

# Oral Health Education Program on Dental Caries Incidence for School Children

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**Objective:** This 3-year retrospective controlled clinical trial assessed the effect of a school-based oral health education program on caries incidence in children. **Study design:** A total of 240 students, aged 5 to 7 years, from two public schools in Monte Sião, Brazil, were included in this study. A school-based oral health education program was developed in one of the schools (experimental group), including 120 students, while the 120 students from the other school did not participate in the program (control group). All children were initially examined for dental caries (dmf-t), and after 3 years, 98 children from the experimental group and 96 from the control group were again examined and answered a questionnaire on oral health issues. The between-groups difference in caries incidence on permanent teeth was calculated using Poisson regression analyses. Logistic regression was used to observe the association between caries incidence and other variables. **Results:** More students from the experimental group stated knowing what was dental caries and declared that they use dental floss daily, but no significant differences in caries incidence was observed between the experimental and control groups. **Conclusion:** The school-based oral health education program is not adequately efficient to decrease caries incidence after three years, but some issues about oral health knowledge could be slightly improved.

**Key words:** Dental caries; dental education; prevention

## INTRODUCTION

During the last few decades, caries incidence has decreased worldwide, but this decrease is mainly observed in high and middle-income countries. This was possibly due to the improvement of life conditions, greater access to fluoridated products, greater promotion of preventive programs, and advances in diagnosis and non-operative management of caries lesions.<sup>1-4</sup> Despite this decrease in incidence, dental caries still remains a public health problem in low-income countries and in disadvantaged groups,<sup>1</sup> so further programs to reduce the disease incidence should be investigated.

Dental caries is a multifactorial disease, and poor oral hygiene, frequent consumption of cariogenic foods and socio-economic aspects are among the many factors involved in the development of the disease. Nevertheless, parental advice and further knowledge on dental health could reduce the risks of caries in schoolchildren.<sup>5</sup> Parents, teachers and dentists are the most important people involved in the dental health education of schoolchildren<sup>6</sup>, so preventive programs aimed at parents, teachers and children have been proposed in order to control caries incidence and minimize the risk of lesions reaching the cavity threshold.<sup>7</sup>

Usually, dentists tend to advice parents and children mostly on sugar intake and tooth-brushing, but this often done during a single office session. Dentists also do not have plans on any future reinforcement of these advices, which could render such approach inefficient for actual prevention of dental caries.<sup>8,9</sup> Therefore, a more extensive school-based prevention program compromising parents, teachers and children could be advantageous and more effective on the children's behavior.<sup>7</sup>

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A systematic review already showed that oral health education interventions have a positive, albeit small, effect on plaque reduction, but this result was observed to be temporary, with no actual effect in reducing the caries incidence.<sup>10</sup> Likewise, another review rendered the effect of dental health education programs inconclusive.<sup>11</sup> However, more recent clinical trials have observed positive effects of some dental health education interventions in infants<sup>12</sup> and preschoolers.<sup>13</sup> Therefore, the impact of this type of program on caries incidence, as well as on the acquired knowledge about oral health in schoolchildren, still remains unclear. So, the aim of this retrospective clinical trial was to assess the effect of a school-based oral health education program on caries incidence, as well as on the children's acquired knowledge about oral health after a period of three years.

## MATERIALS AND METHOD

A retrospective non-randomized clustered controlled clinical trial was designed in order to investigate the effect of a school-based Oral Health Education Program on caries incidence and children's acquired knowledge about oral health. Approval from the local ethics committee was previously obtained for this study and the children's parents signed an informed consent form agreeing to their participation in the study. A total of 240 students, from 5 to 7 years old, from two public schools in Monte Sião, Brazil, were asked to take part in the study. Monte Sião is a countryside city in the state of Minas Gerais, Brazil, which had 18,195 inhabitants in the year 2000. The per capita income is around US\$ 311/month, infant mortality is 22.0 per 1000 live births and Human Development Index is 0.811 (slightly higher than the Brazilian average of 0.792). The city has used 0.7 mg/L of fluoride in its water supply.

The inclusion criteria were: to have no mental or physical impairment which would make them incapable of answering the questionnaire by themselves; and, the children in the experimental group had to take part in the oral health education program since the beginning.

