Original Article

Dental caries in adolescents and its association with excess weight and sociodemographic factors in Londrina, Paraná, Brazil

Cárie dentária entre adolescentes e sua relação com o excesso de peso e fatores sociodemográficos em Londrina, PR, Brasil

Abstract

Purpose: To evaluate the prevalence of dental caries and investigate its association with sociodemographic factors and excess weight in adolescents.

Methods: This is a cross-sectional study with a sample of 424 adolescents between 15 and 19 years of age. The prevalence of dental caries was assessed according to criteria defined by the WHO (1997); sociodemographic characteristics were obtained through interviews with the adolescents, and nutritional status was determined by the body mass index. Statistical analysis was based on the Chi-square, Mann-Whitney, and Kruskal-Wallis tests using a 5% significance level.

Results: The prevalence of dental caries was 72.9% with an average DMFT (decayed, missing and filled teeth) index of 2.93. Excess weight was diagnosed in 22.4% of the adolescents. Factors that were associated with a greater severity included residence/school on the west side of the city ($P<0.0001$), 17 years of age ($P=0.026$), dark skin ($P=0.005$), lower education level ($P<0.0001$), higher maternal age ($P=0.050$), and lower family income ($P=0.033$). Despite an absence of statistical significance, the greatest dental caries severity was found among overweight adolescents and the lowest severity was found among obese adolescents.

Conclusion: Sociodemographic factors have an important influence on the prevalence of dental caries in the study population. Greater excess weight was not associated with dental caries.

Key words: Dental caries; obesity; overweight; demographic indicators; socioeconomic factors; adolescent

Resumo

Objetivo: Avaliar a prevalência da cárie dentária e investigar sua associação com fatores sociodemográficos e o excesso de peso em adolescentes.

Metodologia: Trata-se de estudo transversal com amostra composta por 424 adolescentes entre 15 e 19 anos de idade. A prevalência de cárie foi avaliada segundo critérios definidos pela OMS (1997); as características sociodemográficas, obtidas em entrevistas com os adolescentes; e, o estado nutricional, determinado pelo Índice de Massa Corpórea. A análise estatística compreendeu o uso dos testes Qui-quadrado, Mann Whitney e Kruskall Wallis, com nível de significância de 5%.

Resultados: A prevalência de cárie foi de 72,9%, com o índice CPO-D médio de 2,93. O excesso de peso foi diagnosticado em 22,4% dos adolescentes. Os fatores associados à maior severidade de cárie foram: residir/estudar na região oeste da cidade ($P<0,0001$), ter 17 anos de idade ($P=0,026$) e ter cor de pele negra ($P=0,005$); a menor escolaridade ($P<0,0001$) e idade mais avançada da mãe ($P=0,050$); e, a menor renda familiar ($P=0,033$). Apesar da ausência de associação estatística, a maior severidade de cárie foi registrada entre adolescentes com sobrepeso e a menor, entre os obesos.

Conclusões: Os indicadores sociodemográficos exerceram importante influência na prevalência de cárie na população estudada, a qual não se associou às altas taxas de excesso de peso observadas.

Palavras-chave: Cárie dentária; obesidade; sobrepeso; indicadores demográficos; fatores socioeconômicos; adolescente

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Introduction

Despite a significant decrease in the prevalence of dental caries, this disease is still the primary threat to oral health, in both developed and underdeveloped countries (1). This fact is especially attributed to the dichotomy between the oral health condition of children and adults (1). On the one hand, approximately 70% of countries have achieved the World Health Organization (WHO) goal for the year 2000 of a DMFT value ≤ 3.0 at 12 years of age (1). On the other hand, dental caries affects approximately 100% of adults worldwide (1).I It can be inferred from the literature that there is a gap in oral health care during adolescence due to the paucity of epidemiological studies in this age group (2).

In Brazil, the most recent epidemiological study of oral health that had national coverage revealed that among individuals 15 to 19 years of age, about 90% presented with dental caries, with an average DMFT value of 6.2 (3). Additionally, that epidemiological study revealed that 14.4% of adolescents already presented loss of at least one tooth, and 13.5% of the adolescents had never had a dental appointment (3). This scenario is severe considering the fact that the DMFT index among young people can increase with age, leading to increased tooth loss (2).

According to Zero (4), among the multiple factors associated with the progression of dental caries, diet plays an unquestionable role with nutritional habits being a common risk factor for caries, as well as obesity and the diseases associated with it. The relationship between the ingestion of refined carbohydrates, especially sugars, and the prevalence of dental caries is well documented in the literature. However, studies addressing the relationship between obesity and dental caries in adolescents are scarce (5).

