

Dental caries and associated factors among Brazilian adolescents: a longitudinal study

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Abstract

A decrease in caries experience among children has been observed in all countries. However, this subject has yet to be further investigated in adolescents. The aim of this study was to describe the prevalence and incidence of caries disease and determine possible factors associated to this condition among adolescents. A 2-phase longitudinal study was performed. The first phase comprised a prevalence study of caries carried out with children aged 11 to 13 years (n=247). The second phase was performed with the same participants at the ages of 15 to 17 years. DMF-T and Significant Caries Index (SiC) were used to assess dental caries experience. A logistic regression model analysis of data was performed. On the first phase, 69.23% of the subjects presented caries. The DMFT was 2.52 ± 2.54 and the SiC was 4.23 ± 2.72 . In the second phase, 88.26% of the subjects presented caries. The DMFT and the SiC were 5.27 ± 4.10 and 10.58 ± 3.13 , respectively. Caries incidence was 2.94 ± 3.05 . The multivariate analysis identified that the individuals belonging to the most deprived social classes presented a 2.51-fold (1.22-5.19; $p=0.012$) higher chance of having experience caries (1st phase). The chance was 2.51-fold (1.21-2.55; $p=0.013$) higher in the 2nd phase. In conclusion, high caries prevalence and incidence were observed in the studied population and social factors were associated with these findings. Socioeconomic factors showed a direct association with caries experience.

Key words:

Adolescent; dental caries; epidemiology; risk.

Introduction

Although dental caries experience among children and adolescents in Brazil is still a great concern to the Dental Public Health Services, a decrease in its occurrence has been observed in the last decades¹. A similar reduction has been observed in developed and developing countries alike²⁻³.

The last nationwide study performed in 2003 noted that 68.92% of the children at the age of 12 had caries experience⁴. This situation was observed to be above the World Health Organization (WHO) suggested levels by the year 2000. On the other hand, the DMFT for the same age was of 2.78, below the target suggested by WHO⁵. Between the ages of 15 and 18, 88.94% of the individuals

presented caries experience, and the DMFT was 6.17², indicating a considerable decrease in oral health conditions among the Brazilian adolescents.

Epidemiological studies on dental caries have explored the association of aggravating factors of various natures, such as socioeconomic conditions¹, food intake habits, oral hygiene characteristics, access to fluoridated water, access to health services, among others⁶. Several of these studies were cross-sectional investigations and the caries disease measurements were taken at one moment in time. Incidence measurements to verify aggravating factors associated with health for a same cohort during the course of time have not yet been performed in adolescents.

The aim of this study was to describe the prevalence and incidence of dental caries and to verify the possible influence of socioeconomic, behavioral and clinical factors among Brazilian adolescents.

Material and Methods

The research project was reviewed and approved by the University of West of Santa Catarina's Ethics Research Committee

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A census was performed. The study population was composed of all children aged between 11 and 13 years living in a rural city of Southern Brazil (Água Doce, SC) in the year 2001 (n=247). All children had access to systemic fluoride since the city had uninterrupted public water supply fluoridation since 1989.

This is a 2-phase longitudinal study. On the first phase a study of prevalence of dental caries was carried out and information regarding socioeconomic conditions and oral health behavior was collected by means of a structured questionnaire. The second phase was performed in 2005 (48 months after the first phase), in which a new collection of data on caries prevalence was done. The Brazilian Association of Market Survey Institutes (ANEP – ABIPEME) questionnaire was used to evaluate the subjects' socioeconomic conditions and a structured questionnaire was used to collect oral health behavior data. During the study period, the participants did not have access to any oral health preventive measures. Access was limited to curative procedures, such as dental fillings.

Information concerning caries was obtained through DMFT index. All examinations were performed according to WHO criteria⁷. The adolescents were examined by two calibrated dentists after obtaining an appropriate kappa (>0.80). The Significant Caries Index (SiC) was used to measure the polarization of caries experience in one-third of the participants who presented more disease⁸.

