), states that checking visual acuity in schoolchildren is an approach that helps not only to identify visual problems, but also helps parents seek eye care and enable children to fully develop their potential. The association found between visual acuity and dental caries in the deciduous dentition of children aged 6 to 11 may be connected to simple child health precautions such as seeing a dental surgeon and a ophthalmologist, as well as having access to basic health services.

The study made by Bimstein et al.<sup>25</sup> (2014) did not find a significant difference in the occurrence of dental caries in children and adolescents of an institution for the hearing and visually impaired when comparing them to children without systemic alterations, but found that the children with visual deficiency had a level of dependence on their care-givers statistically greater, more gingivitis and higher plaque scores than the hearing impaired. These findings, then, suggest that people with visual deficiency or visual acuity problems may have more difficulty controlling biofilm and, so, become more prone to dental caries.

The results of this study differ from those found by Bimsteins et al.<sup>25</sup> (2014), Jonh et al.<sup>26</sup> (2017), which found that young adults with visual deficiency in a population under study were quite aware of aspects related to oral health simply because they had received from teachers instruction on its importance by means of oral health education.

Before the epidemiological exams were conducted, the students evaluated in this study attended talks about brushing, the intelligent use of sugar and the prevention of dental caries.

Regarding the need for treatment, there was a higher percentage of need for one-face restorative treatment at 12, 16 and 17 years old, similar to the results found in SB Brazil 2010, and otherwise, in 15-year-old adolescents, it was found greater percentage of need for restorations of two or more faces<sup>2</sup>. Barcelos has only one Family Health Team working with oral health and does not have a Center of Dental Specialties. The demand for dental treatment found among the students evaluated is very high, since 80.8% showed the need for treatment for deciduous dentition, especially among chil-

dren aged 8 to 10 and, 58.9% showed the need for treatment for permanent dentition, especially among children aged 12, 14, 15 and 16. Ardenghi et al.<sup>24</sup> (2013), note that the planning of public provisions and of health promotion actions need to take into account the effect of contextual factors as individual risk determiners.

The present study presents as limitations the fact that it was conducted only in the urban area, not incorporating schoolchildren from the rural area. In addition, the study was conducted with a convenience sample, with students enrolled in public schools participating, considering that the municipality does not presents private schools.

The results of this study point to the need for wider oral health coverage in the town of Barcelos in order to provide better access to children and adolescents to restoration treatments so as to prevent the worsening of oral health conditions. Health promotion actions for awareness and the prevention of dental caries must be created taking into account the risk factors found in Barcelos.

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