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ORIGINAL ARTICLE

Daily Toothbrushing Frequency and the Association with Parental Report of Dental Pain and Discomfort in Preschool Children

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ABSTRACT

Objective: To evaluate the impact of daily toothbrushing frequency on parental reports of dental pain and discomfort in preschoolers. **Material and Methods:** An observational cross-sectional study was conducted involving 376 children between four and five years of age at public preschools in the city of Campo Magro, Brazil. Parents/guardians answered a socioeconomic questionnaire that contained a single question on the child's daily toothbrushing frequency and the Brazilian version of the Dental Discomfort Questionnaire (DDQ-B). Statistical analysis involved bivariate and multivariate Poisson regression analyses (α=0.05). **Results:** After the adjustments in the multivariate analysis, the prevalence of dental pain and discomfort was lower among children whose last visit to the dentist was for prevention (PR = 4.42; 95% CI: 1.75–11.14; p=0.002) and those with a higher daily toothbrushing frequency (PR = 2.13; 95% CI: 1.12–4.05; p=0.021). **Conclusion:** A lower toothbrushing frequency is associated with parental reports of dental pain and discomfort in preschoolers. Educational and preventive measures that stimulate an increase in daily toothbrushing frequency can contribute to a better oral health status in preschoolers, consequently, less prevalence of dental pain and discomfort.

Keywords: Toothache; Pain Perception; Pediatric Dentistry.

Introduction

Dental caries is the most prevalent oral disease in childhood [1] and can cause pain, discomfort [2], sleeping problems, limited chewing function, nutritional problems, and school absenteeism, exerting a negative impact on the quality of life of children and the routine of their families [3,4]. Moreover, dental pain and discomfort are the main reasons why children visit a dentist, often for urgent care [5].

Factors, such as the frequency of the intake of cariogenic foods and toothbrushing frequency [6], are part of the complex etiology of dental caries [7,8], which underscores the importance of the family environment in establishing positive oral health-related behaviors in children [9]. Therefore, when included in the day-to-day activities of the family, oral hygiene habits, such as adequate daily toothbrushing, are fundamental to a child's development of future positive health behavior and to prevent the emergence of caries, which can lead to pain and discomfort [10], as a lower toothbrushing frequency is associated with higher caries experience and, consequently, situations involving dental pain [11-13].

The quantification of experiences of dental pain in children can be performed in different ways, such as parental reports [14,15] and self-reports [16,17]. However, in preschool children (up to five years of age), self-reports may not be reliable due to the lower cognitive level. Therefore, the Dental Discomfort Questionnaire (DDQ) was developed (which has a translated and validated version in Brazilian Portuguese (DDQ-B) [18] to be filled out by parents/guardians for the assessment of pain and discomfort of a dental origin in children between two to five years of age [19].

The present study tested the hypothesis that a higher daily toothbrushing frequency is constantly associated with a lower frequency of parental reports of dental pain and discomfort. For such, a valid observational instrument (DDQ-B) was used to identify the first signs of pain and discomfort associated with dental caries and its clinical consequences. This instrument is considered more sensitive than parental reports involving a single question, which was previously considered the "gold standard" for this evaluation, justifying the present investigation.

Material and Methods

Ethical Considerations

This study was conducted in accordance with the precepts stipulated in the Declaration of Helsinki and received approval from the Human Ethics Committee of the Federal University of Parana (certificate number: 1.421.479) as well as authorization from the Department of Education of the Municipality of Campo Magro, Brazil. Furthermore, the study was reported following the guidelines of the STROBE statement.

Eligibility Criteria and Characteristics of Sample

A cross-sectional study was conducted with 4-5 years preschoolers whose participation was authorized by a parent/guardian by signing a statement of informed consent. All participants were enrolled in public schools in the city of Campo Magro, Brazil. Children with intellectual deficits, systemic conditions, or any other condition that could impede the execution of the clinical dental examination were excluded from the study.

Campo Magro has a population of 24,843 residents and a Human Development Index of 0.701, which is slightly below the Brazilian average (0.755). Its economy is based primarily on family farming and tourism activities [20].

The sample size was estimated, considering the prevalence of dental pain and discomfort to be 50%. A power of 97.5% with the precision of 5%, a confidence interval of 95% and a limit value of the rejection area of 1.96 were also considered. The sample was increased by 20% to cover non-responses and possible losses. A representative sample size was estimated to be between 384 and 460 participants.

