

Periodontitis in individuals with diabetes treated in the public health system of Belo Horizonte, Brazil

Periodontite em indivíduos com diabetes atendidos no sistema de saúde público de Belo Horizonte, Brasil

Abstract

Objective: The aim of the present study was to investigate the prevalence of periodontitis among individuals with diabetes who use the public health system in the city of Belo Horizonte-Minas Gerais, Brazil, and the association of this condition with socioeconomic, behavioral and clinical variables. **Methods:** A cross-sectional study was carried out on a calculated sample of 300 individuals with diabetes. Periodontitis was defined as clinical attachment loss (CAL) \geq 3 mm in two or more non-adjacent teeth or those that exhibited CAL \geq 5 mm in 30.0% of teeth. All subjects were over 30 years of age and underwent a periodontal examination. Socioeconomic and behavioral characteristics as well as medical history and dental history were obtained from a structured interview. Multivariate analysis was conducted using Poisson regression. **Results:** Among the individuals with diabetes, 6.7% exhibited good periodontal health, 68.0% exhibited gingivitis and 25.3% exhibited periodontitis. The following variables were associated with periodontitis after adjustment: male (PR 1.67 95% CI 1.12, 2.49), individuals with diabetes for more than eight years (PR 1.63 95% CI 1.63, 2.38), smokers (PR 1.71 95% CI 1.10, 2.65); individuals with more than 12 missing teeth (PR 2.67 95% CI 1.73, 4.15) **Conclusions:** Multiple determinants are associated with the prevalence of periodontitis among patients with diabetes.

Keywords: Diabetes. Epidemiology. Dental health services. Periodontitis.

Aline Mendes Silva

Andréa Maria Duarte Vargas

Efigênia Ferreira e Ferreira

Mauro Henrique Nogueira Guimarães de Abreu

Department of Social and Preventive Dentistry of the School of Dentistry of the Federal University of Minas Gerais, Belo Horizonte, Brazil.

Correspondence: Aline Mendes Silva. Rua Maria Heilbuth Surette, 528/102 - Buritis, Belo Horizonte, MG - Brazil CEP 30575-100. E-mail: mendes.silva.aline@gmail.com

Resumo

Objetivo: O objetivo do presente estudo foi investigar a prevalência de periodontite entre os indivíduos com diabetes que utilizam o sistema de saúde pública na cidade de Belo Horizonte, Minas Gerais, Brasil, e verificar a associação desta com condições socioeconômicas, comportamentais e variáveis clínicas. **Métodos:** Um estudo transversal foi realizado em uma amostra de 300 indivíduos com diabetes. Todos os indivíduos tinham mais de 30 anos de idade e foram submetidos a exame periodontal. Foi considerada periodontite os quadros de perda de inserção clínica (CAL) ≥ 3 mm em dois ou mais dentes não adjacentes ou os que apresentaram CAL ≥ 5 mm em 30,0% dos dentes. As características socioeconômicas e comportamentais, bem como a história médica e a história odontológica foram obtidas a partir de uma entrevista estruturada. Foi realizada uma análise multivariada utilizando-se a regressão de Poisson. **Resultados:** Entre os indivíduos com diabetes, 6,7% apresentaram boa saúde periodontal, 68,0% apresentaram gengivite e 25,3% apresentaram periodontite. As seguintes variáveis foram associadas com periodontite após o ajuste: sexo masculino (RP 1,67 95% CI 1,12, 2,49), indivíduos com diabetes há mais de oito anos (RP 1,63 95% CI 1,63, 2,38), tabagistas (RP 1,71 95% CI 1,10; 2,65), indivíduos com mais de 12 dentes (RP 2,67 95% CI 1,73, 4,15). **Conclusões:** Determinantes múltiplos estão associados à prevalência de periodontite em pacientes com diabetes.

Palavras-chave: Diabetes. Epidemiologia. Serviços de saúde bucal. Periodontite.

