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Oral health conditions in children with and without school-based oral preventive program

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Abstract OBJECTIVES: To assess the degree of plaque, gingivitis and caries in children who either did or did not take part in a regular oral preventive program, thus establishing an overview of the oral health condition of those populations. METHODS: A population of 325 Brazilian children aged 8–12 years old, from two public schools, whose parents granted permission, were divided into two groups according to their school. The main group (G1) consisted of 203 children from the school, which has the preventive program, while the control group (G2) consisted of 122 children from the school without the program. The children were examined clinically by a single examiner to assess plaque and gingival status, as well as caries prevalence in order to assess their oral health status. Data was inserted in SPSS 11.0 and the Mann-Whitney test with a significance level of 5% was used for data analyses of the independent variables, while the Student *t* test was used for comparison between averages. RESULTS: The mean plaque score and mean gingival bleeding score of G2 were higher than G1 ($P<0.05$). Regarding the percentage of caries-free children, it was 31.0% with a mean DMFT + dmft of 2.07 (± 2.87) in G1 and 21.3% with a mean DMFT + dmft of 3.03 (± 2.79) in G2 ($P>0.05$). CONCLUSION: It was concluded that the oral preventive program seemed to demonstrate a satisfactory impact on the oral health condition of the target children when compared to the ones who were not enrolled in a school-based program.

Key words
Caries,
Dental plaque,
Gingival bleeding,
Oral health promotion,
Schoolchildren

Introduction

Over the past three decades a vast number of publications have shown that gingival and periodontal diseases are associated with supragingival and subgingival bacteria[1)]. Lines of evidence to support such concept were derived from cross-sectional and longitudinal oral hygiene studies, clinical therapeutic trials and *in vivo* and *in vitro* pathogenicity investigations[1,2)].

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Since microbial plaque on dental surfaces is the main etiologic agent of periodontal diseases[3,4)], as well as of dental caries[5)], in case the person is infected by cariogenic bacterias, the prevention of these conditions, through meticulous plaque control and oral health education, is the crucial factor in combating such diseases[6)].

Well-designed oral health programs with the aim of increasing children's awareness of oral health problems and of providing them with the knowledge, skills and attitude required to avoid the preventable oral diseases have been introduced in schools to improve the oral health status of the

population being served[7–9].

In undertaking the evaluation of oral health programs, performance with respect to the program's objectives is of vital importance to ascertain its effectiveness regarding the oral health of the children being served[10], especially when the program is supported by the government, for they need the data to continue offering the benefit or to plan other strategies.

The traditional and effective approach to evaluate the oral health status of children with school-based oral health programs has been a comparison of their oral health indexes with the ones of another population not supported by such programs[6,10,11]. Therefore, the purpose of this cross-sectional study was to assess the degree of plaque, gingivitis and caries in children who either did or did not take part in a regular oral preventive program, thus establishing an overview of the oral health condition of those populations.

Methods

Study population

A written communication delineating the aim of this study was sent to the parents of 630 children aged 8–12 years old from the first, second and third grades of two public schools in Rio de Janeiro, Brazil. This study has been approved by the local ethical committee and the parents of 325 children granted permission. This population was then divided into two groups: the main group (G1)—consisting of 203 children from the same school—received an oral preventive program and the control group (G2)—consisting of 122 children from the other public school—received no preventive program, serving as negative control.

Oral preventive program (G1)

This group participated in a program consisting of the free handing-out of an oral hygiene kit containing a dental gel, a dental biofilm indicator paste and a child's toothbrush, every six months.

Information concerning oral hygiene was given and supervised brushing with the indicator paste was done during the first six months of the program, which is lasting for 30 months. No brushing technique was chosen to be taught the children, since it was judged more adequate to improve the technique already in use by each child.

A conversation with the children's parents aimed to supply information about etiology, progression and control/treatment of dental caries and periodontal diseases before the initiation of the program. The importance of a minimum of two daily brushings was emphasised[12], one in the morning after the breakfast and the other at bedtime, with special care to the quality of the said brushing. The use of dental floss was encouraged as well, but no approach was made to dietary counselling[13]. Parents were instructed to supervise tooth brushing at home, and the dental biofilm indicator paste was recommended to be used once a day. At the same time a dentist was working at the school twice a week in order to fulfill the children's dental needs, regarding treatment.

