Determinants of Chronic Periodontitis among Diabetes Mellitus patients, attending Lagos State University Teaching Hospital, Ikeja. Lagos.

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ABSTRACT:

Objective: To determine the prevalence and factors associated with chronic periodontal disease among diabetic patients.

Methods: A cross sectional study, subjects were diabetes mellitus patients attending the Diabetic clinic of Lagos State University Teaching Hospital participated in the study. Data collection was done using a self-administered, structured questionnaire and the oral examination was done according to the WHO 2013 Oral Health Surveys. Levels of fasting blood glucose were recorded. SPSS version 20 was used for data analysis; level of significance was set at $p \leq 0.05$.

Results: One hundred and fifty-seven diabetic patients aged 28 to 85 years participated in the study of which 63.7% were females. The prevalence of periodontal disease among the participants was 82.8% (gingivitis 44.6% and periodontitis 38.2%). Significant risk factors for periodontitis were age, gender, and oral hygiene practice. Periodontitis was higher in participants ≥65 years old than the participants <65 years old ($p=0.004$). Periodontitis was significantly higher in males than in females ($p=0.014$).

Conclusion: The results of this study indicate that age, sex and oral health behavior are risk indicators of periodontitis in these diabetic participants. The study suggests that an increased age, being male and engaging in poor oral health practice increases the risk of periodontitis in participants with diabetes.

Keywords: Diabetes mellitus, Periodontitis, Risk factors, Age, Gender

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INTRODUCTION

Diabetes Mellitus (DM) is a chronic, metabolic, progressive, disease that is characterized by a high level of glucose in the blood. It occurs as a result of deficiency in insulin secretion from pancreatic beta cells or an increased cellular resistance to the actions of insulin.[1] DM has been declared a pandemic disease by the World Health Organization [2] due to its high incidence and increasing prevalence. The International Diabetes Federation had estimated that in 2019 update, 463 million people were diabetes, and anticipated that by 2045 about 700 million worldwide would have been affected. [3, 4, 5]

To understand the association between systemic health and periodontal diseases, several studies have been carried out.[6 -10]

Periodontal disease is considered as "sixth complication" [5,6,11,] in addition to the already established five complications of DM, e.g., retinopathy, neuropathy, nephropathy, altered wound healing, and macro vascular disease.[6, 11]

Xerostomia, opportunistic infections, delayed wound healing, candidiasis, altered taste, dental caries and burning mouth syndrome are some of the other oral consequences in uncontrolled diabetics. [4,12,13,14, 15]

Periodontitis is a common, chronic, inflammatory disease that induces the gradual destruction of the supporting tissues of the teeth, which may ultimately result in tooth loss. [11]

Diabetes has been unequivocally confirmed as a major risk factor for periodontitis.[16] There is a threefold increase in the prevalence and severity of periodontitis in patients with diabetes, especially those with poor metabolic control [13] and studies have shown that effective treatment of periodontitis results in improvement in glycemic control. [4,12,17,18]

Diabetic patients have been shown to have higher risk of developing periodontal diseases especially severe forms of periodontitis compared to non-diabetic patients. [17,19] The severity of the disease was shown to be dependent on various risk factors such as duration and metabolic control of diabetes as well as the age, gender, social behaviour, diabetic age, glycemic control obesity, nutrition, oral hygiene level and certain aggravating factors (e.g., smoking) [17,18] compliances with treatment and dental visits. [17,19]

Oral hygiene has been shown to be an important determinant. [17] Previous studies have shown that better tooth brushing self-efficacy was related to a higher frequency of tooth brushing, less visible plaque, and better metabolic control in diabetes. [17] Health behavior may partly explain the association between metabolic control in diabetes and periodontal inflammation. [18]

Many studies have been done on Diabetes and periodontal health in Nigeria. [20,21,22,23] However, the present study was performed to assess the risk factors for periodontitis among the diabetes mellitus patients attending diabetic clinic of the Lagos state University Teaching Hospital, Ikeja. Lagos.

METHODS

This cross-sectional observational study was conducted among diabetic patients attending the Diabetic Clinic of the LASUTH, Lagos, Nigeria.