Introduction

Diabetes is an important public health problem, affecting 245 million people worldwide. Each year, seven million individuals develop diabetes and the projection for the year 2030 is that 366 million people will have the disease worldwide. Brazil has the sixth highest prevalence of diabetes in the world and the forecast for 2030 is that 11.3 million will be affected¹.

Periodontitis is one of the main oral health problems². The worldwide prevalence of periodontal disease is from 5 to 20% of the adult population³. In Brazil, the prevalence of severe periodontitis (periodontal pockets greater than 6 mm) among individuals aged 35 to 44 and 65 to 74 years is 9.9% and 6.3%, respectively⁴. The association between diabetes and periodontal diseases has been recognized in the dental literature for many years⁵. Periodontitis is considered one of the main oral health problems encountered in patients with diabetes⁶. With the increase in the incidence of diabetes worldwide, its negative impact on oral health should be considered². Scientific evidence has shown for some time that diabetes is a risk factor for the development of periodontitis. More recent studies have shown that periodontal diseases can have a negative effect on patient control in diabetes⁷. Evidence of this association supports the concept of increased severity, but not the extent of periodontitis in subjects with poorly controlled diabetes⁸. Therefore, the maintenance of periodontal health may result in improved control of blood sugar levels among such individuals⁷. Recent revisions confirm that Type 2 diabetes can be considered a risk factor for periodontitis⁹ and suggest that periodontal treatment could improve the control of glucose levels¹⁰.

Despite advances in recent years, the public healthcare system in Brazil offers limited access to dental services. This problem is also perceived in relation to individuals with diabetes, the treatment of whom is not prioritized by the system¹¹. The aim of the present study was to investigate the

prevalence of periodontal diseases among individuals with type I and type II diabetes who use the public health system in the city of Belo Horizonte (Brazil) and evaluate the association of this condition with socioeconomic, behavioral, and clinical variables, as well as with dental care offered at public health facilities in the city of Belo Horizonte (Minas Gerais, Brazil).

Methods

The present study was carried out from April to June 2006 in the city of Belo Horizonte, the state capital of Minas Gerais, Brazil. According to information made available by City Hall, healthcare services are organized into nine public health districts. Oral healthcare in the Brazilian public healthcare system of Belo Horizonte is structured in the following manner: Basic care, with 200 oral health teams; specialized care, with 46 specialist surgeon dentists, including five in the field of periodontics; and tertiary care, performed in a hospital setting. The study was approved by the Research Ethics Committee of the Federal University of Minas Gerais (Protocol 012/2004).

For the calculation of the study population, a proportion estimate was performed for the occurrence of the disease using the formula established by the WHO¹². A 75.0%

prevalence of periodontal disease (q) in individuals with diabetes was considered¹³, with a required precision of 95.0% (1 - α) and a 4.8% level of precision (d).

The sample was calculated as a total of 300 dentulous male and female individuals over 30 years of age. Belo Horizonte has nine health districts, which have differences in the number of patients with type I and II diabetes. Stratified random sampling was performed for each district. Thus, the number of randomly selected patients was proportional to the number of individuals with diabetes in each district. No patient refused to participate in our study. Type I diabetes was determined in individuals with a previous medical diagnosis of beta-cell destruction, usually leading to absolute insulin deficiency. Type 2 diabetes was determined in individuals with previous medical diagnosis of diabetes ranging from predominantly insulin resistance with relative insulin deficiency to predominantly an insulin secretory defect with insulin resistance¹⁴. Table 1 displays the distribution of patients with diabetes in the Brazilian public healthcare system in nine health districts of the city of Belo Horizonte in 2003.

Clinical examinations were performed by a single examiner in the dental offices of the selected healthcare units, using a reflector for illumination and a triple

Table 1 – Number of patients with diabetes and distribution in the Brazilian public healthcare system, in nine health districts Belo Horizonte, 2003.

Tabela 1 – Número de indivíduos com diabetes e distribuição nos nove distritos sanitários do Sistema Único de Saúde de Belo Horizonte, 2003.