The study was carried out in two public schools, including 120 students from each school. During the year of 2004, an oral health education program was developed in one of the public schools (experimental group), where all children studying in the school, aged 5 to 7 years, took part of the program (n=120). The program was carried out in three main steps: (1) the school dentist (R.A.J.) initially gave a lecture to the children's parents; (2) the school dentist then gave a short course to the school staff; and (3) the teachers gave a six module course to the students, based on different themes: "the importance of the mouth", "dental caries", "oral hygiene", "dietary habits", "deleterious oral habits" and "importance of visiting the dentist". Each module lasted one month, and the program was carried out during 6 months in a simple, low-cost, continuous basis.

Each module was introduced to the students by the use of a "surprise box" containing the theme. Then the students had a group discussion on the theme and during the following two weeks, a 20-minute weekly activity was carried out, either using books, or Muppet theater, or videos, or music. As a revision exercise, in the last week of the month, the students were asked to make toys from recycled materials related to the theme at hand.

The program was carried out in 2004. In the following years, the children's only source of oral health education was from their local dentist during a dental appointment.

The students (n=120) from the other school did not participate in the Oral Health Education Program (control group). Both schools were from the same area, and the students had similar socio-economic background. The schools also had daily dental treatment available for the students and the dentists provided two talks per year on oral health as part of the basic health system.

## Outcome assessment

Data on the caries experience from all children were collected at the beginning of the study. The dentist who attended the schools (R. A. J.) performed all the examinations and scored dental caries according the dmft criteria proposed by World Health Organization (WHO), which assesses decayed, indicated for extraction and filled primary teeth. The examinations were made using plane dental mirrors and WHO periodontal probes. The children were examined while seated on a dental chair, under conventional dental illumination. The presence of caries on permanent teeth was recorded, but at the beginning of the study, very few children had their first permanent molars erupted, so they had no caries lesions.

Three years after performing the oral health program, a group of 98 children from the experimental group and a group of 96 children from the control group were re-examined (positive response rate of 80.8%). Twenty one children or parents refused to participate, 12 children had moved to another school and 13 were absent on the day of the re-examination and application of the questionnaire.

The students were also asked to fill out a 15-item questionnaire, containing questions on oral health issues:

- Knowledge about dental caries: (1) Do you know what is dental caries?; (2) What do you understand as dental caries?; (3) What do you need to do in order to avoid dental caries?;
- Knowledge about fluoride use: (4) Do you use fluoridated products? How?; (5) What is the importance of fluoride?;
- Oral hygiene habits: (6) How many times do you brush your teeth?; (7) Do you use dental floss?; (8) Do you use dental floss everyday?
- Receiving of oral health instructions: (9) Did any one give you any instructions on oral hygiene or diseases in the mouth?; (10) Who?
- Visits to the dentist and preferences: (11) How many times did you go to the dentist during the last year?; (12) Do you like going to the dentist?; (13) Why do you consider brushing your teeth an important matter?; (14) Do you like to brush your teeth?; (15) Do you like to use dental floss?

The children could freely answer the questions, which were later categorized by the interviewer. The categorization is presented on the table 3.

## Statistical analyses

Baseline characteristics of the groups related to gender and positive response rate were compared with Chi-square test, whereas age and baseline dmft differences between the groups were assessed with Student's t-test and Mann-Whitney test, respectively.

Caries incidence on permanent teeth after three years (number of new lesions considered as count outcome) regarding the DMFT

values or its separate components (decayed, missing or filled teeth), adjusted for baseline dmft values, was analyzed using Poisson regression analyses with robust variance. We also calculated the difference considering the binary outcome (children with no new lesions vs. children with new caries lesions) using Poisson regression with robust variance, adjusted for baseline caries experience of children. The differences between the groups in relation to the answers to the questionnaire were calculated using Chi-square or Fischer's Exact tests.

Univariate regression and multiple logistic regression were used to analyze the association of caries incidence on permanent teeth (absence or presence of new caries lesions on permanent teeth after three years) with the demographic factors, initial dmft scores, and the answers to the questionnaire (explanatory variables). Variables with at least 20% of significance in the univariate analysis were considered in the multiple logistic regression analysis, but a 5% significance was considered to maintain the variable in the multivariable model. For all statistical analyses, the level of significance was chosen as  $p < 0.05$ .

