Dental caries and gingivitis among 15 to 19 year-old students in Manaus, AM, Brazil

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Abstract: In the light of the scarcity of epidemiological studies on the oral health of the general population within the context of the Amazon region, this study aimed to estimate the prevalence of dental caries and gingivitis, as well as to evaluate the need for restorative treatment, among school students aged 15 to 19 years in the city of Manaus, AM, Brazil. A cross-sectional study was carried out on a sample of 889 students from within city limits who were enrolled in 26 public and private schools. Dental examinations were performed to obtain the DMFT index (decayed, missing and filled teeth) as well as to determine the treatments needed. The gingival index (Lõe & Silness) was used to classify gingivitis. The intra-examiner diagnostic concordance was 94% and the Kappa statistic was 0.91. The DMFT index found was 4.65 (± 0.12), without significant difference between the sexes or skin color groups. The prevalence of dental caries was 87.4%. Restoration of a dental surface was the greatest need (59.3%). Slight gingival inflammation was present in 78.5% and gingival bleeding following probing occurred in 53.3%. Although the DMFT index was lower than that observed for the northern region of Brazil, restorative dental services are lacking for this population. Additional studies are suggested to better understand the differences found.

Descriptors: Dental caries / epidemiology; Dental caries; Gingivitis / epidemiology; Gingivitis.

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Introduction

Dental caries is considered a disease of worldwide prevalence and incidence, constituting an important public health challenge in various countries. Regional social differences both in developed and in developing countries are also expressed through the health-disease process, thus showing that the unequal incidence of caries in different populations is not only the result of individual biological variations, but socioeconomic factors as well.[1] Hence, identifying this disease and determining its magnitude and distribution in populations is a major step in controlling or maintaining it at acceptable levels.

Contrary to the situation among 12-year-old children, few studies have been conducted to characterize the oral health of adolescents and young adults in Brazil. Only two national surveys[2,3] have covered the age range from 15 to 19 years, and both have shown that caries was greater in 15 to 19-year-olds than among 12-year-olds.

Although Manaus is considered a large-sized city, with its population of 1,612,475 inhabitants,[4] only one epidemiological study has been conducted, among 12-year-old children in 2004,[5] that found moderate prevalence of dental caries, according to World Health Organization (WHO) criteria. The growth of the city has occurred rapidly and, in many areas, in a disorderly manner. This has caused serious problems for the city, not only of an environmental and social nature, but also in regard to public health.[6] Thus, the knowledge of oral health at all ages and in different contexts is vital for decision-making in regard to preventive dental care.[7]

Therefore, the aim of this study was to contribute to the knowledge of the oral health of adolescents aged 15 to 19 years in the city of Manaus, State of Amazonas (AM), by estimating the prevalence of dental caries and gingivitis among this population, considering that they are the most common oral diseases.

Materials and Methods

This study was a cross-sectional one. It was approved by the Research Ethics Committee of the Federal University of Amazonas, under protocol number 031/2006.

To carry out the study, a proportional sample of the population of school students aged 15 to 19 years enrolled in schools of Manaus was selected. The data relating to schools and student enrollment were made available by the Department of Planning and Research/Statistics Management of the State of Amazonas Education Department (SEDUC).

A pilot study was performed, involving six zones that constitute the municipality, with the aim of determining measurements of the variability of the study subject (experience of dental caries and gingivitis). Thus, for the present study, central trend and dispersion measurements of the dependent variable of gingivitis (mean of 0.45 and standard deviation of ± 0.44) were considered since, in the calculations, this was the variable that resulted in requiring the greatest number of students to make up the samples. Previously, the sample size was estimated based on a statistical formula from the last national oral health survey.[3] The sample size took into consideration a non-response rate of 20% (an estimated increase considering possible individual losses), study effect of 2 (considering that the sample pool used conglomerates represented by schools and classes), maximum permitted error of 10%, and a confidence interval of 95%. The minimum sample size calculated was 880 students.

