ORIGINAL ARTICLE

Toothbrushing Frequency and Maternal Schooling Associated with Caries in Primary Dentition in 6- and 7-year-old Children

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ABSTRACT

Objective: *To determine the experience, prevalence and severity of caries in primary dentition and associated factors in 6- and 7-year-old schoolchildren.*

Methods: *A cross-sectional study of 247 schoolchildren aged 6 and 7 years in Campeche, Mexico. Demographic and socio-economic information and oral hygiene practices and attitudes variables were collected through questionnaires directed to the mothers of the children. Dental caries were detected using the World Health Organization criteria. Caries experience (decayed, missing and filled teeth [dmft] average), prevalence (dmft > 0) and severity (dmft > 3 and dmft > 6) were determined and analysed using non-parametric tests.*

Results: *For our sample, 52.2% were boys and 51.8% were 7 years old. The overall average dmft was 1.76 ± 2.46. The prevalence (dmft > 0) of caries was 50.2%, whereas the caries severities were (dmft > 3) 21.5% and (dmft > 6) 6.1%. As the mother's education level increased, the average dmft and caries prevalence decreased (*$p < 0.05$*). When the brushing frequency was lower than brushing once daily, the experience and severity of caries increased (*$p < 0.05$*). Surprisingly, we found that when the mother had a positive attitude towards the child's oral health, the prevalence and experience of caries increased (*$p < 0.05$*).*

Conclusion: *One in two children had dental caries. Oral hygiene practices were associated with dental caries. Certain inequalities in oral health were observed.*

Keywords: Decayed, missing, and filled teeth, dental caries, Mexico, oral health, schoolchildren

INTRODUCTION

Dental caries represent a continuum of disease states that increase in severity and tooth destruction, ranging from subclinical/subsurface changes at the molecular level to lesions affecting dentin and pulp, either with an intact surface or a clear cavitation. Caries occur when the mineral loss, which is caused by acid bacteria biofilm that covers the surfaces of the teeth, is faster than the remineralization process. The disease is initially reversible and can be stopped at any stage, even when some dentin or enamel (cavitation) is destroyed, provided that sufficient biofilm can be removed (1, 2). Tooth decay is a chronic disease that progresses slowly in most people. According to the 'Global Burden of Disease 2010' study, untreated tooth decay in primary teeth is the tenth-most prevalent condition and affects about 9% of the global population (3). In Mexico, epidemiological evidence suggests that dental caries is the main problem of dental public health in different population groups (4, 5), and highly prevalent in primary dentition: in children 6 years of age, the prevalence of dental caries is between 55% and 70% (6). According to the First National Survey of Caries, the average number of decayed, missing and filled teeth (dmft) at 6 years of age is 2.52 and 2.63 at 7 years of age (7).

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Some components of the caries process act on the tooth surface, while another set of determining factors of the process act at the level of the individual. The appearance of dental caries depends on a combination of biological and social factors, such as dental anatomy, enamel defects, low birth weight, a diet rich in sugars, plaque and bacteria present in saliva, and previous disease, as well as socio-economic status, area of residence, education level of parents, occupation, housing characteristics, income, general and health education of the family, and dental care (8–10). Researchers believe that determining the risk indicators of this disease could be considered the first step in the design and implementation of preventive oral health strategies. To allow for effective prevention, researchers must develop efficient ways to identify children and adolescents at high risk of developing dental caries (9).

The aim of this study was to determine the experience, prevalence and severity of dental caries in primary dentition and factors associated with dental caries in 6- and 7-year-old schoolchildren.

SUBJECTS AND METHODS

A cross-sectional study where several oral health indicators were collected in schoolchildren from the city of Campeche, Mexico was conducted. Part of the methodology was published in reports on factors associated with toothbrushing (11) and dental caries on permanent dentition (12). First, of a total of 30 public schools located in an urban region, three were selected randomly. To achieve the objective of this analysis, 6- and 7-year-old children were included. After applying the inclusion criteria (children of 6 or 7 years of age, both sexes, who were enrolled in a selected school and the mother/guardian had signed the letter of informed consent) and exclusion criteria (children who refused to be examined clinically and those who had some disease or defect affecting the oral cavity), the final sample consisted of 247 children.

OUTCOME VARIABLE

In this study, the epidemiological index proposed by the World Health Organization for studies on dental caries in primary teeth was calculated (13); called the dmft index, it refers to the average number of decayed, extracted/suitable for extraction, and filled teeth (dmft) in the sample with primary teeth. The dmft index is obtained by the formula:

$$dmft = \frac{\Sigma \text{ decayed tooth} + \text{missing tooth} + \text{filled tooth}}{\textit{All sample in the study}}.$$

With the variable ‘dmft index’, several cut-offs were established as dependent variables. Therefore, the following were calculated: (a) *caries experience*: it refers to the global average of the dmft index; (b) *caries prevalence*: it refers to the percentage of subjects with at least one tooth with past or present caries and was coded as 0 = if dmft equalled 0, and 1 = if dmft> 0; (c) *low severity of caries in the primary dentition*: it was coded as 0 = if dmft ≤ 3 and 1 = if dmft > 3 and (d) *high severity of caries in the primary dentition*: it was coded as 0 = if dmft ≤ 6 and 1 = if dmft > 6.