## RESULTS

Initially, a total of 240 students entered study, and after 3 years 96 students from the control group and 98 students from the experimental group were re-examined. Differences in age, gender frequency, baseline dmft values, and positive response rate between the groups are presented in the table 1. No significant differences between the groups was observed regarding sex, age and positive response rate, but children in the control group presented significantly higher baseline dmft values than the children in the experimental group (table 1). Due to the different initial dmft scores, the latter was considered as a co-variable in the regression analysis to adjust the results of the caries incidence after three years.

**Table 1:** Baseline characteristics related to the subjects in different experimental and control groups

	Control	Experimental	Total	p
<b>Sex n (%)</b>				
Male	50 (52.1)	43 (43.9)	93 (47.8)	
Female	46 (47.9)	55 (56.1)	101 (52.1)	0.253 *
<b>Age</b>	8.49 ±	8.46 ± 0.56	8.47 ±	0.735
mean ± SD	0.68		0.62	**
<b>Baseline dmft values</b>	3.05 ±	1.34 ± 2.09	2.19 ±	< 0.001
Mean ± SD	2.82		2.62	***
<b>Positive response rate</b>	96 (80.0)	98 (81.7)	194 (80.8)	0.743 *
n (%)				

\* calculated with Chi-square test

\*\* calculated with Student's t test

\*\*\* calculated with Mann-Whitney test

After three years, the caries incidence for the control group was still higher, albeit not statistically significant, than the experimental group, considering the DMF-T value and its decayed component (table 2). No missing teeth were found in any of the groups, and similar values of filled teeth were found in both groups (table 2).

Most of the answers to the questionnaire were not statistically different between the groups (Table 3), but the experimental group had a greater number of students (34.7%) who declared using dental floss every day, while this number dropped to 18.8% in the control group ( $p=0.012$ ). Also, a greater number of students in the experimental group (87.8%) compared to the control group (70.8%) declared knowing what is dental caries ( $p=0.004$ ). This "knowledge", however, did not improve their score on other parts of the questionnaire, as no difference between the groups was observed in the answers to the other questions (table 3).

Table 4 shows the univariate analyses using caries incidence on permanent teeth associated with several independent variables: groups, sex, age, baseline dmft values, and answers to the questionnaire. The students from the control group had 60% more chance of developing new caries lesions than the experimental group (Table 4), and the children with higher baseline dmft values also had more risk of developing caries lesions on permanent teeth. The children who stated not visiting the dentist during the last year had three times as much risk of developing new caries lesions than those who stated visiting the dentist at least twice in the last year (Table 4).

The multiple logistic regression analysis (Table 5) showed that children with a high baseline dmft score or who declared not visiting the dentist in the last year presented significantly greater risk of developing new caries lesions on permanent teeth.

**Table 2:** Caries incidence on permanent teeth in children of experimental and control groups after 3 years of follow up

	Control	Experimental	p
<b>Caries incidence</b>			
Mean (SD)			
Decayed	0.34 ± 0.74	0.07 ± 0.30	0.113*
Missing	0	0	-
Filled	0.28 ± 0.72	0.28 ± 0.78	0.394*
DMF-T score	0.58 ± 0.97	0.34 ± 0.89	0.523*
Children with new lesions n (%)	32 (33.3)	16 (16.3)	0.086**

\* calculated with Wald test using Poisson regression analysis considering caries as a discrete variable, adjusted by the baseline dmft score as co-variable.

\*\* calculated with Wald test using Poisson regression analysis considering caries as dichotomous categorical variable, adjusted by the baseline dmft score as co-variable.