Schools with 10 adolescents or fewer enrolled were excluded. Students using orthodontic appliances were also excluded from this study. The drawing for the schools was a weighted one, in that larger schools had a greater chance of being drawn. A letter of recommendation from the Education Secretary of the State of Amazonas was presented to each teaching unit that was drawn, together with a consent statement that was duly filled out and signed by each school principal. Next, the classes containing students aged 15 to 19 years were drawn, by a simple and non-retaking method, and free and informed consent statements were obtained.

Following this, dental biofilm was removed from each student with a toothbrush, toothpaste and dental floss given out by the examiner. The clinical examinations were performed individually in a room in the school, using a headlamp, No. 5 planar dental mirror, modified WHO-type ballpoint probe and

sterilized gauze compresses to dry the teeth. The students were examined while sitting on a school chair, with the dentist standing in front of the student. Firstly, the DMFT index (decayed, missing and filled teeth) was determined, then the need for treatment was assessed and, finally, the gingivae were probed on the distal, buccal, mesial and lingual surfaces of all teeth.

To ensure reliability and reproducibility of the data, prior intra-examiner calibration was undertaken, by examining 20 adolescents and then reexamining seven days later. The result of this training was 94% of diagnostic concordance, with a Kappa statistical value of 0.91, thus representing a satisfactory level of concordance.[8] In addition to the examiner, an assistant who recorded data on cards was also part of the team.

A form containing questions relating to the student was used, including questions on age, sex, skin color, marital status, place of birth and number of children. A self-assessment was used for racial determination as standardized by the Brazilian Institute of Geographic Statistics, working as an independent variable. Dental caries was assessed using the DMFT index, following the WHO norms, and gingivitis was assessed using the gingival index recommended by Löe.[9]

The statistical analyses were performed using the SAS software, version 6.12. Descriptive statistics were used (mean, standard error and frequency distribution), and the means were compared using the Kruskal-Wallis statistical test. The significance level used for comparisons was 5%.

Results

Examinations were performed on 889 students aged 15 to 19 years. The students were distributed across 26 schools (13 municipal, 11 state and two private schools) in the six zones within the city limits of Manaus. A larger percentage of the students examined were female, with brown skin and born in Manaus. The predominant marital status and number of children, as would be expected for the age group studied, was single, and these students had no children (Table 1). The mean DMFT index found for the age group of 15 to 19 years was 4.65

Table 1 - Characterization of the study population, according to sex, skin color, marital status and place of birth.

Variables		Age in years											
		15 n = 458		16 n = 151		17 n = 121		18 n = 95		19 n = 64		15 - 19 n = 889	
		n	%	n	%	n	%	n	%	n	%	n	%
Sex	female	265	57.86	78	51.66	65	53.72	47	49.47	35	54.69	490	55.12
	male	193	42.14	73	48.34	56	46.28	48	50.53	29	45.31	399	44.88
Skin color	white	101	22.05	23	15.23	33	27.27	16	17.02	10	15.63	183	20.61
	brown	300	65.5	107	70.86	80	66.12	69	73.40	47	73.44	603	67.91
	black	41	8.95	15	9.93	7	5.79	7	7.45	5	7.81	75	8.45
	Indian	14	3.06	5	3.31	1	0.83	2	2.13	2	3.13	24	2.70
	yellow	2	0.44	1	0.66	0	0.00	0	0.00	0	0.00	3	0.34
Marital status	married	4	0.87	2	1.32	6	4.96	9	9.47	6	9.38	27	3.04
	single	452	98.69	147	97.35	114	94.21	79	83.16	53	82.81	845	95.05
	divorced	0	0.00	0	0.00	0	0.00	1	1.05	0	0.00	1	0.11
	others	2	0.44	2	1.32	1	0.83	6	6.32	5	7.81	16	1.80
Number of children	none	454	99.13	147	97.35	112	92.56	81	85.26	49	76.56	843	94.83
	one child or more	4	0.87	4	2.65	9	7.44	14	14.74	15	23.44	46	5.17
Place of birth	Manaus	365	79.69	109	72.19	90	74.38	64	67.37	45	70.31	673	75.70
	other places	93	20.31	42	27.81	31	25.62	31	32.63	19	29.69	216	24.30

(± 0.12). The prevalence of dental caries was 87.4%. Table 2 shows the means for decayed, missing and filled components of the index, highlighting the higher mean of the decayed component. The Kruskal-Wallis test found no significant difference in the mean DMFT index between the sexes (p = 0.58), or between the skin color groups studied (p = 0.31).