Health Discripts	Belo Horizonte	Sample (%)
Barreiro	10,301	33 (11.0%)
Centro-Sul	5,900	19 (6.3%)
Leste	9,926	32 (10.6%)
Nordeste	17,138	55 (18.3%)
Noroeste	16,482	53 (17.6%)
Norte	10,301	33 (11.0%)
Oeste	9,927	32 (10.6%)
Pampulha	5,244	16 (5.6%)
Venda Nova	8,428	27 (9.0%)
Total	93,647	300 (100%)

syringe to dry teeth. Biosafety norms were followed. Williams (Hu-Friedy®, Chicago, USA) periodontal probes, mouth mirrors and gauze were used. All faces of the teeth were examined and data were recorded on an odontogram. Probing was performed in a circumferential manner and the highest values found in the sites were annotated. In order to avoid errors inherent to the probing process, the option made was to exclude third molars. The Kappa agreement index (K) was used and revealed satisfactory values for probing depth (0.81), clinical attachment loss (0.91), and bleeding upon probing (0.79) for a single examiner¹².

Interviews were also conducted to collect data on dental care (dental care in the previous year, visit to the dentist's office in the previous year), medical history (type, duration, control of diabetes), socioeconomic data (age, gender, income, schooling, marital status), and behavioral data (tobacco smoking habits). The following parameters were considered in the diagnosis: gingivitis, individuals who exhibited at least one site of bleeding on probing based on the criteria of the American Academy of Periodontology (2000)¹⁵; and periodontitis, individuals who exhibited clinical attachment loss (CAL) 3 mm in two or more non-adjacent teeth or those who exhibited CAL 5 mm in 30.0% of teeth based on the criteria proposed by Tonetti & Claffey (2005)¹⁶.

The results were entered in a database using the Statistical Package for Social Science (SPSS, Chicago, USA, version 17.0). Descriptive analysis of the data was based on the calculation of proportions for the following variables: prevalence of periodontitis, dental care in the previous year, medical history, socioeconomic and behavioral data. Univariate analysis was performed and the dependent variable was dichotomized into the presence or absence of periodontitis. The chi-square test (χ^2) was used in this step, with the level of statistical significance set at $\alpha=0.05$. The variables income, age, duration of diabetes, and number of missing teeth were dichotomized using the median value. Schooling was

dichotomized by grouping education levels: "university/high school" and "elementary/no schooling". For the identification of the factors associated with the prevalence of periodontitis a multivariable analysis was performed using the Poisson regression analysis with binary outcomes allowing the estimation of the prevalence ratios (PR) and their 95% confidence intervals. The variables with p values ≤ 0.20 in the univariate analysis were included in the multivariable analysis and were kept in the model if they remained statistically significant ($p < 0.05$).

Results

The average age of the study population was 55.3 years (± 10.0), with a median age of 55 years. Average duration of diabetes was 9.1 years (± 7.2). The sample was comprised mostly of women (60.0%). Average monthly family income was US\$229 (\pm \$255); 70.7% earned up to US\$233 (exchange rate: US\$1.00 = R\$2.57 in April 2005). A total of 84.0% of participants had either no schooling or only elementary education; 15.3% of the patients were tobacco smokers; 28.7% had type I diabetes and 71.3% had type II diabetes. The mean number of missing teeth was 13.49 (± 7.0); 51.0% of participants had lost as many as 12 teeth.

A total of 6.7% exhibited a healthy periodontium; 68.0% exhibited gingivitis; and 25.3% exhibited periodontitis. The univariate analysis revealed that periodontitis was statistically more prevalent among men ($p = 0.001$); among participants with type II diabetes ($p = 0.030$); those with more than eight years of diabetes ($p = 0.027$); those who had lost more than 12 teeth ($p = 0.000$); those with tobacco smoking habits ($p = 0.019$); and those who had not visited the dentist in the previous year ($p = 0.016$). Table 2 displays the results of the univariate analysis.

The multivariate analysis (Table 3) revealed that the following variables maintained a statistical association with the prevalence of periodontitis among participants: gender, duration of diabetes, tobacco smoking habits, number of missing teeth. The prevalen-

Table 2 – Univariate analysis of the distribution of the independent variables and prevalence of periodontitis, Brazil, 2006.

