Original Article

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Trends in dental caries experience and fluorosis prevalence in 12-year-old Brazilian schoolchildren from two different towns

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Abstract

Aim: To describe the prevalence of dental caries and fluorosis in schoolchildren from two different towns in São Paulo State, Brazil, 2007 - town A (water fluoridation since 1971) and town B (water fluoridation since 1997) - and to compare current prevalence rates with previous surveys, in town A, for dental caries (1971-2005) and for dental fluorosis (1991-2001), and in town B, for dental caries and dental fluorosis (1991-2004). **Methods:** The sample consisted of 724 schoolchildren aged 12 years from public and private schools (town A) and 197 schoolchildren from public schools (town B). The schoolchildren were examined under natural light by a dentist, using CPI probes and oral mirrors. The mean number of decayed, missing and filled permanent teeth (DMFT), and Significant Caries (SiC) Index were determined for dental caries and the Thylstrup and Fejerskov index (T-F) for fluorosis. **Results:** The DMFT was 0.85 and 1.02; SiC index was 2.52 and 2.83 in towns A and B, respectively. Fluorosis prevalence was 29.4% (town A) and 25.4% (town B). In both towns, a significant dental caries reduction has been observed. Concerning fluorosis prevalence, an increase of 44.1% was noted in town A and 1170% in town B. **Conclusions:** Results show continuous decrease in dental caries experience in both towns. Regarding fluorosis prevalence, stabilization trends were observed in town A. In town B, however, a constant increase was noted.

Keywords: dental caries, fluorosis, DMF index, oral health, epidemiology.

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Introduction

Trends in caries experience have been reported throughout the world[1-4]. Caries decline has been also observed in Brazil in both fluoridated and non-fluoridated areas, mainly in schoolchildren in the southern and southeastern regions[5-6]. The most recent epidemiological survey of oral health promoted by the Ministry of Health confirmed the trend of decline of caries in Brazilian schoolchildren[7]. Although, a series of clinical consequences have been observed over the last decades, such as the reduction in disease progression speed[8], and the polarization phenomenon in which a minority of individuals presents the highest caries scores[9-11]. The minority of individuals, the so-called high-caries risk individuals[12], usually belongs to a family with low monthly income[13].

On other hand, an increase of fluorosis prevalence has also been observed throughout the world[14-15]. Some findings suggest that risk of fluorosis development is associated with regular use of fluoride supplements[16-17]. Despite of the use of fluoride toothpaste by young children can be considered a risk factor for dental fluorosis[18], a recent review of the literature showed that the evidence pointing to the conclusion that starting the use of fluoride toothpaste in children under 12 months of age may be associated with an increased risk of fluorosis is weak and unreliable, and, even for older children, the evidence is equivocal[19].

Although the present study is regarded as a local epidemiological survey, it presents 36 years of longitudinal data. Taking into account all these factors, it is essential that studies are carried out to monitor these tendencies and plan actions for public oral health. The aims of this research were to describe the prevalence of dental caries and dental fluorosis in 12-year-old schoolchildren from two different towns in São Paulo State, Brazil, 2007 - town A (water fluoridation since 1971) and town B (water fluoridation since 1997) - and to compare the current prevalence rates with those from previous surveys, developed in town A (1971-2005), for dental caries and for dental fluorosis (1991-2001), and in town B, for dental caries and dental fluorosis (1991-2004).

Material and methods

Ethical aspects

This study was approved by the Ethics Committee of Piracicaba Dental School, University of Campinas, protocol number 089/2006.

Characteristics of the towns

Both towns are located in the São Paulo State, Brazil. Town A has 358,108 inhabitants[20]. Fluoride has been added to water supply since 1971 (0.7 ppmF). Town B has 18,026 inhabitants[20]. Fluoride has been added to water supply since 1997 (0.7 ppm F).