Sample size/sampling

The sample size was determined by using the formula for sample size calculation for descriptive studies as stated below. [24]

$N = Z^2 p q/d^2$

N = Sample size, Z = Standard normal deviation = 1.96 at 95% Confidence limit,
P = Prevalence rate = 91.8% = 0.918, prevalence of periodontal disease in diabetics. [23]
q = (1 – P) = (1–91.8%) =8.2% = 0.082. d = Error margin = 5%) =0.05, $N=1.96^2$ x 0.918x 0.082/0.0025 = 115.7 =116 Nonresponsive put at 20% = 20/100 x 116 =23
Total sample size 116+23= 139

Inclusion criteria

Male and female adults, with type 2 diabetes, aged 18 years and above, attending the diabetic clinic of the hospital, who gave their consent, were recruited into the study.

Exclusion criteria

Patients who were acutely ill and therefore not able or not willing to be a part of the study were excluded.

Data collection

The self-administered, structured questionnaire was designed in easy-to-understand English by the author. Questionnaires for this study were distributed to consecutive consenting patients with diabetes during their clinic visit to the endocrinology clinic of the hospital. The questionnaire was verbally explained, by the attending doctors, in the local language to participants who do not read or understand English language. The questionnaire assessed the demographic profile of the participant such as age, gender, education, and occupation. Other information elicited were, the frequency of tooth brushing, previous dental visits, use of interdental cleaning tools, duration of diabetes, and body mass index (BMI)

The dental examination assessed the periodontitis and oral hygiene status of the participants

The periodontal status of the participants was evaluated using the World Health Organization Community Periodontal Index (CPI). [25] The index teeth were 11, 16, 17, 26, 27, 31, 36, 37, 46 and 47. Coding was as follows, 0 = healthy, 1= bleeding, 2= calculus, 3 = pocket 4-5 mm, 4 = pocket 6mm or more. Periodontitis was defined as CPIs of 3 and 4, while those with CPITN scores 0, 1 or 2 were the no periodontitis group in this study.

The oral hygiene status was assessed using the simplified oral hygiene index (OHI-S) by Green and Vermillion.[26] According to this index, oral hygiene index of between 0.0 and 1.2 was described as good, between 1.3 and 3.0 as fair, and between 3.1 and 6.0 as poor.

Body mass index (BMI) levels were calculated using the following formula (weight (kg)/ height^2 (m^2). Subjects were categorized as normal weight (BMI level 18.5- 24.9 kg/m2), overweight (BMI level 25- 29 kg/m2) and obese (BMI level ≥30 kg/m2). [27]

Levels of fasting blood sugar (glucose) were recorded.

Ethical clearance

Ethical approval for the study was obtained from the Research and Ethical Committee of the Lagos State University Teaching Hospital. Ikeja.

Statistical analysis

The Statistical Package for Social Sciences (SPSS) version 20 was used to calculate descriptive data and perform chi-square test for the analysis of data. P value was set at <0.05

RESULTS

Out of 157 participants, about two-thirds100 (67.3%) of the participants were female. The age range of the participants was 28 years to 85 years with a mean age of 63.3 ± 10.6 years. More than half 82 (52.2%) of the participants were middle-aged adults<65years while the remaining 75(47.8%) were elderly >65years. Twelve of the participants (7.6%) had no formal education and 69 (44.0%) had tertiary education.

Less than half 67 (42.7%) of the participants had suffered diabetes for more than 10 years. Less than half 74 (47.1%) of participants ever visited the dentist. More than half, 97(61.8%) of participants brushed their teeth once a day.

More than half, 83 (52.9%) of the participants had fair oral hygiene. Out of 157, 32(20.4%) of the participants had Code 3 (Pocket >3mm) and 28(17.8%) had Code 4 (Pockets>5mm). BMI was normal in 62(39.5%) and fasting blood sugar was normal in 95(60.5%) of the participants respectively [Table 1].

The age, sex, and frequency of tooth -brushing were statistically significant with chronic periodontitis of the participants with p=0.014, p= 0.004 and p=0.047, respectively. Visits to the dentist, OHIS Score, duration of diabetes, Fasting blood sugar and BMI were not statistically significant with chronic periodontitis.