Socioeconomic, behavioral and clinical-epidemiological characteristics were classified using dichotomic variables. The socioeconomic characteristics were: parental schooling; family income, in minimal wages (one minimum wage corresponds to approximately 150 U.S. dollars). The social level was divided according to methodology from the Brazilian Association of Market Survey Institutes (ANEP – ABIPEME), as published elsewhere⁹; classes A and B represent the categories with a higher socioeconomic level and classes C, D and E represent those with the lowest socioeconomic conditions; and the number of people *per* household.

Regarding oral health, the individuals were asked whether they had seen a dentist in the previous 12 months, and the frequency of the brushing, flossing and weekly use of mouthwash with fluoride.

Concerning the clinical-epidemiological characteristics, were observed: the prevalence of caries at baseline, caries prevalence in the same participants 48 months after baseline and the incidence of carious lesions during the study period, according to the DMFT.

Data were analyzed by STATA 8.0 software. The continuous variables were presented as means and standard deviation. The dichotomic variables were represented in the form of absolute (n) and relative (%) frequency. The nonparametric Wilcoxon matched-pair signed-rank test was used to determine the difference in DMFT means between the two exams. The nonparametric Mann-Whitney test was used to verify the differences between the mean DMFT

and SiC in the dichotomic variable groups. Single and multivariate logistic regressions were used to verify factors associated with caries prevalence and incidence. For the multivariate analysis, the statistically significant variables from the single variate regression were introduced in the model.

Results

The study was carried out with 247 adolescents, of which 131 were male (53.04%). One-hundred and sixty-six mothers (65.99%) and 157 (63.56%) fathers reported having less than 8 years of schooling. Of the total cohort, 154 (62.60%) participants belonged to families with a monthly income of up to 3 minimum wages; 188 (76.11%) belonged to the least favored social groups (C, D and E) and 194 (78.54%) lived in households with up to 5 people.

At baseline, 171 (69.23%) participants had caries experience. The mean DMFT was 2.52 (\pm 2.54) and the mean SiC was 4.23 (\pm 2.72) (Table 1). On phase 2 of the study, 218 (88.26%) participants had caries experience. The mean DMFT was 5.27 (\pm 4.10) and the mean SiC was 10.58 (\pm 3.13) (Table 1).

The mean incidence of caries disease (DMFT) was 2.94 (\pm 2.96) and the median was 2 (Table 2). A higher and statistically significant mean was observed between the D, M and F components and the DMFT in the second phase of the study, compared to the baseline (Table 1).

The results of the analysis of the differences between the mean DMFT and the dichotomic variable groups are shown in Table 2. In the first phase of the study, a higher mean DMFT was observed among the participants whose mothers had less years of schooling (p = 0.001), whose fathers had less years of schooling (p = 0.001), who belonged to families with a smaller monthly income (p = 0.05), who flossed less than once a day (p = 0.019). On the multivariate analysis, the greater risk of caries was associated with social class and frequency of brushing. Participants who belonged to the least favored social classes presented a 2.51-fold (1.22-5.19) higher chance of having caries experience, when compared to those individuals of more favored social classes (p = 0.012); those individuals

Table 1 - Median and standard deviation (SD) of the DMFT and the Significant Index for Caries (SiC) in adolescents (Água Doce-SC, 2006)

Variables	Baseline Median \pm SD	48 Months Median \pm SD	Incidence Median \pm SD
D	0 \pm 1.24	1 \pm 2.06*	0 \pm 2.11
M	0 \pm 0.54	0 \pm 0.71*	0 \pm 0.64
F	1 \pm 1.90	3 \pm 3.14*	1 \pm 2.31
DMFT	2 \pm 2.54	5 \pm 4.10*	2 \pm 3.05
SiC	4 \pm 2.72	10 \pm 3.13*	6 \pm 2.96

* Statistically significant differences when comparing the baseline examination to the 48-month examination (p<0.05; Wilcoxon test).