**Table 3:** Comparison of children's acquired knowledge about oral health between experimental and control groups

	Control N (%)	Experimental N (%)	p *
<b>1. Do you know what dental caries is?</b> Yes (ref.)	68 (70.8)	86 (87.8)	
No	28 (29.2)	12 (12.2)	0.004
<b>2. What is caries for you?</b> Answers related to the disease (ref.)	23 (24.0)	15 (15.3)	
Answers related to the cause	56 (58.3)	79 (80.6)	0.037
Do not know	17 (17.7)	04 (4.1)	0.108
<b>3. What do you need to do to avoid dental caries?</b> Correct answers (ref.)	91 (94.8)	97 (99.0)	
Incorrect answers or do not know	05 (5.2)	01 (1.0)	0.116
<b>4. Do you use fluoridated products?</b> Yes (ref.)	41 (42.7)	38 (38.8)	
Do not use or do not know	55 (57.3)	60 (61.2)	0.577
<b>5. What is the importance of fluoride?</b> To prevent and avoid caries (ref.)	22 (22.9)	21 (21.4)	
Aesthetic reasons	31 (32.3)	34 (34.7)	0.724
Do not know	43 (44.8)	43 (43.9)	0.901
<b>6. How many times do you brush your teeth?</b> Up to 3 times (ref.)	59 (61.5)	53 (54.1)	
More than 3 times	37 (38.5)	45 (45.9)	0.298
<b>7. Do you use dental floss?</b> Yes (ref.)	75 (78.1)	88 (89.8)	
No	21 (21.9)	10 (10.2)	0.027
<b>8. Do you use dental floss every day?</b> Yes (ref.)	18 (18.8)	34 (34.7)	
No	78 (81.2)	64 (65.3)	0.012
<b>9. Did any person give you any instructions on oral hygiene and diseases from mouth for you?</b> Yes (ref.)	74 (77.1)	83 (84.7)	
No	22 (22.9)	15 (15.3)	0.177
<b>10. Who gave you these explanations?</b> Parents (ref.)	20 (20.8)	22 (22.4)	
Dentist	54 (56.3)	61 (62.2)	0.941
Did not receive instructions	22 (22.9)	15 (15.3)	0.293
<b>11. How many times did you go to the dentist last year?</b> Twice or more (ref.)	55 (57.3)	58 (59.2)	
Once	23 (23.95)	13 (13.3)	0.111
Did not go or do not remember	18 (18.8)	27 (27.5)	0.324
<b>12. Do you like to go to the dentist?</b> Yes (ref.)	75 (78.1)	84 (85.7)	
No	21 (21.9)	14 (14.3)	0.169
<b>13. Why do you consider brushing your teeth an important matter?</b> Answers related to aesthetic and cleaning (ref.)	37 (38.5)	28 (28.58)	
Answers related to the disease	59 (61.5)	70 (71.42)	0.187
<b>14. Do you like to brush your teeth?</b> Yes (ref.)	93 (96.9)	93 (94.9)	
No	3 (3.1)	5 (5.1)	0.721
<b>15. Do you like to use dental floss?</b> Yes (ref.)	82 (85.4)	86 (87.7)	
No	14 (14.6)	12 (12.3)	0.633

\* calculated by Chi-square test or by Fischer's Exact test

**Table 4:** Univariate analysis of explanatory variables related to the children and acquired knowledge about oral health and caries incidence on permanent teeth