No-prevention program (Control—G2)

Children in this group received no informational sessions about oral diseases or oral hygiene instructions before the clinical examination. Besides, they did not have a dentist assisting them in the school.

Clinical examinations

All examinations were performed by a single previously trained examinator in both schools, in a classroom, with the child lying on a chair and with the aid of a flashlight. For each child the presence of bleeding after papillary stimulation, according to Eastman Interdental Bleeding Index (IBI)[14] was assessed. Then the vestibular, lingual or palatal surfaces of every tooth present in the mouth were dyed and inspected for classification according to the Dental Biofilm Index (DBI) by Quigley-Hein modified by Turesky *et al.*[15] Children were then instructed to brush their teeth, and were supervised until the complete removal of the dyed dental biofilm. After this, children went back to the examination room for the ascertaining of the presence of decayed, missing or filled teeth, according to DMFT and dmft indexes. The individual bleeding index was obtained by calculating the proportion of bleeding sites in relation to non-bleeding ones, and the biofilm average was obtained by adding the scores of each surface and dividing the result by the total amount of analysed surfaces.

For a better understanding of the DBI distribution in the sample, children, who had more quantity of scores 0 and 1 attributed to their tooth surfaces, were considered as having a low amount of biofilm, and those who had more scores 2 or above, were considered as having a great amount of biofilm, according to the criteria of Turesky *et al.*[15]

Socio-economical-educational status

A pre-tested questionnaire containing questions that allowed an evaluation of the socio-economical-educational level of the target population was sent to the parents of each child from both schools. The chief purpose of this questionnaire was to ascertain whether the two groups were comparable.

The analysed data supplied by this questionnaire refer to 76 returned answers from G1 and 54 from G2.

In this study, families from both groups showed practically no difference in the parents' level of schooling. Both in G1 and G2 it was verified that the highest percentage is that of parents with completed senior high schooling (Table 3).

Benefit

It is important to point out that, after the examination of the children enrolled in G2, an oral hygiene kit was offered to them, with fluoride dental cream and a child's toothbrush. In addition, they were informed about oral hygiene procedures and supervised brushing was done.

Every child belonging to G1 who needed restorative treatment was directed to the school dentist for the necessary dental treatment, whereas the children from the control group in need of dental treatment were directed to the pediatric dental clinic of a Public University in Rio de Janeiro.

Table 1 Percentual distribution of children as to gender and age average in both groups (n = 325)

	Gender	n (%)	Age
			X ± SD
Group 1	F	115 (56.7)	9.20 ± 0.83
	M	88 (43.3)	9.11 ± 0.71
	Gender	n (%)	Age
			X ± SD
Group 2	F	58 (47.5)	9.20 ± 1.16
	M	64 (52.5)	9.26 ± 1.01

Table 2 Sample distribution according to family income (in minimum salaries/wages), by group (n = 130)

	Family income (in minimum salaries/wages)							
	0–1	1.01–2	2.01–3	3.01–4	4.01–6	>6	Without salaries	Total n (%)
G1 n (%)	14 (18.4)	20 (26.3)	22 (28.9)	13 (17.1)	4 (5.3)	2 (2.6)	1 (1.3)	76 (100.0)
G2 n (%)	8 (14.8)*	15 (27.8)*	12 (22.2)*	9 (16.7)*	4 (7.4)*	3 (5.6)*	3 (5.6)*	54 (100.0)
Total n (%)	22 (16.9)	35 (26.9)	34 (26.2)	22 (16.9)	8 (6.2)	5 (3.8)	4 (3.1)	130 (100.0)

Note: Chi-square test, $P>0.05$ (*)

Table 3 Sample distribution, by group, according to parents' schooling level (n = 130)