Table 2 - Median and standard deviation (SD) of the DMFT according to risk variables, in adolescents (Água Doce-SC, 2006)

Variables	Baseline	48 Months	Incidence
	% DMFT ≥ 1 ; Median \pm SD	% DMFT ≥ 1 ; Median \pm SD	% DMFT ≥ 3 ; Median \pm SD
Gender			
Male	70.63; 2 \pm 2.35	89.23; 5 \pm 4.33	46.15; 2 \pm 3.44*
Female	70.43; 2 \pm 2.74	87.07; 5 \pm 3.83	46.55; 2 \pm 2.54
Schooling of the mother			
Complete Elementary	56.79; 1 \pm 2.47 ^a	78.57; 3 \pm 3.83 ^h	38.10; 2 \pm 2.83 ⁿ
Incomplete Elementary	77.64; 32.86 \pm 2.51 ^a	93.25; 66.02 \pm 4.10 ^h	50.31; 33.19 \pm 3.13 ⁿ
Schooling of the father			
Complete Elementary	57.14; 1 \pm 2.11 ^b	78.16; 3 \pm 3.65 ⁱ	34.48; 2 \pm 2.70 ^o
Incomplete Elementary	78.06; 3 \pm 2.66 ^b	93.63; 6 \pm 4.14 ⁱ	52.23; 3 \pm 3.20 ^o
Family Income/month			
3 or more minimum wages	60.92; 2 \pm 2.68 ^c	81.52; 4 \pm 3.89	41.30; 2 \pm 2.96
Up to 3 minimum wages	75.97; 2 \pm 2.44 ^c	92.21; 5 \pm 4.14	48.70; 2 \pm 3.07
Social Class (ANEP)			
Class A and B	50.82; 1 \pm 2.02 ^d	75.00; 3 \pm 3.65 ^j	32.81; 1 \pm 2.74 ^p
Class C, D and E	77.35; 3 \pm 2.63 ^d	92.90; 6 \pm 4.09 ^j	50.82; 3 \pm 3.12 ^p
Number of people in the household			
Up to 5	69.31; 2 \pm 2.68	87.11; 5 \pm 4.18	44.33; 2 \pm 3.16 ^q
5 or more	75.47; 3 \pm 1.97	92.45; 6 \pm 3.73	52.83; 3 \pm 2.57 ^q
Visited the dentist in the last 12 months			
Yes	71.88; 2 \pm 2.38	85.94; 5 \pm 4.13	43.75; 2 \pm 3.18
No	70.22; 2 \pm 2.60	89.07; 4 \pm 4.00	46.99; 2 \pm 2.63
Brushes teeth at least 3 times a day			
Yes	66.28; 2 \pm 2.56	86.44; 5 \pm 4.25	43.50; 2 \pm 3.26
No	81.43; 2 \pm 2.46	92.86; 6 \pm 3.64	52.86; 3 \pm 2.42
Flosses at least once a day			
Yes	74.34; 3 \pm 2.71 ^f	88.79; 6 \pm 4.04 ^k	50.00; 3 \pm 2.81
No	67.44; 2 \pm 2.33 ^f	87.79; 4 \pm 4.10 ^k	42.75; 2 \pm 3.26
Uses fluoridated mouthwashes at least once a week			
Yes	68.47; 2 \pm 2.56	90.35; 5 \pm 4.01	41.23; 2 \pm 2.61
No	72.52; 2 \pm 2.52	86.47; 5 \pm 4.16	50.38; 3 \pm 3.37
Caries prevalence (Baseline)			
Yes	NA**	100.00; 6 \pm 3.44 ^l	54.97; 1 \pm 2.63 ^r
No	NA**	59.15; 1 \pm 3.59 ^l	21.13; 3 \pm 3.58 ^r
SiC (DMFT – Baseline)			
1st and 2nd tertile	NA**	82.94; 4 \pm 3.94 ^m	58.33; 2 \pm 3.03 ^s
3rd tertile	NA**	100.00; 7 \pm 3.67 ^m	34.41; 3 \pm 2.85 ^s