By the time data was collected, the city of Campo Magro had 460 children between four and five years of age enrolled in the public school system. Thus, a census study was conducted due to the similarity of the results. Children from all ten preschools within the city public school system were included.

Pilot Study

The assessment measures were tested in a pilot study with 25 randomly selected preschoolers, according to the eligibility criteria, to verify the viability of the study design in the population. The parents/guardians answered a socioeconomic questionnaire developed specifically for this study and the Brazilian version of the Dental Discomfort Questionnaire (DDQ-B). The results demonstrated that the proposed methods were feasible. Children who participated in the pilot study were excluded from the main study.

Dental Discomfort Questionnaire (DDQ-B)

The version of the DDQ translated and validated for Brazilian Portuguese (DDQ-B) is composed of seven questions addressing parental perceptions of behaviors related to dental pain or discomfort, specifically with children five years old or younger. The possible answers are "never" (0), "sometimes" (1), and "always" (2). The final score of the instrument ranges from 0 to 14, with higher scores indicating a greater frequency of behaviors related to pain or discomfort of a dental origin [21]. Moreover, a cutoff score of 5 indicates that the child may require more invasive clinical procedures, such as root canal therapy or tooth extraction [22].

Socioeconomic characteristics were obtained through a structured questionnaire addressing monthly family income, schooling of the parents/guardians, family structure, the child's access to dental services, perception of parent/guardian regarding the child's oral health, and the reason for the child's last visit to the dentist (prevention: yes or no).

Child's daily toothbrushing frequency was recorded based on the answer to the following question: “How many times per day does your child brush his/her teeth?”. The response was dichotomized as "none or once" and "two or more".

The DDQ-B and the socioeconomic questionnaire were sent to be answered by the parents/guardians of the children who had signed the statement of informed consent and whose children met the inclusion criteria.

Statistical Analysis

The data were collected and analyzed with the aid of the Social Package for Social Sciences®, version 20.0 (SPSS Inc., Chicago, IL, USA) and STATA program (StataCorp Inc.).

The dependent variable was the parental report of dental pain or discomfort measured using the DDQ-B scores indicating the need for more invasive clinical procedures [22] and dichotomized as < 5 or ≥ 5 [21]. The independent variables were categorized as follows: sex (female or male), family structure (nuclear or non-nuclear), family income (≤ the Brazilian monthly minimum wage [BMMW] or > the BMMW, corresponding to US$280 by the time data were collected), parent's or guardian's schooling (≤ eight years or >

eight years of study), child's access to dental service (yes or no), reason for the last visit to a dentist (prevention [yes or no]), parent's/guardian's perception of child's oral health (good or fair/poor), and toothbrushing frequency (none/once or two/more times). Associations between the independent variables and dependent variable were tested using bivariate regression analysis. Independent variables with a p-value < 0.20 in the bivariate analysis were incorporated into the multivariate analysis, with the calculation of prevalence ratios (PR) and 95% confidence intervals (CI). The variables with a p-value < 0.05 after the adjustments in the multivariate analysis were considered significantly associated with the outcome and were maintained in the final model.

Results

A total of 460 children were potentially eligible for the study, and 378 parents/guardians signed the informed consent statement (response rate: 81.96%). Unfortunately, two children were absent on the days scheduled for the clinical examinations. Thus, the final sample was composed of 376 preschoolers [2].

The mean age of the children was 60.6 ± 5.72 months (range: 48 to 71 months) and the sample was evenly distributed between girls and boys (50% each). Most questionnaires were answered by mothers (n = 334; 90.3%) and 28.7% of the children had a non-nuclear family (n = 106). The prevalence of pain or discomfort of dental origin determined using the DDQ-B (DDQ-B scores>0) was 70.3% (n = 260). The mean and median DDQ-B scores were 1.91 ± 2.11 and 1.00 (variance: 4.45), respectively, with a minimum and maximum of 0 and 14 points. Considering the cutoff point indicative of children requiring dental care for more invasive procedures (DDQ-B≥ 5 points), the prevalence was 13.0% (n = 48). Most parents/guardians reported that their children had their teeth brushed more than twice per day. Table 1 shows the frequency distribution and mean DDB-Q score according to the independent variables.

Table 1. Distribution of frequency and mean DDQ-B scores according to the independent variables.