Tabela 2 – Análise univariada da distribuição das variáveis independentes e prevalência de periodontite, Brasil, 2006.

Variable	Absence of periodontitis		Presence of periodontitis		p-value ^a
	N	%	N	%	
Gender					
Female	147	81.7	33	18.3	0.001
Male	77	64.2	43	35.8	
Age (years)					
30-54	116	78.4	32	21.6	0.145
55-86	108	71.1	44	28.9	
Income					
Up to US\$ 175	102	71.8	40	28.2	0.308
Above US\$ 175	111	77.1	33	22.9	
Schooling					
No schooling	17	60.7	11	39.3	0.054
Up to 8 years	165	74.0	58	26.0	
Over 8 years	41	85.4	7	14.6	
Marital status					
Married, co-habitation	131	76.2	41	23.8	0.490
Single, divorced, widowed	93	72.7	35	27.3	
Type of diabetes					
Type I	57	66.3	29	33.7	0.030
Type II	166	78.3	46	21.7	
Duration of diabetes					
Up to 8 years	120	80.0	30	20.0	0.027
Over 8 years	99	68.8	45	31.2	
Report of controlled glucose					
Yes	91	79.8	23	20.2	0.221
No	113	73.4	41	26.6	
Tobacco Smoking Habits					
Yes	18	39.1	28	60.9	0.019
No	196	77.2	58	22.8	
Missing teeth					
Up to 12	132	86.3	21	13.7	0.000
More than 12	92	62.6	55	37.4	
Dental care in previous year					
Yes	95	82.6	20	17.4	0.016
No	127	70.2	54	29.8	

a – p-value according to Pearson's chi-square test / a – valor p Segundo o teste qui-quadrado de Pearson

Table 3 – Multivariate analysis of the distribution of the independent variables and prevalence of periodontitis, Brazil, 2006.

Table 3 – Análise multivariada da distribuição das variáveis independentes e prevalência de periodontite, Brasil, 2006.

Variable	PR	CI (95%)	p-value
Gender			
Female	1.00		0.011
Male	1.67	1.12-2.49	
Duration of diabetes			
Up to 8 years	1.00		0.011
More than 8 years	1.63	1.12-2.38	
Tobacco smoking habits			
No	1.00		0.016
Yes	1.71	1.10-2.65	
Missing teeth			
Up to 12	1.00		0.000
More than 12	2.67	1.73-4.15	

ce ratio (PR) for periodontal disease was 1.67 (95% confidence interval [CI]: 1.12, 2.49) among men; 1.63 (95% CI: 1.63, 2.38) for individuals with diabetes for more than eight years; 1.71 (95% CI: 1.10, 2.65) for smokers; 2.67 (95% CI: 1.73, 4.15) for individuals with more than 12 missing teeth.

Discussion

Periodontitis is the second largest health problem¹⁷ and advanced periodontal disease affects 10 to 15% of the population worldwide¹⁸. In Brazil, the prevalence of individuals with periodontal pockets deeper than 4 mm is 9.9% in the population between 35 and 44 years of age, and 6.3% among individuals 65 to 74 years of age⁴. In the present study, there was a 25.3% prevalence of periodontitis among individuals with diabetes. As the national data cited above refer to a population without diabetes, the results of this study demonstrate that diabetic individuals have a higher prevalence of periodontal disease than individuals without diabetes^{18,19}.

Recognition of the mounting evidence on the relationship between oral and systemic health^{9,10,20} will confront dental hygienists, dentists, physicians, nurses, and other healthcare workers with the importance

of working together. Nowhere is this more important than in the early identification of individuals with undiagnosed diabetes and the co-management of oral and overall health in patients with diabetes. There is sufficient evidence of the bidirectional relationship between diabetes and periodontal disease to formulate guidelines for screening undiagnosed diabetes and the co-management of patients with diabetes in the clinical practice of dentistry and dental hygiene. There is also sufficient evidence regarding the role periodontal disease plays in increasing systemic inflammation to suggest that non-dental healthcare providers should screen patients for periodontal disease. For dental and non-dental practitioners who embrace the opportunity to become more actively involved in this important arena of healthcare, this new and exciting level of clinical practice is certain to benefit patients and be professionally rewarding²¹.