Population studied

In town A, the sample size was calculated on the basis of caries experience reported in previous studies. A cluster sampling method was used admitting a sampling error of 0.2, mean number of decayed, missing and filled permanent teeth (DMFT) and, design error of 2, mean of 1.32 DMFT, standard deviation (SD) of 1.92, non-reply rate (loss of sampling elements) of 20%, and confidence level of 95%, 850 schoolchildren aged 12 years were selected in 2007. Public and private schools were randomly selected. Thus, 18 public and 6 private schools were selected, totalizing 24 schools, and 12 year-old children were chosen at random in each school (n = 850). The inclusion criteria were: children whose parents had given consent for participation, were present on the examination day, did not present severe dental hypoplasia, and did not use fixed orthodontic appliance. The final sample in 2007 was composed of 724 12-year-old schoolchildren of both genders, out of which, 613 were from public schools and 111 from private schools, achieving a response rate of 85%.

In town B, considering that exist only three public schools, all 12-year-old schoolchildren, were invited to participate in this study, totalizing 244 children. The inclusion criteria were the same for town A. The final sample in 2007 was composed of 197 12-year-old schoolchildren, achieving a response rate of 80.7%.

Diagnostic criteria and codes

Dental caries was registered using the DMFT index according to World Health Organization caries diagnostic criteria[21] and the Significant Caries (SiC) index that was determined for the one-third of the sample with the highest caries scores[22]. Fluorosis prevalence was measured by the T-F index[23].

Calibration

A benchmark dental examiner, skilled in epidemiological surveys, conducted the calibration process in 2007. In the practical activities with clinical examinations and data analyzes, the mean Kappa was 0.89 for dental caries and 0.88 for dental fluorosis. Approximately 10% of the sample was re-examined in order to verify the intra-examiner reproducibility. Kappa values of 0.95 for dental caries and 0.89 Kappa for dental fluorosis were observed.

Examination methodology

The results of the present study were compared with the results of previous surveys carried out in town A, (1971-2005) for dental caries and (1991-2001) for dental fluorosis, and in town B (1991-2004), for dental caries and dental fluorosis. All epidemiological surveys reported for both towns were conducted following the same protocol. Epidemiological exams in this study were carried out in 2007, and performed by one previously calibrated dentist in outdoor setting, under natural light, using CPI probes and mirrors #5[21]. Before examination each child brushed their teeth under the supervision of a dental hygienist.

Statistical procedures

The DMFT and SiC indexes, the proportion of caries-free children and the percentage of children with dental fluorosis were calculated. The variation of DMFT index over time was assessed by analysis of regression, and fluorosis prevalence was compared over time by the Chi-square test at 5% significance level.

Results

In 2007, the mean value of DMFT and SiC index were 0.85 (SD = 1.54) and 2.52 (SD = 1.72), respectively, in town A and 1.02 (SD = 1.61) and 2.83 (SD = 1.60), respectively, in town B. The results show that 65.61% and 59.39% of children were caries-free for town A and town B, respectively.

Table 1 summarizes the results of dental caries

Table 1. Mean DMFT and reduction (%) of caries experience for 12-year-old schoolchildren in town A and town B, Brazil, according to year of survey.

Year of survey Town A	Sample	Mean DMFT	% Reduction in consecutive surveys	% Reduction in relation to 1971	Year of survey Town B	Sample	Mean DMFT	% Reduction in consecutive surveys	% Reduction in relation to 1991
1971[24]	204	8.60	-	-	1991[28]	200	6.7	-	-
1977[24]	188	7.41	13.84	13.84	1995[28]	160	3.9	41.8	41.8
1980[24]	144	6.17	16.73	28.25	1997[28]	314	2.9	25.7	56.7
1992[25]	123	3.47	43.76	59.65	2001[26]	244	2.1	27.6	68.7
								65.5	
1995[26]	142	2.70	22.19	68.60	2004[5]	236	1.2	42.9	82.1
1996[27]	189	2.00	25.92	76.74	2007*	197	1.0	16.6	85.1
2001[26]	824	1.70	15.00	80.23					
			57.5						
2005[6]	939	1.32	22.35	84.65					
2007*	724	0.85	35.60	90.12					