In addition to biological processes, socioeconomic conditions may influence the incidence of dental caries, disproportionately affecting disadvantaged groups in terms of both disease frequency and severity (6). The association between social deprivation and dental caries was highlighted in a study with adolescents in São Paulo, Brazil (7).

The present study aimed to evaluate the prevalence of dental caries and to investigate its association with sociodemographic factors and excess weight in adolescents of Londrina, in the state of Paraná, Brazil.

Methods

The study design was cross-sectional. The research was approved by the Research Ethics Committee of the Universidade Norte do Paraná (PP/0012/08).

The study population was composed of school-age adolescents of both genders enrolled in high schools of the Londrina (Paraná, Brazil) public school system. According to the school census reported by the Regional Education Nucleus in early 2008, the size of this population was 18,273. From this population, a minimum sample size of 391 was defined based on the formula proposed by Barbetta (8), with a 95% confidence interval and a 5% acceptable error margin.

To compensate for potential losses, we added 20% to that sample size (N=469). Inclusion and exclusion criteria were, respectively, age of 15 to 19 years and failure to present an informed consent form signed by the participant's parents or guardians.

Prior to the selection of participants, the municipality was divided into strata based on five geographical areas (North, South, East, West, and Central). In each of these areas, schools were classified as either large or small, based on the number of students enrolled. The next step consisted of randomly selecting one small and one large school in each region. A total of 10 schools were randomly selected. Next, two additional random selections were performed among 9th to 11th grade students in the target age group.

To evaluate the exposure and severity of dental caries, we used the decayed/missing/filled teeth (DFMT) index according to the criteria defined by the World Health Organization (WHO) (9). The clinical assessment was performed at the schools, under natural indirect light, with the examiner and the subject seated, using a flat oral mirror and a CPI probe after removing food remains with gauze. Standard biosafety measures were followed to protect the research staff and the study subjects. Data were collected in individualized records by adequately trained data entry personnel.

Staff training and calibration, as well as methodological adjustments, were performed in a pilot study that involved 30 adolescents who were not included in the final sample. The intra-examiner agreement was assessed by the Kappa statistic, and excellent agreement was found (Kappa=0.97).

The demographic (gender, age, skin color, residence area, and maternal age) and social characteristics (mother's education and family income) were obtained through personal interviews with the adolescents using a previously validated semi-structured form. Nutritional status was determined by the body mass index (BMI) using the BMI percentile curves defined by the Centers for Disease Control and Prevention (10).

Data were processed and analyzed by the Statistical Package for Social Science – SPSS, version 15.0. Univariate analysis was performed to identify potential associations between independent (sociodemographic characteristics and nutritional status) and dependent variables (history/severity of dental caries). For this analysis, the following tests were used: Chi-square, Mann-Whitney, and Kruskal-Wallis. The significance level was set at 5%.

Results

Of 469 consent forms sent to parents or guardians, 424 were signed (response rate = 90.4%). There was a predominance of females (66.7%) and participants 15 years of age (35.6%). The prevalence of caries was 72.9%, and excess weight (overweight and obese) was diagnosed in 22.4% of the evaluated adolescents (Table 1). Among those with a history of dental caries (Table 2), the average DMFT value was 2.93±2.88. Notably, the "decayed" (D) component accounted for 40% of the index.

Table 1. Dental caries incidence and nutritional status among adolescents from the city of Londrina, Paraná, Brazil (n=424).

Diagnosis	n	%
Dental caries		
Cavity free	115	27.1
With cavity	309	72.9
Nutritional status		
Low weight	23	5.4
Normal weight	306	72.2
Overweight	59	13.9
Obese	36	8.5

Table 2. Dental caries severity among adolescents from the city of Londrina, Paraná, Brazil (n=424).

	Dental caries severity			
	D	M	F	DMFT
Mean	1.18	0.04	1.71	2.93
Standard deviation	1.76	0.24	2.40	2.88
Minimum	0	0	0	0
Maximum	9	3	14	17

The prevalence of caries was not associated with the nutritional status of the population (Table 3). Similar percentages of adolescents who were free of dental caries and those with dental caries were observed in both normal and low weight groups. When focusing on the groups with excess weight (overweight and obese), the greatest caries level was found among participants who were overweight (15.5%). Similarly, the greatest severity of dental caries was found among overweight adolescents (DMFT=3.46±3.01) and the lowest severity among obese adolescents (DMFT=2.39±3.14).