Variables	Categories	N (%)
Sex	Female	188 (50.0)
	Male	188 (50.0)
Family Structure	Nuclear	263 (71.3)
	Non-nuclear	106 (28.7)
Monthly Family Income	≤ 1 Minimum Wage	308 (83.2)
	> 1 Minimum Wage	62 (16.8)
Schooling of the Parents/Guardians	≤ 8 Years	319 (86.7)
	> 8 Years	49 (3.3)
Child's Access to Dental Services	Yes	205 (56.2)
	No	160 (43.8)
Reason for the Child's Last Visit to the Dentist (Prevention)	Yes	103 (50.5)
	No	101 (49.5)
Perception of Parents/Guardian Regarding Child's Oral Health	Good	173 (50.7)
	Reasonable or Bad	68 (49.3)
Child's Daily Toothbrushing Frequency	None or Once	56 (15.5)
	Two or More	306 (84.5)

Table 2 shows the results of the bivariate analysis. The prevalence of parental report of dental pain and discomfort was 5.2-fold higher among children whose last dental appointment was not due to preventive procedures, 4.16-fold higher among those whose parents considered their children's oral health to be fair or poor, and 2.42-fold higher among those who brushed their teeth less than twice per day.

Table 2. Univariate analysis of the association between dental pain and discomfort (DDQ-B scores) and the independent variables.

Variables		DDQ-B scores			PR[c] (95% CI)	p-value
		<5 N (%)	≥ 5 N (%)	Total N (%)		
Sex	Female	165 (88.7)	21 (11.3)	186 (100.0)	1	0.335
	Male	157 (85.3)	27 (14.7)	184 (100.0)	1.30 (0.76–2.21)	
Family Structure	Nuclear	231 (88.5)	30 (11.5)	261 (100.0)	1	0.156
	Non-nuclear	88 (83.0)	18 (17.0)	106 (100.0)	1.47 (0.86–2.53)	
Monthly Family Income	≤ 1 MW	267 (86.7)	41 (13.3)	308 (100.0)	1	0.668
	> 1 MW	55 (88.7)	7 (11.3)	62 (100.0)	1.17 (0.55–2.50)	
Schooling of the Parents/Guardians	≤ 8 Years	103 (82.4)	22 (17.6)	125 (100.0)	1	0.051
	> 8 Years	216 (89.6)	25 (10.4)	241 (100.0)	1.69 (0.99–2.88)	
Child's Access to Dental Services	Yes	173 (85.2)	30 (14.8)	203 (100.0)	1	0.179
	No	144 (90.0)	16 (10.0)	160 (100.0)	0.67 (0.38–1.19)	
Reason for the Child's Last Visit to the Dentist	Yes	98 (95.1)	5 (4.9)	103 (100.0)	1	<0.001*
	No	74 (74.7)	25 (25.3)	99 (100.0)	5.20 (2.07–13.04)	
Perception of Parents/Guardian Regarding Child's Oral Health	Good	165 (95.4)	8 (4.6)	173 (100.0)	1	<0.001*
	Reasonable/Bad	273 (89.5)	32 (10.5)	166 (100.0)	4.16 (1.97–8.78)	
Child's Daily Toothbrushing Frequency	None or Once	41 (74.5)	14 (25.5)	55 (100.0)	1	0.002*
	Two or More	100 (32.8)	205 (67.2)	305 (100.0)	2.42 (1.38–4.24)	

Note: PR[b] (Crude Prevalence Ratio); MW: Minimum Wage; *Highlighted values represent statistical significance.

Table 3 displays the results of the multivariate analysis. A lower toothbrushing periodicity remained significantly associated with reports of dental pain and discomfort independently of the parent's/guardian's schooling and the reason for the last dental visit.

Table 3. Multiple Poisson Regression Model: Association between dental pain and discomfort (DDQ-B scores) and study characteristics.

Variables	Categories	DDQ-B scores			PR[c] (95% CI)	p-value	PR[a] (95% CI)	p-value
		<5 N (%)	≥ 5 N (%)	Total N (%)				
Schooling of the Parents/Guardians	≤ 8 Years	103 (82.4)	22 (17.6)	125 (100.0)	1	0.051	1	0.069
	> 8 Years	216 (89.6)	25 (10.4)	241 (100.0)	1.69 (0.99–2.88)		1.80 (0.95–3.41)	
Reason for the Child's Last Visit to the Dentist (Prevention)	Yes	98 (95.1)	5 (4.9)	103 (100.0)	1	<0.001	1	0.002*
	No	74 (74.7)	25 (25.3)	99 (100.0)	5.20 (2.07–13.04)		4.42 (1.75–11.14)	
Child's Daily Toothbrushing Frequency	None or Once	41 (74.5)	14 (25.5)	55 (100.0)	1	0.002	1	0.021*
	Two or More	100 (32.8)	205 (67.2)	305 (100.0)	2.42 (1.38–4.24)		2.13 (1.12–4.05)	

PR[b](Crude Prevalence ratio); PR[a](Adjusted Prevalence ratio); *Highlighted values represent statistical significance.