	Parents' schooling level					
	1st to 4th grade	5th to 8th grade	senior high level	university courses	unknown level	Total n (%)
G1 n (%)	13 (17.1)	22 (28.9)	32 (42.1)	8 (10.5)	1 (1.3)	76 (100.0)
G2 n (%)	10 (18.5)*	14 (25.9)*	21 (38.9)*	9 (16.7)*	—	54 (100.0)
Total n (%)	23 (17.7)	36 (27.7)	53 (40.8)	17 (13.1)	1 (0.8)	130 (100.0)

Note: Chi-square test, $P>0.05$ (*)

Data analysis

All data were inserted in the SSPS 11.0 version. The independent variables were compared according to the Chi-square test, and for the comparison of averages, the Student *t* test was used. Concerning the analysis of the questionnaire results, Chi-square test was used. For all analyses the significance level was considered of 5%.

Reproducibility

Reproducibility plaque assessment was determined by a method using photographs developed by Kelly *et al.*[16] And, reproducibility of dental caries assessment was verified by re-examining 12 children, whose teeth were evaluated individually and without knowledge of their previous records.

Intra-examiner agreement expressed by intra-class correlation coefficient[17] was 0.837 (95% intervals of confidence = 0.803–0.866) for dental plaque. The results of intra-examiner agreements assessment for dental caries was 0.975 using Kappa Statistic[18].

Results

Percentual distribution of children as to gender and age average in both groups can be observed in Table 1, which shows similarities between G1 and G2.

Regarding DBI, a lower biofilm average was observed in the dental surfaces of the children in G1 compared to those of G2, as well as the bleeding index mean (IBI) (Table 4).

It should be noted that, in the children from G1—though they had a lesser amount of biofilm and consequently a lower gingival bleeding index—a greater number of outliers was found, concerning

Table 4 Dental Biofilm (DBI) and Interdental Bleeding (IBI) Indexes in the studied groups

Indexes	Group	N	Mean	Minimum	Maximum	Std. Deviation
DBI	1	203	2.04	1.06	4.09	0.61
DBI	2	122	3.02*	1.46	4.33	0.52
IBI	1	203	0.01	0.00	0.21	0.035
IBI	2	122	0.02*	0.00	0.21	0.036

Note: Student *t* test, $P<0.05$ (*)

Table 5 Sample distribution according to the biofilm amount found in each group (n = 325)

	Biofilm	Group 1 n (%)	Group 2 n (%)	Total n (%)
DBI	low	118 (58.1)	8 (6.6)*	126 (38.8)
DBI	high	85 (41.9)	114 (93.4)*	199 (61.2)
Total		203 (100.0)	122 (100.0)	325 (100.0)

Note: Chi-square test, $P<0.05$ (*)

Table 6 Sample distribution according to the presence or absence of interdental bleeding (n = 325)

		Group 1 n (%)	Group 2 n (%)	Total n (%)
IBI	0.00	171 (84.2)	76 (62.3)*	247 (76.0)
IBI	>0.00	32 (15.8)	46 (37.7)*	78 (24.0)
Total		203 (100.0)	122 (100.0)	325 (100.0)

Note: Chi-square test, $P<0.05$ (*)

both DBI and IBI (Figs. 1 and 2).

Data referring to the amount of biofilm presented by children in each group are shown in Table 5. Besides, the sample distribution according to the presence or absence of interdental bleeding can be verified in Table 6.

Considering the percentage of caries free children (DMFT + dmft = 0), it could be seen that in G1 this amount was of 31.0% with a mean DMFT + dmft of 2.07 (±2.87), whereas in G2 it was 21.3% with a mean DMFT + dmft of 3.03 (±2.79) ($P>0.05$). However, when the number of children with filled teeth (but with clinical absence of cavities) was considered, it was noted that, in G1, 43.3% of the children showed this condition; while in G2 only 27.9% ($P<0.05$) did.

With regard to the evaluation of socio-economical-educational indicators, it was found that the groups under study are similar. According to Table 2, no significant difference ($P>0.05$) between the groups was found concerning family income.

