Sociodemographic, Socio-economic, Clinical and Behavioural Factors Modifying Experience and Prevalence of Dental Caries in the Permanent Dentition

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ABSTRACT

Objective: *To identify the sociodemographic, socio-economic, clinical and behavioural factors that modify the experience of decayed, missing and filled teeth (DMFT) and caries prevalence in Nicaraguan children 9−12 years old.*

Subjects and Methods: *We conducted a cross-sectional study in 800 school children 9−12 years old in the city of León, Nicaragua. The clinical oral examinations to identify caries experience were undertaken by two trained and certified examiners. Sociodemographic, socio-economic and behavioural data were collected using questionnaires. Negative binomial regression (NBR) and binary logistic regression (BLR) models were used to model caries experience and caries prevalence, respectively.*

Results: *Mean DMFT index was 0.98 ± 1.74 and caries prevalence (DMFT > 0) was 37.9%. In the NBR model, the categories that increase the expected DMFT mean were: older age, female gender, presence of plaque, and if the school children received curative and curative/preventive dental care in the last year. In the BLR model, the odds of presenting with caries in the permanent dentition were increased in older children, those from large families, mothers with a positive dental attitude, and those school children who received curative and curative/preventive dental care in the last year.*

Conclusions: *Using different models, we identified several sociodemographic, socio-economic, clinical and behavioural factors that modify the experience (NBR) and prevalence (BLR) of dental caries.*

Keywords: Dental caries, oral health, Nicaragua, school children

Factores Sociodemográficos, Socioeconómicos, Clínicos y Conductuales Modifican la Experiencia y la Prevalencia de Caries Dental en la Dentición Permanente

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RESUMEN

Objetivo: *Identificar los factores sociodemográficos, socioeconómicos, clínicos y conductuales que modifican la experiencia (índice CPOD) y la prevalencia de caries en niños nicaraguenses de 9 a 12 años de edad.*

Sujetos y Métodos: *Se llevo a cabo un estudio epidemiológico transversal en 800 escolares de 9 a 12 años de edad de la ciudad de León, Nicaragua. Los exámenes bucales clínicos, para identificar la*

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experiencia de caries, los realizaron dos examinadores capacitados y estandarizados. Se recolectaron datos sociodemográficos, socioeconómicos y conductuales utilizando cuestionarios. Para el análisis multivariado se empleó el modelo de regresión binomial negativa (RBN), para la experiencia de caries, y el modelo de regresión logística binaria (RLB), para la prevalencia de caries.

Resultados: *El promedio del índice CPOD fue de 0.981.74, mientras que la prevalencia de caries (CPOD> 0) fue de 37.9%. En el modelo de RBN, las categorías que incrementan la media esperada del índice CPOD fueron: la mayor edad, el sexo femenino, la presencia de placa dentobacteriana y si el escolar recibió atención dental curativa y curativa/preventiva en el último año. En el modelo de RLB, los momios de presentar caries dental en la dentición permanente se incrementaron en los niños de mayor edad, los de familias grandes, de madres con actitud dental positiva, y en los que acudieron a recibir tratamiento dental curativo y curativo/preventivo.*

Conclusiones: *Utilizando diferentes modelos para analizar la experiencia (RBN) y la prevelencia (RLB) de caries dental se identificaron distintas variables sociodemográficas, socioeconómicas, clínicas y conductuales que las modifican.*

Palabras clave: Caries dental, salud bucal, Nicaragua, escolares

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INTRODUCTION

Oral health is a neglected area of global health and has traditionally registered low on the radar of national policy-makers and, in many countries, issues on oral health are not included in national health surveys. The reasons for this situation are complex and varied. Globally, the burden of major oral diseases and conditions is high. Dental caries is one of the most common chronic diseases worldwide. Ninety per cent of people have had dental problems or toothache caused by caries, and in low-to-middle income countries, most caries remains untreated (1). According to the Global Burden of Disease (GBD) 2010 Study, dental caries is the most common burden and the greatest burden globally is untreated caries in permanent teeth (global prevalence of 35% for all ages combined), whereas untreated caries in deciduous teeth is the 10th most prevalent condition, affecting 9% of the global population (2). In many countries over the world, including the Latin America-Caribbean region, dental caries is still the main oral public health problem, with high prevalence and incidence in all age groups (3−13). Although caries is a highly preventable disease, the problem continues to affect the majority of the population.