Independent variables

The independent variables included in the study were of various types (demographic, socio-economic and behavioural) and collected using a structured questionnaire; this was addressed to the mothers/guardians of the students and delivered through the schools and picked up by the same route. For this analysis, the variables were age (6 and 7 years), sex (0 = boys, 1 = girls), frequency of toothbrushing (0 = daily, at least 1 time/day, 0 = less than once a day), time when toothpaste use started (0 = after 2 years, 1 = before 2 years), maternal education (from 0 to 22 years) and the attitude of the mother towards the oral health of her child (0 = positive, 1 = negative). The mother’s attitude was summarized as positive (score 1) if she answered ‘yes’ to both of the following questions: 1. Do you consider it important that your child keeps his/her primary teeth in good condition? 2. Have you ever examined his/her teeth to ascertain if they are healthy? The mother’s attitude was summarized as negative (score 0) if she answered ‘no’ to either of the two questions (14–21).

Clinical examinations

Dental examinations were performed by four previously trained and standardized examiners using the criteria used by a researcher with experience in oral epidemiological studies (kappa > 0.90). Before clinical examinations, children’s teeth were not brushed; however, when the plaque hindered visibility, teeth were cleaned with sterile gauze. Exams were performed using dental flat mirrors and probes under natural light, in appropriate places in schools. X-rays were not used.

Data analysis

An exploratory analysis was performed to describe the sample and evaluate information. The variables were analysed according to their scale of measurement, and the measures of central tendency and dispersion for

quantitative variables and frequencies and percentages for qualitative variables are reported. Bivariate analysis was performed using the Chi-square and Mann–Whitney tests. Statistical significance was taken at $p < 0.05$. The statistical package used for analysis was Stata 11.0 (Stata Corp, LLC, College Station, TX, USA).

Ethics statement

This study met the specifications of protection for research participants and adhered to the ethical regulations in force in the Autonomous University of Campeche, Mexico, and the scientific principles of the Declaration of Helsinki. The children's mothers were contacted and informed in a letter on the design and work plan; if they accepted and took part in the study, a signed letter of informed consent was required.

RESULTS

Table 1 presents the descriptive results of the study. Of the 247 students, 52.2% were boys and 51.8% were 7 years old. The majority (84.6%) reported brushing their teeth at least once a day. In total, 71.3% of students start using toothpaste after 2 years. The average mothers' schooling was 10.06 ± 4.40 years and 64.8% had a positive attitude towards the oral health of her child. The dmft index was 2.46 ± 1.76. The caries prevalence (dmft > 0) was 50.2%, while the severities were (dmft > 3) 21.5% and (dmft > 6) 6.1%.

Table 1. Characteristics of schoolchildren aged 6 and 7 years enrolled in the study

Variables	Mean ± SD	Min-Max
Mother's schooling	10.06 ± 4.40	0–22
	n	**Percentage**
Age		
6 years	119	48.2
7 years	128	51.8
Sex		
Boys	129	52.2
Girls	118	47.8
Tooth brushing frequency		
At least once a day	209	84.6
Fewer than once a day	38	15.4
Start of toothpaste use		
After 2 years	176	71.3
Before 2 years	71	28.7
Mother's attitude to child's oral health		
Positive	160	64.8
Negative	87	35.2

The results of the bivariate analysis are shown in Table 2. Applying the Spearman correlation test, we note that when maternal education increases, the dmft mean decreases ($r = -0.1311$; $p = 0.0395$). Similarly, to evaluate the prevalence of caries in the Mann–Whitney test, the mother's schooling was lower among children with caries (10.69 *vs* 9.43) than among those who did not have caries ($z = 2.238$; $p = 0.0253$). When brushing frequency was less than once a day, caries experience was higher (2.58 ± 2.93 *vs* 1.62 ± 2.35; $p = 0.0415$; Mann–Whitney test) than those who brushed more frequently.