Explanatory variables	Caries incidence n (%)		OR (95% IC)	p *
	0	> 0		
<b>Group – Experimental (ref.)</b>	64 (66.7)	32 (33.3)		
Control	82 (83.7)	16 (16.3)	0.39 (0.20-0.77)	0.006
<b>Sex – Male (ref.)</b>	75 (78.9)	20 (21.1)		
Female	71 (71.7)	28 (28.3)	1.48 (0.76-2.86)	0.242
<b>Age (cont. variable)</b>	8.45 ± 0.59	8.54 ± 0.71	1.25 (0.75-2.10)	0.389
<b>Baseline dmf-t (cont. variable)</b>	1.82 ± 2.35	3.48 ± 3.17	1.25 (1.10-1.40)	<0.001
Answers to the questions**				
<b>Q1 – Yes (ref.)</b>	119 (77.3)	35 (22.7)		
No	27 (67.5)	13 (32.5)	1.64 (0.76-3.51)	0.212
<b>Q2 - Answers related to the disease (ref.)</b>	30 (78.9)	8 (21.1)		
Answers related to the cause	103 (76.3)	32 (23.7)	1.17 (0.49-2.79)	0.732
Do not know	13 (61.9)	8 (38.1)	2.31 (0.71-7.48)	0.164
<b>Q3 - Correct answers (ref.)</b>	143 (76.1)	45 (23.9)		
Incorrect answers or do not know	05 (5.2)	01 (1.0)	3.18 (0.62-16.30)	0.176
<b>Q4 - Yes (ref.)</b>	57 (72.2)	22 (27.8)		
No or do not know	89 (77.4)	26 (22.6)	0.76 (0.39-1.46)	0.408
<b>Q5 - To prevent and avoid caries (ref.)</b>	33 (76.7)	10 (23.3)		
Aesthetic reasons	49 (75.4)	16 (24.6)	1.08 (0.44-2.66)	0.871
Do not know	64 (74.4)	22 (25.6)	1.13 (0.48-2.67)	0.773
<b>Q6 - Up to 3 times (ref.)</b>	63 (76.8)	19 (23.2)		
More than 3 times	83 (74.1)	29 (25.9)	1.16 (0.60-2.25)	0.664
<b>Q7 – Yes (ref.)</b>	126 (77.3)	37 (22.7)		
No	20 (64.5)	11 (35.5)	1.87 (0.82-4.26)	0.143
<b>Q8 – Yes (ref.)</b>	43 (82.7)	9 (17.3)		
No	103 (72.5)	39 (27.5)	1.81 (0.81-4.06)	0.136
<b>Q9 – Yes (ref.)</b>	114 (72.6)	43 (27.4)		
No	32 (86.5)	5 (13.5)	0.41 (0.15-1.13)	0.064
<b>Q10 - Parents (ref.)</b>	31 (73.8)	11 (26.2)		
Dentist	83 (72.2)	32 (27.8)	1.09 (0.49-2.42)	0.839
Did not receive instructions	32 (86.5)	5 (13.5)	0.44 (0.14-1.41)	0.168
<b>Q11 - Twice or more (ref.)</b>	90 (79.6)	23 (20.4)		
Once	29 (80.6)	7 (19.4)	0.94 (0.37-2.43)	0.906
Did not go or do not remember	14 (53.8)	12 (46.2)	3.35 (1.37-8.22)	0.008
<b>Q12 – Yes (ref.)</b>	122 (76.7)	37 (23.3)		
No	24 (68.6)	11 (31.4)	1.51 (0.68-3.37)	0.321
<b>Q13 - Answers related to aesthetic and cleaning</b>	63 (74.1)	22 (25.9)		
Answers related to the disease	83 (76.1)	26 (23.9)	0.90 (0.47-1.73)	0.745
<b>Q14 – Yes (ref.)</b>	138 (74.2)	48 (25.8)		
No	8 (100.0)	0 (0.0)	-	-
<b>Q15 – Yes (ref.)</b>	127 (75.6)	41 (24.4)		
No	19 (73.1)	7 (26.9)	1.14 (0.45-2.91)	0.784

\* calculated by chi-square test; \*\* Answers and categorization described on Table 3. OR = Odds ratio; 95% CI = confidence interval

Table 5: Multiple logistic regression analysis of explanatory variables related to the children and acquired knowledge about oral health and caries incidence on permanent teeth

Explanatory variables	OR (95 % IC)	p *
<b>Baseline dmft values</b> (cont. variable)	1.23 (1.07-1.41)	0.003
Q11 - How many times did you go to the dentist last year?		
Twice or more (ref.)		
Once	0.98 (0.37-2.58)	0.970
Did not go or do not remember	3.63 (1.43-9.20)	0.007
Hosmer-Lemeshov test: p = 0.894		

**DISCUSSION**

In this retrospective controlled clinical trial, both groups were from different schools, and each school received a different preventive program: the experimental group dealt with oral health issues in a constant and consecutive program involving teachers, parents, and students during one year, while the control group had only sporadic talks given by dentists as part of the public Family Health Program supported by the Ministry of Health in Brazil. Therefore, it served as a control to compare the Oral Health Education Program proposed in this study.