Chronic periodontitis was more in males 29(50.0%) than females 31(31.0%) and more in the >65 age group. Chronic periodontitis was more [31 (48.4%)] in those who brush twice a day than those [32 (43.2%)] who had never visited the dentist. Chronic periodontitis was higher in those with fair oral hygiene status 35 (42.2%). Chronic periodontitis was higher in those who have had diabetes for more than 10 years with 26 (38.8%), those who were overweight 21 (41.2%) and those with high fasting blood sugar 25 (40.3%). (Table 2)

Table 1: Characteristic of the study participants

Variables	Freq (%)
Sex	
Female	100 (63.7)
Male	57 (36.3)
Age group	
>65years	75 (47.8)
<65years	82 (52.2)
Education	
None	12 (7.6)
Primary	36 (22.9)
Secondary	40 (25.5)
Post-secondary	69 (44.0)
Frequency of tooth brushing	
Once	94 (59.9)
Twice	63 (40.1)
Other cleaning products	
Dental floss	18(11.5)
Interdental brush	3(1.9)
Toothpick	85(54.1)
None	51(32.5)
Dental visit	
Yes	74 (47.1)
No	83 (52.9)
Last dental visit	
1year	**20 (12.7)**
2-5years	20(12.7)
>5years	34(21.7)
None	83(52.9)
CPITN Scores	
Healthy	27(17.2)
Bleeding	12 (7.6)
Calculus	58(37.0)
Pockets>4-5mm	32 (20.4)
Deep pockets>6mm	28 (17.8)
OHIS Score	
Good	43(27.4)
Fair	83 (52.9)

Poor	31 (19.7)
Missing Teeth	
<4	68(76.4)
>4	21(24.6)
Duration of Diabetes	
<10years	90 (57.3)
>10years	67 (42.7)
BMI	
Normal	62 (39.5)
Overweight	51 (32.5)
Obese	44 (28.0)
Blood Sugar	
Normal	95 (60.5)
High	62 (39.5)
Total	**157(100)**

Table 2. Characteristics of the periodontal status of the study participants.

Variable	No periodontitis n =97	Periodontitis n= 60 38.2	Total n=157	P value
Sex				0.014
Female	69 (69.0)	31 (31.0)	100 (63.7)	
Male	28 (41.1)	29 (50.9)	57 (36.3)	
Age group				0.004
>65years	55 (73.3)	20 (26.7)	75 (42.8)	
<65years	42 (51.2)	40 (48.8)	82 (52.2)	
Education				0.505
None	6(50.0)	6(50.0)	12 (7.6)	
Primary	23(63.9)	13(36.1)	36 (22.9)	
Secondary	28(70.0)	12(30.0)	40 (25.5)	
Post-secondary	40(58.0)	29(42.0)	69 (44.0)	
Frequency of tooth brushing				0.047
Once	64 (68.1)	30 (31.9)	94 (59.9)	
Twice	33 (52.4)	30 (47.6)	63 (40.1)	
Interproximal hygiene				0.813
Dental floss	11(61.1)	7(38.9)	18(11.5)	
Interdental brush	3(100.0)	0 (0.0)	3(1.9)	
Toothpick	53(62.4)	32(37.6)	85(54.1)	
None	30(58.8)	21(41.2)	51(32.5)	
Dental visit				0.221
Yes	42 (56.8)	32 (43.2)	74 (47.1)	
No	55 (66.3)	28 (33.7)	83 (52.9)	
OHIS Score				0.264
Good	31 (72.1)	12 (27.9)	43 (27.4)	
Fair	48 (57.8)	35 (42.2)	83 (52.9)	
Poor	18 (58.1)	13 (41.9)	31 (19.7)	
Duration of Diabetes				0.896
<10years	56 (62.2)	34 (37.8)	90 (57.3)	
>10years	41 (61.2)	26 (38.8)	67 (42.7)	
BMI				0.823
Normal	40 (64.5)	22 (35.5)	62 (39.5)	
Overweight	30 (58.8)	21 (41.2)	51 (32.5)	
Obese	27 (61.4)	17 (38.6)	44 (28.0)	
Fasting Blood Sugar				0.661
Normal	60 (68.2)	35 (36.8)	95 (60.5)	
High	37 (59.7)	25 (40.3)	62 (39.5)	