*Equal letters means that the groups analyzed were different ($p < 0.05$), using the Mann-Whitney test; ** NA = not applicable; * 1 minimum wage corresponds to approximately USD 150

that reported smaller a frequency of brushing had a 2.03-fold (0.99-4.15) higher chance of having caries when compared to individuals who reported a higher frequency of brushing ($p = 0.052$) (Table 3).

On the second phase, a higher mean DMFT was observed among participants whose mothers had less years of schooling ($p = 0.001$), whose fathers had less years of schooling ($p = 0.001$), among adolescents who belonged to families with smaller income ($p = 0.048$), who flossed less than once a day ($p = 0.034$), who had caries experience in the first phase of the study ($p = 0.001$) and who were in the one-third of the participants with higher DMFT on

the first phase of the study ($p = 0.001$) (Table 2). Participants belonging to the least favored social classes presented a 2.51-fold (1.21-2.55) higher chance of presenting caries experience when compared to the most favored social classes ($p = 0.013$) (Table 3).

Concerning the incidence of caries, a higher mean DMFT was observed among participants whose mothers had less years of schooling ($p = 0.019$), whose fathers had less years of schooling ($p = 0.003$), who lived in households with more than 5 people ($p = 0.035$), who had experience of caries in the first phase of the study ($p = 0.001$), and were in the one-third of the participants with higher DMFT

Table 3 - Multivariate logistic regression analysis according to caries prevalence (DMFT=0 vs DMFT>0) and incidence (Inc d”3 vs Inc >3) in the adolescents. Água Doce-SC, 2006

Variables	AOR*	IC 95%	p
Risk model for the Baseline			
Social Class (ANEP)			
Class A and B	1 ^a		
Class C, D and E	2.51	1.22-5.19	0.012
Schooling of the father			
Complete Elementary	1 ^a		
Incomplete Elementary	0.71-3.22	0.279	
Schooling of the mother			
Complete Elementary	1 ^a		
Incomplete Elementary	1.55	0.75-3.22	0.237
Family Income/month*			
3 or more minimum wages	1 ^a		
Up to 3 minimum wages	0.91	0.44-1.87	0.788
Brushes teeth at least 3 times a day			
Yes	1 ^a		
No	2.03	0.99-4.15	0.052
Risk model for the examination after 48 months			
Social Class (ANEP)			
Class A and B	1 ^a		
Class C, D and E	2.51	1.21-5.22	0.013
Schooling of the father			
Complete Elementary	1 ^a		
Incomplete Elementary	1.45	0.69-3.18	0.316
Schooling of the mother			
Complete Elementary	1 ^a		
Incomplete Elementary	1.69	0.81-3.57	0.164
Family Income/month*			
3 or more minimum wages	1 ^a		
Up to 3 minimum wages	0.99	0.78-2.04	0.980
Risk model for the incidence			
Caries prevalence (Baseline)			
Yes	1 ^a		
No	1.19	0.98-1.21	0.127
Social Class (ANEP)			
Class A and B	1 ^a		
Class C, D and E	1.72	0.86-3.43	0.127
Schooling of the father			
Complete Elementary	1 ^a		
Incomplete Elementary	1.67	0.84-3.32	0.142
Schooling of the mother			
Complete Elementary	1 ^a		
Incomplete Elementary	1.03	0.53-2.00	0.938

^a reference value; *statistically significant ($p < 0.005$); *AOR = OR adjusted;

^b 1 minimum wage corresponds to approximately USD 150.

in the first phase of the study ($p = 0.001$) (Table 2). On the multivariate analysis, none of the variables studied were associated with the incidence of caries (Table 3).