An analysis of the association between cavities and sociodemographic factors revealed correlations between the former and maternal education, family income and residence/school area of the adolescents (Table 4). Adolescents with cavities had a higher rate of less educated mothers (*P*=0.001) and lower income families (*P*=0.004). Of note, of the adolescents who were cavity-free, 51.3% resided in the central area of the city. Furthermore, there was a tendency towards an association between maternal age and cavities in the adolescents with a higher cavity-free rate and with mothers in the 38 to 48 year age group (65.7%).

Table 3. Association between frequency/severity of dental caries and the nutritional status of adolescents from Londrina, Paraná, Brazil (n=424).

Nutritional status	Dental caries			Dental caries severity	
	'no caries'	'with caries'	P-value*	Mean (SD)	P-value †
	n (%)	n (%)			
Low weight	6 (5.2)	17 (5.5)	0.122	2.48 (2.11)	0.160
Normal weight	81 (70.4)	225 (72.8)		2.92 (2.87)	
Overweight	11 (9.6)	48 (15.5)		3.46 (3.01)	
Obese	17 (14.8)	19 (6.1)		2.39 (3.14)	

* Chi-square test; † Kruskal-Wallis test.

Table 4. Association between frequency/severity of dental caries and sociodemographic indicators of adolescents from Londrina, Paraná, Brazil (n=424).

Indicators	Dental caries			Dental caries severity	
	'no caries'	'with caries'	P-value*	Mean (SD)	P-value
	n (%)	n (%)			
Adolescent gender					
Male	40 (34.8)	101 (32.7)	0.771	2.72 (2.92)	0.237 †
Female	75 (65.2)	208 (67.3)		3.03 (2.86)	
Adolescent age					
15 years	50 (43.5)	101 (32.7)	0.184	2.32 (2.40)	0.026 ‡
16 years	34 (29.6)	113 (36.6)		3.25 (2.85)	
17 years	25 (21.7)	78 (25.2)		3.41 (3.48)	
18 years	3 (2.6)	12 (3.9)		3.20 (2.78)	
19 years	3 (2.6)	5 (1.6)		1.63 (1.51)	
Skin color					
White	79 (68.7)	189 (61.2)	0.291	2.59 (2.67)	0.005 ‡
Black	7 (6.1)	27 (8.7)		3.85 (3.59)	
Brown	25 (21.7)	87 (28.2)		3.56 (3.06)	
Yellow	4 (3.5)	6 (1.9)		1.70 (1.70)	
Maternal age					
27 to 37 years	29 (26.9)	61 (21.6)	0.069	2.93 (2.96)	0.050 ‡
38 to 48 years	71 (65.7)	182 (64.3)		2.75 (2.67)	
49 years and above	8 (7.4)	40 (14.1)		4.19 (3.83)	
Maternal education					
0-8 years	37 (34.3)	150 (53.0)	0.001	3.49 (3.01)	< 0.0001 ‡
9-11 years	47 (43.5)	94 (33.2)		2.52 (2.73)	
12 and years and above	24 (22.2)	39 (13.8)		2.25 (2.72)	
Family income					
350.00 to 1.245.00	30 (29.4)	108 (43.0)	0.004	3.28 (3.18)	0.033 ‡
1.246.00 to 2.075.00	32 (31.4)	80 (31.9)		2.64 (2.66)	
2.076.00 and over	40 (39.2)	63 (25.1)		2.36 (2.72)	
City area					
Central	59 (51.3)	98 (31.7)	0.002	2.18 (2.50)	< 0.0001 ‡
East	7 (6.1)	32 (10.4)		3.10 (2.89)	
West	9 (7.8)	39 (12.6)		4.13 (3.01)	
North	22 (19.1)	60 (19.4)		3.32 (3.33)	
South	18 (15.7)	80 (25.9)		3.14 (2.71)	

* Chi-square test; † Mann-Whitney test; ‡ Kruskal-Wallis test.

The severity of dental caries was associated with age, skin color, and residence/school area of the adolescents (Table 4). The mean DMFT value was higher in the West area (DMFT= 4.13±3.01), in the 17 year age group (DMFT=3.41±3.48), and among dark skin adolescents (DMFT=3.85±3.59). In addition, the severity of dental caries was associated with maternal age, education and family income. The most severe index was found among adolescents whose mothers: had little education (DMFT=3.49±3.01), were older than 49 years of age (DMFT=4.19±3.83), and belonged to lower income families (DMFT=3.28±3.18).