Dental caries is a multifactorial infectious and transmissible disease involving an imbalance of normal molecular interactions between the tooth surface/subsurface and the adjacent microbial biofilm where acids are produced (14). Studies have identified associations between numerous factors and dental caries, supporting the agreement that dental caries is a multifactorial disease modulated by genetics, behaviour and environment (15). It is well known that caries depends on several factors comprising the interaction of agent, host, environment and time. In this context, previous studies carried out in school children with permanent dentition demonstrated that sociodemographic variables such as age and gender, socio-economic variables including income, occupation and education of the parents; and behaviour variables related to the frequency of tooth brushing and dental health services utilization, past caries experience and parents' characteristics, can be associated with dental caries (4, 7−13, 16−21).

The epidemiological information of caries in some Latin American countries such as Nicaragua is limited. This study was conducted to identify the sociodemographic, socio-economic, clinical and behavioural factors that modify the experience of decayed, missing and filled teeth (DMFT index) and the prevalence (DMFT > 0) of caries in permanent dentition in Nicaraguan children of nine to 12 years old.

SUBJECT AND METHODS

This study complied with stipulations for the protection of human subjects and the ethical regulations of participating institutions. A cross-sectional study was conducted in the city of León, Nicaragua, to collect information on various events related to oral health. Part of the methods has been previously published (6, 22−24). Following the sampling strategy proposed by the World Health Organization [WHO] (25), and after fulfilling the inclusion and exclusion criteria, 800 children attending 25 elementary schools were randomly selected.

Oral examinations were carried out to identify caries experience (decayed teeth, teeth with fillings, and missing teeth due to caries) and to calculate the DMFT index and caries prevalence (DMFT > 0), and were the dependent variables. All subjects were examined by one of two examiners trained and standardized (Kappa > 0.85), using a flat dental mirror and natural light. Additionally, presence of dental plaque was recorded. The sociodemographic, socio-economic and behavioural variables were collected using questionnaires distributed to mothers through the schools and collected later in the same way.

Socio-economic position (SEP) variable was determined with the maximum level of schooling and the

occupation of both parents, combining with principal components analysis, specifically polychoric correlation (26). The component generated was divided into SEP tertiles – the first tertile represented the group with the lowest SEP, and the third tertile represented the highest SEP. To use this methodology, it is necessary to have complete information on all the observations of the variables used. Given that some mother and father information was missing, data were imputed according to the missing value imputation analysis methodology [regression] (27).

Measures of central tendency and dispersion for continuous variables were calculated. For categorical variables, the frequencies of each category were obtained, as well as the corresponding percentages. For bivariate analyses, we used Spearman's correlation test, Chi-squared test, and non-parametric test for trends, according to the scale of measurement of the variables. The multivariate models used were negative binomial regression (NBR – to identify the variables that modified the DMFT) and binary logistic regression [BLR – to model the caries prevalence] (28, 29). The statistical programme used was Stata 11.0®.

RESULTS

The analysis included 800 school children nine to 12 years old. Table 1 shows the description of the variables included. The average age was 10.50 ± 1.12 years; the gender distribution was similar. The mean DMFT was 0.98 ± 1.74, and the caries prevalence (DMFT > 0) was 37.9%. Table 1 also presents the distribution of DMFT index through the categories of the independent variables. From the variables included in the study, child's age, mother's age, size of the family, mother's attitude toward oral health, frequency of tooth brushing, presence of plaque and type of dental care received, were statistically significant ($p < 0.05$) when

Table 1: Characteristics of respondents and bivariate analysis of decayed, missing and filled teeth (DMFT index) and caries prevalence (% DMFT > 0) in the children included in the study