Discussion

The present study has compared the oral health status of schoolchildren submitted to a preventive oral program to that of schoolchildren without the support of a program. The children belonged to two different schools. Nevertheless, the similarities between the two groups can be verified by characteristics such as gender, age structure, average age in years (Table 1), as well as by the results obtained in the evaluation of socio-economical-educational indicators applied to this study (Tables 2 and 3). Therefore it was possible to conclude that the groups could in fact be compared.

The overall response rate in the questionnaire survey was 40%, but this has not compromised the findings on comparability of the groups. The mere fact that the population was restricted to two public schools promotes the belief that the groups were similar. Moreover, this response rate has been described as satisfactory by Tomita *et al.*[19)]

Few studies[20–22)] reported methodological rigor in social characterization or definition of criteria for this classification, which could render the interpretation of the findings more difficult[19)]. So, it seems that there is no standard methodology for the definition of these socio-economical-educational criteria and therefore, it was decided to consider family income and parents' schooling level as social indicators in this study.

Further considering the methodology applied to the present study, a control group from another educational institution has been chosen, in order to prevent the 'contamination effect' created by the main group's positive attitude towards the program when there is contact with the children from the control group, what could mask the findings of this study or even invalidate it. This kind of contamination has been reported in a study performed by Albandar *et al.* in 1994[6)]. To this aspect is added the fact that it can be considered anti-ethical to restrict a benefit to a certain number of children in a given institution.

The oral health indicators used in the present

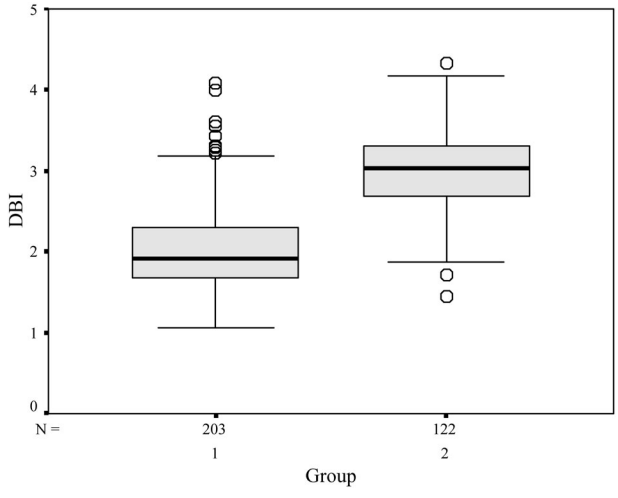

Fig. 1 Dental Biofilm Index mean in relation to the groups

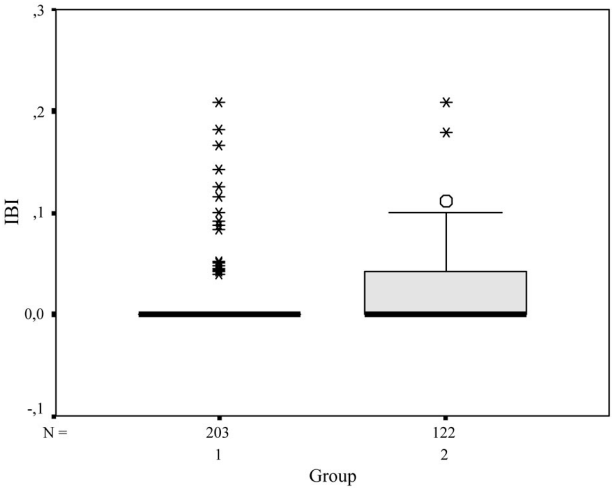

Fig. 2 Interdental Bleeding Index mean in relation to the groups

study have proved good applicability and practicity, especially within the constraints in the development of this work, defined as a cross-field study. But it cannot be denied that the DMFT index obscures precise comparisons of the relative effects of programs on dental health of schoolchildren, because while preventive treatment seeks to reduce all components of the index (the numbers of decayed, missing and filled teeth), restoration merely reduces the number of decayed and possibly missing teeth, and increases the number of filled teeth[10]. However, data from this research indicated that when the number of children with filled teeth, clinical absence of cavities and missing teeth was considered a satisfactory oral condition (D = 0, d = 0, M = 0, m = 0), the percentage of children free from these lesions, in G1, was 43.3%, whereas in G2 only 27.9% showed this condition ($P<0.05$). This finding should not be belittled, for from the moment these children had their cavities treated, and were included in a preventive program, where they received instruction on how to prevent dental caries, it was assumed that the probability of new lesions would decrease.