Discussion

In the present study, the percentage of cavity-free adolescents was 27.1% and the DMFT was 2.93. These values denote better oral health conditions in the evaluated sample when compared to the results of local and regional studies in the same age group (7,11-13) as well as results of the most recent national study, which registered a 12.8% cavity-free rate and a 5.77 severity for the Southern macro-region of the country (3).

Among the factors that can explain the observed improved oral health condition, it is worth mentioning the fact that Londrina has had fluoridated water since 1972 and a Baby Clinic program since 1986, linked to the Universidade Estadual de Londrina. Remarkably, this program was a first experience with babies' oral health in Latin America and since then has been considered a referral center in the area. Therefore, it can be speculated that the improved oral health conditions observed in the study sample were, in part, a result of the participation of adolescents in this program.

Notably, the present study showed a tendency for the DMFT index values to increase with age, which is consistent with the literature (3,7,11,13,14). This finding must be carefully analyzed. Particularly during adolescence, self-care, including oral health, is neglected (15). Therefore, oral health promotion should be focused on the family and household environment (16). Furthermore, oral health policies traditionally do not prioritize adolescence (17). Considering these facts, it is essential for administrators and health professionals to formulate public policies that are not limited to clinical and preventive care, but rather promote equitable access to services and develop a collective management of health actions.

The finding that adolescents with dark skin presented the highest caries index is also consistent with the findings of previous work (19). The inequality among ethnic groups in regards to the risk of dental caries has been attributed to the fact that the socioeconomic conditions of black and mulatto individuals are than white individuals because an association with other biological factors has not been found (20).

In this study, the investigated socioeconomic factors demonstrated a direct association with both the incidence and severity of dental caries in adolescents. The greatest prevalence of the disease was found among those who belonged to low-income families and whose mothers had little education. These findings are consistent with those reported by another study that also noted that social inequity is associated with a higher prevalence of caries (21). These findings also reinforce the results of "SB-Brazil 2003," the most recent national oral health survey, which showed that the incidence of caries was more severe in populations with greater social deprivation (3).

According to Baldani et al. (21), in Brazil, there is a correlation between higher income and education and access to information and dental treatment. Likewise, Frias et al. (18) commented that the higher chance of caries in certain groups of adolescents demonstrates their higher vulnerability to the disease and reveals the reduced utilization of oral health care services for both educational/preventative and therapeutic actions.

A possible limitation of the present study was the sample selection, which involved only adolescents who were enrolled in the Brazilian public education system. However, it must be noted that this education system serves 78.7% of high school students in Londrina. Moreover, the city area stratification strategy was important because it allowed groups with greater dental needs to be identified. Thus, while establishing curative-preventative actions for oral health focused on adolescents, public health service administrators should prioritize those who live/study in the West area of the city.

Another interesting factor in the present study was maternal age. Adolescents whose mothers were older than 49 years of age demonstrated higher levels of caries in comparison to those whose mothers were younger, which may be a result of a paradigm change in dental practice. In recent years, health promotion actions have been more valued and more widely implemented.

Studies focusing on the relationship between dental caries and excess weight (overweight and obese) have presented controversial results. On the one hand, Moreira et al. (22) reported the absence of an association between dental caries and obesity in Brazilian adolescents between 12 and 15 years of age. On the other hand, Macek and Mitola (23) found that BMI was inversely associated with the severity of dental caries in permanent teeth in American children and adolescents between 2 and 17 years of age; i.e., those with excess weight had a lower DMFT value than those with normal weight. However, a significant association with caries severity and obesity in elementary school children and adolescents was reported in another study (24) that found a higher caries index among the obese.

Although a direct comparison among these studies cannot be performed due to the different age group investigated in the present study, our findings are consistent with the findings of Moreira et al. (22) because there was no statistically significant association between the caries severity and the nutritional status of adolescents. However, adolescents with lower rates of caries belonged to the low weight and obese groups. Additionally, the highest severity of dental caries was in the overweight group, while the lowest rate was in the obese group. According to Zardetto (11), being overweight

may be considered a risk factor for higher caries severity. The analysis of adolescent nutritional status in the present study revealed an alarming proportion of overweight adolescents (22.4%), confirming the results of a similar Brazilian study (25). The high rates of dental caries and overweight adolescents in this study emphasize the need for interventions that focus on healthy eating habits, including the restriction of sugar consumption, and aim at preventing and controlling chronic diseases.

Conclusions

Socioeconomic indicators such as age, skin color, and area of residence/study, maternal age and education and family income were important determinants of caries prevalence in adolescents in the study population. Despite the lack of an association between caries prevalence and nutritional status, the greatest severity of caries was found in overweight adolescents and was lowest among obese adolescents.

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