Discussion

During the first phase of the study, at the age of 12, 69.23% of the children presented caries experience; on the other hand, the DMFT for the same age group was 2.52, lower

than the WHO recommendations of DMFT d” 3⁵. Countries such as England, Sweden and Denmark have DMFT that ranges between 0.9 and 1.1 for this age group¹⁰. There is a very large variation among experts with regard to the impact of various possible factors in explaining the caries experience decrease among the countries, and the use of fluoride toothpaste has been a consensus of a definite positive effect in this reduction¹¹.

Among countries that have caries prevalence below 3, such as those mentioned above, the SiC index is recommended in order to monitor caries experience in one-third of the participants that presented higher indices of the disease¹². On the first phase of the study, the SiC was 4.23, which is higher than the target set for the year 2015 ($<3^{13}$). Sweden and Senegal are some of the few countries that have already achieved this goal¹³⁻¹⁴. In 1997, England presented a SiC of 3.5 for children at the age of 12, the United States 3.6, Germany 4.1, France 4.7, Mexico 5.0 and Costa Rica 13.7¹³. Even though this new index is being proposed, the WHO goal defined for the year 2000 should still be considered, especially for those countries with a mean DMFT above this value, or even below but close to it, such as the case of this study¹².

On the second phase of the study (after 48 months), 88.26% of the participants presented caries experience, and the DMFT was 5.27, indicating a considerable decrease of the oral health status of the adolescents. The incidence of the DMFT was 2.94, in which the filled (F) component presented the highest incidence (1.64), indicating the curative characteristics of the Brazilian dental services. Nevertheless, these values were inferior to the nationwide study that found a DMFT of 6.17 in the 15-to-18-year-old age group². During this phase of the study, the SiC was 10.58, which is considered elevated, if compared to the results of Marthaler, et al.¹⁵(2005), who found a SiC of 4.31 at the age of 15. However, it was below the values found among adolescents in the 15 to 19 year age group in the State of São Paulo, Brazil². Marthaler, et al.¹⁵ (2005) suggest the adoption of the SiC target of 5.0 at the age of 15.

In the present study, the mean DMFT was higher in those groups whose parents presented lower schooling levels, lower family income and no flossing at least once a day. These findings reinforce the results found by other authors⁶, who noted that socioeconomic inequalities were associated with higher prevalence of caries disease. The second moment of the survey (48 months after the first examination) and the incidence presented similar standards. On the multivariate analysis, it was noted that participants belonging to the least favored social classes presented a 2.51-fold higher risk for caries experience in both phases of the study, thus reinforcing the influence of living conditions on oral health¹⁶. In the first phase of the study, it was observed that participants who brushed their teeth less than three times a day had 2.03-fold higher chances of having caries, which is in agreement with the findings of previous studies¹⁷⁻¹⁸. The ideal brushing frequency depends on the efficiency of the cleaning¹⁸. From a public health standpoint, this should not be the main objective for intervention in high-risk populations¹⁹.

Our investigation confirmed the results of studies by Antunes, et al.¹ (2004) and Marthaler, et al.¹⁵ (2005) regarding the polarization of caries disease, in which a small group of people is normally responsible for a higher proportion of the disease within a population. Nevertheless,

it has been discussed that new cases of the disease have not appeared in the group with the highest caries experience²⁰.

Although this is a longitudinal study to determine factors associated with the risk of caries, the DMFT index was used. For longitudinal studies, the most indicated index would be the DMFS²¹. The reason why the DMFT index was adopted was because the study was carried out in 2 phases, and in the first phase, the use of DMFT had the purpose of serving as a parameter for the local planning of Health Services. Possible factors that contribute to the high caries incidence for age groups older than 12, should be further investigated.

In conclusion, high caries prevalence and incidence were observed in the studied population and social factors were associated with these findings. Socioeconomic factors showed a direct association with caries experience.

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