Considering the dental biofilm index proposed by Quigley-Hein modified by Turesky *et al.*[15]—which has been used in this study, a low amount of biofilm in the dental surface examined would get score 0 or 1. On the other hand, the surfaces with high amounts of biofilm would get score 2 or above. In this study, this was done to facilitate the understanding of the distribution of the Dental Biofilm Index in the sample, as well as to supply parameters for the high or low amounts per children.

With regard to the presence or absence of gingival bleeding in the groups under study, the results revealed that 84.2% of the G1 children and 62.3% of the G2 ones presented no gingivitis (Table 6). Thus, another aspect of the study—in which the criticism falls on one of the indexes—is the relationship between the number of children with low amounts of dental biofilm in G2 (only 8) or 6.6% of the sample (n = 122) and the low percentage of children presenting gingivitis (37.7%). It seems that the stimulation of the interdental papilla with a toothpick—as proposed by the Eastman bleeding index recommended by Caton *et al.*[14], and used in this study—even with the most inflamed tissue being located in the centre of the interproximal area, has not provided the same precision as the stimulation of gingival tissue using a probing index. However, it should be taken into consideration that the maneuver used in this study constitutes a technique easily accepted by children[14], and also that the examinations for this study were performed in the school environment, with the exclusive help of a flashlight, and without dental chairs.

Regarding the results found, it was ascertained that when comparing both groups, the one supported with the program presented lower dental biofilm and gingival bleeding means (Table 4), with a statistically significant difference ($P<0.05$). These data corroborate the ones found by Marthaler and Moss[23], Albandar *et al.*[6] and Hartono and Lambri[24]. Besides, Hartono and Lambri[24] stated that preventive programs to promote oral health are extremely important for the acquisition of adequate hygiene habits on the part of the participant individuals.

Furthermore, the mean DMFT + dmft of children from both G1 and G2 (control group) did not significantly differ, but the mean DMFT + dmft of children from the main group tended to be lower (caries free = 31.0%) than of those from the control group (caries free = 21.3%). These data are similar to the ones found by Hartono and Lambri[24]. Although the children from the control group are not included in a program, it is known that water fluoridation is present in their water supply for many years, and probably, those children had benefited from this, which perfectly explains such data.

A large number of outliers was found in G1 (Figs. 1 and 2), relative to both dental biofilm and gingival bleeding as evaluation tools. This finding clearly demonstrates that some children shall never adopt the philosophy of health promotion and maintenance fostered by programs, persisting in their usual oral hygiene standards, very similar to those found in the control group. This is the reason why a greater homogeneity in the results for G2 was verified, for this group was not given oral hygiene instruction, that is, it was not a participant in any prevention program. Contrary to this was the behavior of the main group (G1), in which, after instruction had been given, early adopters, receptive and impervious (those who shall never adopt these hygiene habits) subjects have been found.

Concerning the duration of the program, it has not been a purpose of this research to compare data from previous examinations with its own findings, for the control group was not formed in the baseline. This was done because it has been judged inadequate to limit the benefits of a program to a part of the

population, even though this part was from another institution, and, in this case, this partial population would also have to be deprived of any benefits in order to allow a dependable assessment of the program's exposition effect along its duration.

Nevertheless, the present findings indicate that a preventive program seemed to have a favorable impact on the oral health of the children submitted to it, as it has been the case in the G1 school. But the authors believe that further studies should be made, as it is extremely important to follow the long-term effect of preventive programs, in order to monitor the reach and extent of the implemented procedures on the change of behavior regarding oral health, and the real results for the risk and incidence of diseases in the studied population.

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