Polynomial Regression ($p<0.01$) of mean of DMFT according to year of survey.
*Present Study

experience obtained in all surveys in both towns. In town A, the studies carried out between 1971 and 2007 and showed a reduction of 90.12% in the DMFT index, out of which 57.5% was in the last 11 years, in the 1996-2007 period. In town B, the six surveys carried out between 1991 and 2007, showed a reduction of 85.1% in the DMFT index. After 10 years of fluoridation of the water supply (1997-2007), caries experience decreased by 65.5%, while in the 1991-1997 period, with no fluoride in drinking water, the percentage of caries reduction was 56.7%.

Table 2 shows the prevalence of fluorosis (T-F [3] 1) in both towns between 1991 and 2007. In town A, 29.4% of the individuals presented fluorosis. A total of 70.6%, 13.95%, 14.78% and 0.67% of the children were scored as T-F = 0, T-F = 1, T-F = 2 and T-F = 3, respectively, in 2007. According to the data collected in 1991, out of the 211 children examined, 20.4% presented fluorosis, result that remained nearly the same when data was collected in 1995, when 17.6% presented the same condition, not showing significant difference ($p < 0.05$). In the 1997-2001 period, the increase was only 5.1%, not showing significant difference either ($p < 0.05$). When comparing the data collected in 1991 and in 2007, a 44.1% increase of fluorosis prevalence was observed.

In town B, between 1991 and 2007, an increase of 1170% of fluorosis prevalence was noted. In 2007, 25.4% of the sample presented fluorosis (Table 2). A total of 74.6% of the schoolchildren were fluorosis free (T-F = 0), and 7.64%, 16.25% and 1.51% of the sample presented fluorosis T-F = 1, T-F = 2 and T-F = 3, respectively.

A significant decline of DMFT in the 12-year-old schoolchildren could be demonstrated over a 36-year period of evaluation by analysis of regression with $R^2 = 0.9916$, ($p < 0.01$) for of town A and over a 16-year-period of evaluation by analysis of regression with $R^2 = 0.9898$ for town B, showing linear effect for DMFT and year of survey (Figures 1 and 2).

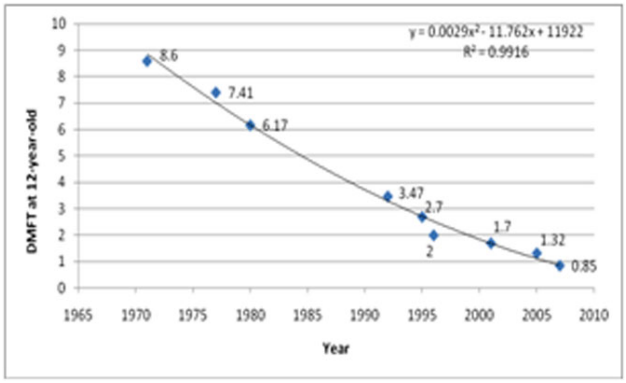

Fig. 1. DMFT variation for 12 year-old schoolchildren over time in town A, Brazil ($p<0.01$).

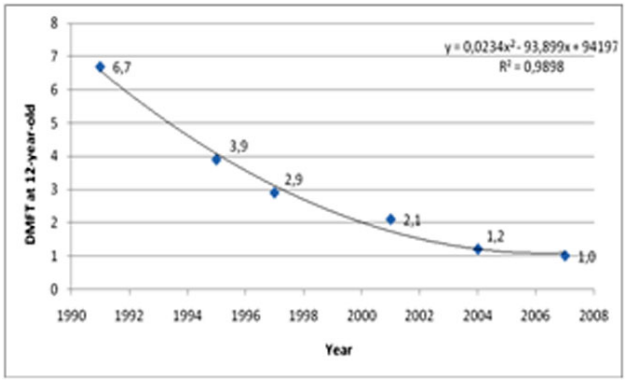

Fig. 2. DMFT variation for 12 year-old schoolchildren over time in town B, Brazil ($p<0.01$).