Analyzing the percentage composition of the DMFT, 73.1% of the adolescents had decay, followed by 39.7% missing teeth. Only 37.7% of the sample had one or more teeth filled. A DMFT index of zero was observed in only 12.6% of the adolescents, while 60.3% were not missing teeth.

In regard to the need for dental treatment, the greatest need was for restoration of one or more tooth surfaces, followed by pulp treatment (Table 3).

The prevalence of gingivitis was 94.71%, and the greatest percentage of these cases consisted of mild gingival inflammation, followed by moderate (Table 4). There was no significant difference between the sexes in relation to gingival bleeding when the Kruskal-Wallis test was applied (p = 0.86). In the entire sample, 474 (53.3%) presented gingival bleeding on probing, on at least one tooth surface. No significant differences were found between the skin color groups in relation to the gingival index (p = 0.10).

Discussion

This study was the first epidemiological survey

Table 2 - DMFT index and its components among students aged 15 to 19 years in the city of Manaus, AM.

Age	n	Decayed	Missing	Filled	DMFT
15	458	2.42 (± 0.12)	0.58 (± 0.04)	1.21 (± 0.09)	4.22 (± 0.15)
16	151	2.94 (± 0.27)	0.82 (± 0.09)	1.00 (± 0.14)	4.76 (± 0.31)
17	121	2.75 (± 0.27)	0.65 (± 0.10)	1.42 (± 0.21)	4.83 (± 0.33)
18	95	3.00 (± 0.34)	1.23 (± 0.16)	1.61 (± 0.34)	5.84 (± 0.49)
19	64	2.48 (± 0.28)	1.65 (± 0.19)	1.14 (± 0.23)	5.28 (± 0.42)
15 – 19	889	2.62 (± 0.09)	0.78 (± 0.04)	1.24 (± 0.07)	4.65 (± 0.12)

Table 3 - Need for dental treatment among students aged 15 to 19 years (n = 889). Mean number of teeth per person, standard error (SE) and percentage. Manaus, AM, 2007.

Parameters	Restoration (one surface)	Restoration (two or more surfaces)	Endodontic treatment + restoration	Extraction
Mean	1.3395	0.5016	0.4713	0.3835
SE	0.0522	0.0347	0.0288	0.0339
%	59.3%	28.3%	31.2%	20.2%

Table 4 - Gingival index (Lõe[9], 1967), among students aged 15 to 19 years. Manaus, AM, 2007.

Gingival index classification	Age in years											
	15		16		17		18		19		15 - 19	
	n	%	n	%	n	%	n	%	n	%	n	%
Healthy gingivae	30	3.37	4	0.45	3	0.34	5	0.56	5	0.56	47	5.29
Mild gingival inflammation	363	40.83	117	13.16	97	10.91	73	8.21	48	5.40	698	78.52
Moderate gingival inflammation	65	7.31	29	3.26	21	2.36	17	1.91	11	1.24	143	16.09
Severe gingival inflammation	0	0.00	1	0.11	0	0.00	0	0.00	0	0.00	1	0.11
Total	458	51.52	151	16.98	121	13.61	95	10.69	64	7.20	889	100.00

Note: There was no significant difference between gingival condition and age (p = 0.34).

of dental caries and gingivitis of adolescents aged 15 to 19 attending schools in Manaus.

The skin color composition of the city's population is 63.7% brown and 34.2% white.[4] This was reflected in the participants of this study, among whom 67.9% were brown and 20.6% white. Although studies have shown significant differences between racial groups and oral diseases,[10] this study did not find this, possibly because the majority of participants were brown skinned.