Discussion

The main finding of the present study was that a lower toothbrushing frequency is associated with DDQ-B scores equal or higher than five, indicating the need for more invasive clinical procedures, such as pulp therapy or extraction.

Kumar et al. [11] reported that a lower toothbrushing frequency leads to a substantially greater risk of the emergence of new caries lesions in the primary dentition when compared to the permanent dentition. Daily Toothbrushing can exert an impact on dental pain and discomfort, as caries is diet/biofilm dependent [23]. Once adhered to the tooth surface, cariogenic biofilm increases the probability of demineralization of the tooth enamel and the onset of the carious process. In more advanced situations, the carious process reaches the dentin-pulp complex, which can cause pain symptoms in children.

Children with dental pain or discomfort experience greater limitations regarding daily activities compared to those with no reports of pain/discomfort. Moreover, the occurrence of dental pain/discomfort impacts the family routine [5,24]. Studies that used the same assessment tool for this outcome also found an association between higher scores and the prevalence/severity of dental caries [2,25,26].

The decision of parents/guardians regarding the period of oral hygiene of their preschool children is influenced by different factors, such as the parent's/guardian's work schedule, child's study schedule, number of children in the home, daily activities performed in the morning and evening, personal disposition, and personal stress [8,24]. Previous studies have reported a lower frequency of dental caries among children who brush at least twice per day with fluoride toothpaste than those who brush only once per day or not at all [27-29].

In the present study, information on the children's daily toothbrushing was obtained from a question included in the socioeconomic questionnaire, which could be considered a limitation. However, this report was obtained from the mother or main caregiver, who is closest to the child's routine, which minimizes this bias.

The prevalence of dental pain and discomfort was measured using the DDQ-B and considering the cutoff point of ≥ 5 points, which indicates the need for more invasive clinical procedures, such as pulp therapy and extraction [22]. The prevalence of dental pain varies depending on how this outcome is measured. Several studies report higher rates for preschoolers and schoolchildren, ranging from 20 to 40% [14,15,17,30,31]. The studies cited evaluated the prevalence of dental pain based on a single question directed to parents/guardians, such as "Has your child had a toothache in the last two months?" or " Has your child had a toothache in the last six months?" Thus, parents and guardians may underestimate the occurrence or confuse pain of a dental origin with pain of other origins, which may explain the different prevalence values reported. In the present investigation, we used the Brazilian version of the Dental Discomfort Questionnaire (DDQ-B), a validated observational instrument that addresses behaviors related to dental pain or discomfort. So, the parental report is not based exclusively on parents' perceptions but also on the identification of specific behavior manifested by children that may be associated with dental pain and discomfort.

The characteristics of the families of children with reports of dental pain and discomfort were residence in a region with low socioeconomic status, a non-nuclear family, and parents/guardians with a low level of schooling. As the literature reports associations between the oral health status of children and both socioeconomic characteristics and family structure [14,16], the present findings can be extrapolated to populations of preschool children with similar socioeconomic characteristics.

One of the strengths of the present study was the use of a validated instrument that is more sensitive than a simple question to parents/guardians regarding the occurrence of toothache, as the DDQ-B, able to identify behaviors that may be related to dental pain, such as the difficulty of sleeping or chewing. The

identification of such behaviors can indicate the presence of early clinical signs of caries lesions in a stage when educational and preventive procedures can still be effective in arresting these lesions, preventing the child from going to the dentist for more invasive interventions, such as pulp therapy or extraction.

The major limitation of this study regards the cross-sectional design, which does not enable establishing cause-and-effect relations. However, the present results can contribute to educational and prevention measures directed at encouraging adequate oral hygiene on the public level (schools and healthcare units), in the family setting through counseling for parents/guardians, and in private dental offices through educational and prevention strategies incorporated into the pediatric dental treatment plan.

Conclusion

The school environment is a setting where children are more receptive to health education actions. Therefore, strategies can be developed to encourage a greater daily toothbrushing regularity to promote oral health in children. Measures that encourage individuals to adopt adequate daily toothbrushing favor the establishment of healthy behaviors, as daily decisions and actions contribute to children's oral health.

Authors' Contributions

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All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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