Table 2. Percentage of individuals with TF ^{3} 1 and variation (%) of fluorosis prevalence for 12-year-old schoolchildren in town A and B, Brazil, according to year of survey.

Town	Year of survey and authors	Sample	Fluorosis prevalence (% T-F≥1)		% Increase in consecutive surveys	% Increase in relation to 1991
Town A	1991[28]	211	20.4 b		-	-
	1995[28]	142	17.6 b		- 13.7	- 13.7
	1997[28]	190	3 1.0 a		76.1	52.0
	2001[26]	824	31.4 a	5.1	1.3	54.0
	2007*	724	29.4 a		- 6.4	44.1
Town B	1991[28]	200	2.0 c		-	-
	1995[28]	160	4.4 c		120	120
	1997[28]	314	10.2 b		132	410
	2001[26]	244	12.7 b		25	535
	2004[5]	236	15.7 b	149	24	685
	2007*	197	25.4 a		62	1170

Different letters indicate statistically significant difference at 5% significance level (Chi-square test).
*Present Study

Discussion

Results show constant decrease in caries prevalence in both towns over time (Figures 1 and 2). The decline in caries prevalence detected in the present study is an event also observed worldwide[29]. In comparison to national data[30], 12-year-old schoolchildren from town A and B presented lower caries experience (0.85 and 1.0 DMFT respectively). Recent international reported data have shown that the DMFT for 12-year-old children is also low ranging from 0.80 in Dublin, Ireland[31]. However, higher results were observed in a survey conducted with non-indigenous schoolchildren living in the Amazon basin of Ecuador, showing a DMFT of 5.25[32].

In town A, taking into account caries prevalence in studies carried out in 1980, DMFT was found to be nearly three times higher than the one found in 1992, which lead us to infer that schoolchildren examined in this last year benefited from fluoridated water, other forms of caries control and prevention, which may have caused this reduction. Even though the experimental design of the present study did not supply data for the evaluation of the causes for this reduction, one can conclude that the wide use of dentifrice fluoridated, which became available in Brazil in 1989, interacted in such a way that promoted a decline in caries prevalence.

As for the SiC index, 2.52 and 2.83 were found in town A and B in 2007, respectively. These values are over two times higher than the mean DMFT for the entire sample in both towns. These findings are in line with some studies reported[33], demonstrating that caries experience in those individuals more affected by the disease is over two times higher[34].

Regarding dental fluorosis, reports in scientific literature have demonstrated an increase in prevalence rates[35-36], which could be confirmed in this research in town B, when comparing data from 2007 with those from 1991 to 2004 (Table 2). However, in town A, results show that this index remained nearly the same for 10 years (1997 to 2007), presenting a tendency to stabilize in most part of the period, showing a small reduction of 6.4% between 2001 and 2007, without statistical significance ($p < 0.05$).

Considering the increase of fluorosis prevalence comparing both towns from 1997 (year that began the process of water fluoridation in town B) to 2007, it was observed that town A presented an increase of only 5.1%, whereas in town B, the increase was 149%. One can suggest that others studies could be carried out to monitor fluorosis prevalence in town B.

In relation to fluorosis severity, the lowest score for both towns was the component T-F 3, and the highest was the T-F 2. However, in a research carried out in Nigeria, the most severe form was T-F 6 and T-F 5[37].

According to the epidemiological surveys discussed in this study, a continuous decline of dental caries experience could be verified after 36 years of water supply fluoridation in town A, from 1971 to 2007, and in town B from 1991 to 2007. Regarding dental fluorosis, stabilization trends were observed in town A. However, in town B, a constant increase was noted. It is possible that concomitant use of fluoridated dentifrice and water are directly related with the increase in

the prevalence of dental fluorosis. Future epidemiological surveys should be carried out to evaluate and monitor dental caries and fluorosis trends over time.

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