The general water supply for the city is not fluoridated,[11] and piped water reaches the homes of 74.5% of the city's residents. The remainder consumes water from artesian wells (14.3%) and other sources (11.2%).[4] This information is extremely important, given that the use of fluoridated water is one of the principal factors controlling the incidence of dental caries among populations.[12]

The DMFT index observed among the students aged 15 to 19 years in this sample (4.65 ± 0.12) (Table 2) was lower than that found for the northern region in the latest national survey carried out in Brazil (DMFT of 6.1)[3] and similar to that found in another major northern region city, Belém (DMFT of 4.63).[13] However, the decay component observed in the city of Manaus (73.1%) exceeded that observed in all the macroregions of Brazil, including what was found in Belém (9.9%). The lower DMFT indices found in the latest national survey were concentrated in the southern and southeastern regions of the country (DMFT of 5.77 and 5.94, respectively).

In São Paulo State,[14] 71.2% of the adolescents presented restorations, and only 22.2% presented decayed teeth, thus contrasting with 37.7% of the adolescents presenting filled teeth and 73.1% presenting decayed teeth, in Manaus. These data suggest that there are differences both in the provision and access to oral healthcare services between the two cities. It is noteworthy that 82% of cities in São Paulo State have fluoridated water.[15]

Therefore, although the index observed in Manaus is lower than the national average for the northern region,[3] this must be interpreted with great caution. It should be stressed that the last national survey not only included state capitals but also smaller-sized municipalities, and the sample selected was home-based, whereas in the present study, the sample was selected from students. It can be assumed that the students had both access to services and information, compared with individuals not in school. On the other hand, the first national survey in 1986[2] only covered state capitals, and the northern region was represented by Manaus and Belém. In this case, the sample of adolescents between 15 and 19 years of age was selected both in schools and homes, and the mean DMFT index for the region was 11.89. Thus, the incidence of dental caries appears to have declined among adolescents in Manaus, compared to 1986.

Several studies involving 12-year-old children have indicated a decline in the DMFT index, both in Brazil and worldwide, as seen in studies conducted in Norway[16] and Spain.[17] However, when an older age group is studied, the experience of caries increases, as seen in studies by Astroth *et al.*[18] (1998), Cangussu *et al.*[19] (2004), Gomes *et al.*[20] (2004) and Moreira *et al.*[21] (2007), which showed DMFT indices at 12 years of age of 4.08, 1.44, 1.0 and 3.37 and at 15 years of age of 6.40, 2.66, 2.9 and 5.65, respectively. The results from the present survey are consistent with the previously observed profile. In the study by Rebelo *et al.*[5] (2004) among 12-year-old school students, also in Manaus, the DMFT index was 2.81.

Moreover, considering the target proposed by WHO[20] for 2010, in which adolescents at the age of 18 years ought not to have lost any teeth due to caries, we observed in the present study that 39.7% of the students in the age group from 15 to 19 years had lost at least one tooth to disease. It is noteworthy that the target proposed for the year 2000 was not attained (85% of the population presenting a score of zero for the "missing" component).

Mild gingival inflammation was the gingival abnormality most often present, in all ages, corresponding to almost 80% of the total. It was also observed that gingival bleeding on probing was present in more than half of the students. These findings are also consistent with a study conducted among 18-year-old adolescents in Florianópolis,[22] in the southern region of Brazil, where 86% presented bleeding. Our findings may suggest that oral hygiene practices

are not being performed adequately by adolescents. This situation could be reversed by programs promoting oral health.[23,24]

Conclusions

Prevalence of dental caries in ages ranging from 15 to 19 years was 87.5%, with a CPO-D index of 4.65. The study population showed some form of gingival inflammation in 94.7% of cases, while the most widespread treatment needed was fillings in one dental surface (59.3%) followed by endodontic treatment (31.2%). Although the DMFT index was below that observed for the northern region of the country, the percentage of students presenting untreated disease was high, as was the percentage of teeth lost due to caries. A need for restorative dental services for this population was noted. Additional studies involving other variables may further explain the differences encountered.

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