In a population of diabetic individuals in a public hospital, Drumond-Santana *et al.* (2007) found a 49.1% prevalence of periodontitis, which is higher than the value found in the present study¹⁹. However, two aspects may explain this difference. Firstly, the sample assessed was restricted to a general hospital, which may reflect a lesser proximity to the actual situation of perio-

dental health of the diabetic population. Secondly, the criterion used for the diagnosis of periodontitis was the presence of one site with a depth of > 4mm¹³. Considering this same cutoff point, the prevalence of periodontitis in diabetic individuals in the present study would be 74.0%. Other studies have mentioned that individuals with diabetes have higher percentages of deep pockets and severe attachment loss than non-diabetic individuals and individuals with diabetes have a three-fold greater chance of suffering the loss of periodontal support tissue¹⁸.

In the present study, there was a statistically significant association between periodontitis and gender ($p = 0.011$). This corroborates other studies reporting that periodontal problems are more prevalent and more severe among diabetic men²². Such a finding implies that public health-care services need to actively seek changes in clinic hours and other measures that address care for men with diabetes, as males seek health services less often than women²³.

There was a statistically significant association between the time from which the patient was diagnosed with diabetes and the presence of periodontitis ($p = 0.011$). Some studies have found a relationship between the duration of diabetes and periodontal conditions, whereas others have reported no differences when comparing the duration of diabetes with the periodontal parameters of bleeding, probing depth, and clinical attachment loss²⁴.

According to the World Health Organization (2007)³, tobacco smoking is a risk factor for the development of periodontal disease. In the present study, tobacco smoking was associated with periodontitis ($p = 0.016$). This finding corroborates studies that have found that tobacco modifies clinical gingival characteristics and is considered a risk factor for periodontal disease¹⁴. It has also been reported that individuals with diabetes who smoke are 1.71 times more likely to exhibit periodontal disease than those who do not smoke¹⁹.

Tooth loss was associated with periodontitis ($p = 0.000$). There was an average of 13.4 missing teeth in the present study. It is important to remember that tooth loss is also quite high among the general Brazilian population, with an average of 13.2 missing teeth among 35-to-44-year-olds and 25.8 among 65-to-74-year-olds⁴. Diabetes may be considered an indicator of the risk for tooth loss²⁴.

Stratified random sampling was performed in the present study. No weighing of the estimated prevalence ratio values was carried out in the analysis. So this is a limitation of our results.

Dental care for individuals with diabetes is deficient in Brazil, as access to dental services in the country is limited to a portion of the population⁹ and there are no priorities for any special groups, except pregnant women and children under 14 years of age. Data from a national epidemiological survey (SB-BRASIL) carried out in 2004 reveal that 2.82% of the population between 35 and 44 years of age and 5.81% of those in the 65-to-74-year-old age group had never been to the dentist. It is estimated that 30 million Brazilians have never been to a dental office, despite the fact that the country has one of the highest numbers of dentists in the world⁴. The Brazilian public healthcare system is an organization of considerable importance from the standpoint of access to dental services, but still plays a proportionately small role when considering the oral health needs of the Brazilian population.

Conclusion

The results of the present study indicate a high prevalence of gingivitis (68.0%) and periodontitis (25.3%) among individuals with diabetes who utilize public health services in the city of Belo Horizonte (Brazil). This prevalence was much higher than that found in the Brazilian population without diabetes as well as higher than the one found in other studies investigating the prevalence of periodontitis in diabetic populations. Multiple determinants, such as

clinical and behavioral factors, are associated to the prevalence of periodontitis among patients with diabetes. Public healthcare strategies are needed in order to broaden

access to oral health care services in Brazil and to integrate healthcare professionals regarding care for individuals with diabetes.

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