Variables	Mean ± SD	DMFT	*p*-value	Prev	*p*-value
Age (year)	10.50 ± 1.12	0.98 ± 1.74	0.0000†	37.9	0.0004*
Mother's age (year)	34.47 ± 6.02	0.98 ± 1.74	0.0147†	37.9	0.0101*
Family size	3.35 ± 1.71	0.98 ± 1.74	0.0463†	37.9	0.0208*
	n (%)				
Gender					
Boys	401 (50.1)	0.86 ± 1.52		35.2	
Girls	399 (49.9)	1.11 ± 1.93	0.0817*	40.6	0.113‡
Birth order					
First/Second	525 (65.6)	0.94 ± 1.76	0.1233*	36.0	
Third or more	275 (34.4)	1.06 ± 1.70		41.5	0.131‡
Mother's attitude toward oral health					
Negative	360 (45.0)	0.86 ± 1.70		33.6	
Positive	440 (55.0)	1.08 ± 1.77	0.0172*	41.4	0.025‡
Tooth brushing frequency					
Fewer than 7 times/week	358 (74.1)	0.77 ± 1.42		32.4	
At least once a day	442 (25.9)	1.15 ± 1.94	0.0029*	42.3	0.004‡
Dental plaque					
Low	12 (1.5)	0.08 ± 0.29		8.3	
High	788 (98.5)	0.99 ± 1.75	0.0281*	38.3	0.034‡
Received dental care (last year)					
No care	567 (70.9)	0.69 ± 1.38		31.2	
Preventive	27 (3.4)	0.48 ± 0.85		29.6	
Curative	145 (18.1)	1.59 ± 2.26		53.8	
Both	61 (7.6)	2.44 ± 2.41	0.0001	65.6	0.000
SEP (schooling)					
Low	301 (37.6)	0.89 ± 1.55		38.5	
Medium	233 (29.1)	1.01 ± 1.70		36.9	
High	266 (33.3)	1.06 ± 1.96	0.9638	38.0	0.928
SEP (occupation)					
Low	329 (41.1)	1.00 ± 1.82		38.0	
Medium	289 (36.1)	0.96 ± 1.62		38.4	
High	182 (22.8)	0.98 ± 1.78	0.9631	36.8	0.940

Prev = prevalence of dental caries (% subjects with DMFT > 0); SEP = socio-economic position, *Mann-Whitney, †Spearman correlation, ‡Chi-squared

contrasted with DMFT index and caries prevalence. Gender and birth order were taken into account to fit the final multivariate model (*p*-value less than 0.25).

Table 2 shows the results of multivariate negative binomial regression and logistic regression. In the negative binomial regression model, the categories that increased the expected DMFT mean were older age, female gender, presence of plaque and if the school children received curative and curative/preventive dental care in the last year. In the logistic regression model, the possibility of caries in permanent teeth rose with increasing age, the largest family size in children with mothers with a positive dental attitude, and those who received curative and curative/preventive dental treatment.

Table 2: Multivariate models for decayed, missing and filled teeth (DMFT index; negative binomial regression) and for the caries prevalence (DMFT > 0; binary logistic regression) in children 9−12 years old from León, Nicaragua

Variables	% of change	*p*-value	OR (95% CI)	*p*-value
Age	30.9 (17.3−46.0)	0.000	1.24 (1.08, 1.43)	0.002
Family size	Without change	$p > 0.05$	1.16 (1.07, 1.26)	$p < 0.001$
Gender				
Boys	1*		1*	
Girls	26.7 (1.6−58.1)	0.035	Without effect	$p > 0.05$
Mother's attitude toward oral health				
Negative	1*		1*	
Positive	Without change	$p > 0.05$	1.41 (1.01, 1.97)	0.046
Tooth brushing frequency				
Fewer than seven times/week	1*		1*	
At least once a day	Without change	> 0.05	Without effect	$p > 0.05$
Dental plaque				
Low	1*		1*	
High	996 (46.8−8080)	0.020	Without effect	$p > 0.05$
Received dental care (last year)				
No care	Without change	$p > 0.05$	Without effect	$p > 0.05$
Preventive	1*		1*	
Curative	243 (74.3−576)	$p < 0.001$	3.32 (1.38, 7.95)	0.007
Both	379 (159−785)	$p < 0.001$	5.11 (1.98, 13.18)	0.001
Global fit test	Likelihood-ratio test of alpha = 0: $X^2 = 329.58$; $p < 0.001$		Hosmer-Lemeshow: $X^2 = 7.67$; $p = 0.4662$	