Table 2. Bivariate analysis of caries on primary dentition

Variables	dmft	dmft > 0	dmft > 3	dmft > 6
Mother's schooling	1.76 ± 2.46*	124 (50.2)*	53 (21.5)	6.1
Age				
6 years	1.92 ± 2.62	62 (52.1)	30 (25.2)	10 (8.4)
7 years	1.63 ± 2.32	62 (48.4)	23 (18.0)	5 (3.9)
Sex				
Boys	1.57 ± 2.12	68 (52.7)	23 (17.8)	3 (2.3)
Girls	1.98 ± 2.78	56 (47.5)	30 (25.4)	12 (10.2)
Tooth brushing frequency				
At least once a day	1.62 ± 2.35*	100 (47.9)	39 (18.7)	11 (5.3)
Fewer than once a day	2.58 ± 2.93	24 (63.2)†	14 (36.8)*	4 (10.5)
Start of toothpaste use				
After 2 years	1.88 ± 2.42	94 (53.4)	42 (23.9)	10 (5.7)
Before 2 years	1.49 ± 2.57†	30 (42.3)	11 (15.5)	5 (7.0)
Mother's attitude to child's oral health				
Positive	2.03 ± 2.57*	89 (55.6)*	40 (25.0)	11 (6.9)
Negative	1.28 ± 2.19	35 (40.2)	13 (14.9)	4 (4.6)

*$p < 0.05$, †$p < 0.10$.

Similarly, the severity of caries (dmft > 3) was higher in the group that brushed their teeth less frequently (36.8% *vs* 18.7%; $p = 0.012$, Chi-square test) than among those who did so more frequently. Surprisingly, we found that the positive mother's attitude towards the oral health of her child increased caries experience (positive = 2.03 ± 2.57 *vs* negative = 2.19 ± 1.28, Mann–Whitney test: $p = 0.0103$) and prevalence (positive = 55.6% *vs* negative = 40.2%, Chi-square: $p = 0.021$).

DISCUSSION

In Mexico, data on dental caries in the primary dentition are relatively rare. In this work, dental caries proved to be a public health problem, noting that one of every two children had the disease. We also note that tooth-brushing and maternal schooling modify the experience, prevalence and severity of caries. On the other hand, surprisingly, the positive attitude of mothers towards the

oral health of children raised the prevalence and experience of caries. The prevalence of dental caries that we observed (50.2%) was lower than the figures reported in other Mexican studies, where the percentages were between 55% and 70% (6). Similarly, the overall dmft mean (1.76) in this study (1.92–6 years) was lower than that observed in the first National Survey of Caries, where the mean dmft for children of 6 years of age was 2.52 (7), in San Luis Potosi (2.62) (6) and in Campeche (2.62) (22). When compared to some international works, the results were lower than those reported in studies conducted in China, where there was a dmft of 4.5 and a prevalence around 80% (23). In the United Arab Emirates, figures also show the average dmft in children 4–6 years old is between 5.1 and 8.4, while the prevalence is 78%–95% (24). In Latin America, Nicaragua has average caries experiences rates of up to 3.54 teeth and a prevalence of more than 70% (19).

Regarding oral hygiene, whether measured by the presence of plaque or using self-reported toothbrushing frequency, numerous studies confirm that this is a significant risk factor in the development of dental caries. Systematic toothbrushing can suppress bacterial activity in dental plaque and stop the development of the initial injury, so toothbrushing is considered one of the more cost-effective measures for the prevention of tooth decay and tooth loss in primary dentition (11, 14, 15, 18–20, 22, 25, 26).

There is ample evidence suggesting that position within the social structure is a strong predictor of both morbidity and mortality. In addition, there is a known association between health and social status—individuals with higher socio-economic levels enjoy better health than those of lower socio-economic levels; this is known as the ‘social gradient in health’, which refers to inequalities in the distribution of health statuses of the population that are related to inequalities in social status (27, 28). Although this association is not entirely understood, the results are similar in dentistry (29). However, although several studies have included different socio-economic indicators, these factors consistently behave as risk factors for dental caries (14, 22), which concurs with the results of our study.

Surprisingly, schoolchildren who had a mother with a positive attitude towards her child’s oral health had higher levels of caries in our study; other authors found no significant effect on primary teething (20) or permanent dentition (19), but many studies have shown the opposite, in Mexico and elsewhere (15–18, 21, 30). For example, among mothers with negative attitudes, their children have decreased toothbrushing frequency (15, 18), decreased use of oral health services (16, 17) and higher level of caries in primary dentition (14, 21). For this association, we do not have a scientifically coherent explanation; however, we could say that it can be attributed to certain biases that were present when the questionnaire data were collected.

This study has some limitations that must be taken into account when the results are interpreted. First, its cross-sectional design does not establish causal relationships but rather statistical associations. On the other hand, the use of questionnaires, although it is a valid way to collect epidemiological data, could introduce some form of information bias, since mothers may lie.

CONCLUSION

We note that one of every two children in our group in Campeche, Mexico presents with dental caries. This makes it a serious public health problem with implications regarding treatment costs for the Health System and homes in Mexico, and from the suffering and pain of the schoolchildren who have the disease. Poor oral hygiene practices were negatively associated with dental caries. Conversely, children that brushed more frequently had better dental health. Differences in the levels of decay were associated with maternal schooling, suggesting the existence of certain inequalities in oral health. Finally, and for the first time, it is reported that the children of mothers with positive attitudes towards oral health had higher numbers of caries, which must be clarified in further studies. It is necessary that prevention activities are conducted in schools to improve oral health.

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