The students in both groups had similar age and gender distribution. Furthermore, both schools were public, so the socioeconomic background of all students was similar.<sup>14</sup> The children, however, had different baseline dmft scores. This difference was taken into account in all data analyses. The regression analysis considering the caries incidence after 3 years showed no differences between the control and experimental groups, which suggests that the program, by itself, did not reach the expected effectiveness in promoting oral health. In fact, higher caries incidence was more related to baseline caries experience than the preventive program employed. Previous caries experience consistently has shown a significant association with dental caries incidence.<sup>15</sup>

The school-based oral health preventive program proposed in the present study could have had an impact on the number of visits to the dentist. Although not statistically significant, a greater number of students from the experimental group related visiting the dentist at least twice in the last year. Also, the students who did not visit the dentist in the last year had three times higher risk of developing new caries lesions than those who had visited the dentist twice in the same period. Therefore, previous visits to the dentist are a protective factor against caries occurrence.<sup>16, 17</sup> In fact, regular visits to a dentist could also be associated with several favorable issues, such as general concern about health, increased knowledge on oral health<sup>18</sup> or even higher socio-economic status.<sup>19</sup>

Previous studies have shown that some educational programs have promoted a reduction on the caries index, possibly due to an enhanced awareness on oral health topics.<sup>12, 13, 20-22</sup> Other evidences, however, show a small positive, albeit temporary effect of educational interventions on dental health, mostly related to plaque reduction and improving knowledge in oral health.<sup>10</sup> In any case, it has been suggested that the participation of the whole family is a

fundamental factor for the success of these educational programs.<sup>23</sup> In the present study, the program focused on students, as well as their teachers and parents, but still we did not observe any differences in the caries incidence between the groups. One should bear in mind that the talk to the parents took place at the start of the program, and such information was only given on one occasion, which may not have been sufficient to reflect on the children’s knowledge on oral health issues. On the other hand, the annual talks the school dentists gave to both groups could also play a role on the knowledge of the control group, thus allowing similar findings between the groups. This can be particularly observed in the answers to the questions about what to do in order to avoid caries (question 3), the number of daily hygiene instances (question 6), and the children’s knowledge on fluoride (questions 4 and 5).<sup>24</sup>

The lack of statistical difference in the caries incidence scores after three years may have been due to the similarities on the children’s knowledge in both groups. This lack of preventive effect of oral health education has also been observed in systematic reviews.<sup>10, 11</sup> It seems that most programs about oral health education do not have long-term efficacy.<sup>10</sup> Still, it has been suggested that continuous one-to-one counseling sessions, in a motivational interviewing system towards parents, may increase the family awareness and knowledge on oral health.<sup>10, 25, 26</sup> One must bare in mind that it is not the fact that one has an increased awareness or knowledge on oral health issues, that one will convert this knowledge into preventive action.<sup>27</sup> If any, this process is slow and gradual. But positive effects of oral health education programs on caries prevention have been observed on two clinical trials,<sup>12, 13</sup> although prevention in children cannot rely only on information given to parents and caretakers.<sup>28, 29</sup>

Since dental caries is multi-factorial, one important aspect that educational programs could emphasize is dietary counseling. Frequent ingestion of sugary food and soft drinks is related to dental caries<sup>30, 31</sup> and nutritional counseling carried out either at home<sup>32</sup> or in a dental care office<sup>33</sup> has presented long-term positive effects on caries reduction. Still, despite having included issues on dietary habits in our oral health education program, we observed no differences between the groups. But we also did not include questions on dietary habits in the questionnaire to assess the students’ knowledge on this topic. So, further studies emphasizing dietary counseling in similar school-based educational programs should be conducted.

The findings obtained in the present study should be interpreted within some limitations. Firstly, the baseline caries assessment was performed by different dentists in the experimental and control groups, who received no training and calibration procedures. This fact occurred due to the retrospective nature of the study, but the dental caries assessments were made according to the WHO criteria, which has presented acceptable reliability values.<sup>34, 35</sup> However, the lack of training between the examiners could still introduce a bias to the study. Another problem is concern to the lack of randomization of the sample. As the program was offered to all students in the classroom, randomization based on individual would be very difficult, but randomization performed based on classroom could improve the internal validity of the study. Another point is related to the retrospective characteristic of the study, where we rely on the children’s memory after a period of 3 years. So, despite the interesting findings obtained in the present study, a prospective clustered randomized (based on classrooms)

controlled clinical trial employing this oral health education program and including questions about behavioral changes and dietary habits should be conducted to corroborate our results.

## CONCLUSION

The School-based Oral Health Education Program is not efficient in decreasing the caries incidence of children after a 3-year period.

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