* Reference category. Note: Estimates were calculated with robust standard errors (clustering)

DISCUSSION

In the present study, we examined the sociodemographic, socio-economic, clinical and behavioural factors that modify both experience and prevalence of caries in permanent teeth using different regression models; differences were found in terms of the variables associated with these two indicators. However, comparing the results with published literature became difficult due to the statistical models used in other studies. In this sense, the age and type of dental care received in the year prior to the study were the only variables associated with both the experience and prevalence of dental caries. Age has been studied in relation to caries in permanent teeth, and the risk increases over the years. Villalobos-Rodelo *et al* (21) found the same trend using the BNR model, but not for the type of dental care received. Meanwhile, Martinez-Perez *et al* (30), using BLR, also found that age was a risk factor for the prevalence of caries in permanent teeth, as each year extends the exposure to the oral environment. Regarding the type of dental service received, Vadiakas *et al* (17) observed in Greek adolescents that caries experience and untreated caries were higher in those who visited the dentist only when they had pain or to restore a tooth, compared with those visiting the dentist for a check-up, for prevention or to perform topical fluoride. However, they used a linear regression model.

Gender is considered a risk factor for dental caries in permanent teeth; women have higher levels of caries than males. This was observed in the BNR model but not in the prevalence of caries model. Our findings were consistent with those of Villalobos-Rodelo *et al* (21) who used the same mathematical model. In our BLR model, gender had no effect. In contrast, other studies have found that gender has an effect on the prevalence of caries in permanent teeth with BLR (30). Some authors attribute this, among other things, to the eruption age and the early hormonal fluctuation in girls, compared with boys (16, 31).

The cariogenic process seems to also be associated with economic factors, regardless of the indicator used. In this sense, family size has been considered an indicator of socio-economic status, assuming that families with many

members have to share similar resources among a larger number of family members, compared with the resource:family size ratio in smaller families. Although no one knows exactly what the link is between these variables, it can be hypothesized that subjects with poorer socio-economic status may also have less access to information of oral health, less access to preventive and curative treatment, or fewer healthy attitudes and practices (20).

Socio-behavioural factors play an important role in the presence of dental caries. It is widely acknowledged that parental beliefs about oral health and parental oral health-related behaviours play a fundamental role in the establishment of preventative behaviours that will mitigate against the development of childhood dental caries (32). The mother's attitude toward oral health showed inconclusive results, compared to what has been published in the literature (20, 33). In the present study, children with mothers who had a positive attitude had a higher prevalence of caries (but not a similar experience); because other studies have shown that positive attitude has better effects of oral health indicators, some of these findings could have been influenced by diverse biases when collecting questionnaire data.

Indicators of oral hygiene, frequency of tooth brushing and the presence of plaque were used as variables related to dental caries in permanent teeth. The dental environment of a young child may be affected by the beliefs and practices of mothers that directly affect his/her oral health. In our study, unlike others, there was no relationship between dental caries (prevalence and experience) and self-reported frequency of tooth brushing. However, we found a relationship between the presence of plaque and caries experience (but not prevalence). Such findings may also suggest deficiencies in oral brushing technique, as has been shown by other authors who used the BNR model (21). We did not find such association with the prevalence of caries.

CONCLUSION

Using different models to analyse the experience (NBR) and prevalence (BLR) of dental caries, we were able to identify several sociodemographic, socio-economic, clinical and behavioural factors. Because the modifying effects are different, we posit that model selection should be made according to the nature of the variable. It is necessary to implement strategies in oral health programmes to improve the oral health status of this particular school population and avoid future loss of teeth due to caries (11, 13, 34).

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