DISCUSSION

The prevalence of periodontal disease among the participants in the study was 82.8% (gingivitis 44.6% and periodontitis 38.2%). 82.8% is lower than 92,8% (gingivitis 63.2% and periodontitis 28.5%) from the report of Ojehanon et al. [23] 93.6% (57.0% gingivitis 36.6% periodontitis) from Zaidan et al. [19] from Benin Nigeria and 793.6% from Doha, Qatar, however the pattern [whereby gingivitis is higher in proportion to periodontitis] is comparable. In the reports from the study of Barrientos *et al*. [28] though the prevalence of periodontal disease of 89.7% was comparable, the prevalence of periodontitis was higher than that reported in this present study, (29.1%gingivitis, 60.6%periodontitis). Periodontitis was also reported higher (Gingivitis 27.0% periodontitis was 73.0%) by Deheriya et al [4] where all their participants had periodontal disease. The observation of differences in the prevalence of periodontitis in other studies may be due to the difference in glycemic control of the study population. Individuals with poorly controlled diabetes are more likely to have increased prevalence and severity of periodontitis than those with good or moderate control.[11]

The results of this study revealed that age was significantly associated with the prevalence and severity of periodontitis in the participants with diabetes. Several studies showed that the prevalence and severity of periodontal disease increased with age. [1, 2] There was a significant increase in periodontal disease among older patients aged 65years or older, this is comparable to the reports from the studies of Siamulandabala et al.[17]and Han et al.[11] Overall, prevalence and severity of periodontal disease increases with age that is similar with other published studies which have shown that increasing severity of periodontal diseases is due to the cumulative effect of untreated disease process over a period of time instead of ageing process.[11,17,29]

Differences between the two sexes have also been noted in previous studies.[11,18,29] A previous report revealed that diabetic males had worse periodontal conditions compared with diabetic females [18] and that there was a statistically significant association between males and severity of periodontitis.[11]This is consistent with this study. The reasons for these gender difference has been thought to reflect better oral hygiene practices; and/or more utilization of oral health care services among women.[30] However, the relationship observed between gender and periodontitis is statistically significant. [29,30] These results therefore suggest that there is a greater need for regular periodontal evaluation and effective oral hygiene care among males with diabetes than in diabetic females to decrease the risk of developing periodontitis and progression of periodontitis into a more severe form. [4]

The frequency of tooth brushing was statistically significantly associated with severity of periodontal diseases. Similar to the report of Schulze et al. [18]

Oral brushing frequency of the participants in this study was comparable to the reports of other studies: most of the patients in this study brushed once a day (59.9%); this frequency was within the range reported between 59.4% and 65.0%.[15,17,31] The percentage of DM patients that brushed their teeth twice a day was (40.2%), and this was similar to other studies with frequency ranging between 38.2%-46.0%. [5,12,17,31]

We also found that 47.6% of the participants who brush twice or more a day had periodontitis and 31.0% of participants who brush once a day had periodontitis. This may be due to the duration of brushing and faulty brushing techniques, rather than the number of times per day that the participant brushed the teeth.[32]

Tooth brushing may be effective in removing plaque on buccal and lingual surfaces, but it will not reach interdental areas effectively[18] hence, not effective for the interdental areas. A number of other hygiene devices are available to accomplish this: dental floss, interdental brushes, and toothpicks are designed to reach the specific interdental areas, so interproximal cleaning represents an important aspect of oral self-care and has beneficial effects on

plaque and gingival health.[18] The frequency of interproximal cleaning in the present study, was far below the recommendations of daily practice and may therefore be a major determinant for increased periodontitis.[18]

About one third of the participants 32.5% did not perform interproximal cleaning as part of their routine dental hygiene practice. This was lower than the 58% reported by Ilec et al. [5] Comparable with the report of Çankaye et al.[15] Majority (54.1%) of our participants use toothpick as an adjunct tool for interdental cleaning. The frequency of interproximal cleaning was found to be far below the recommendations of daily practice and may therefore be a major determinant for increased periodontitis.[18] This could also be linked to reduced oral health care awareness amongst the participants.

The level of oral hygiene of diabetic patients, in this present study was considered fair. This was consistent with the report of Trentin et al.33 Poor oral hygiene increases the risk of periodontitis by two- to five-fold compared with good oral hygiene.[34,35] The participants were also found to have a suboptimal oral hygiene behavior as only 27.4% had good oral hygiene score. Comparable to the 13.2% reported by Khakre et al. [36]

Oral hygiene must be maintained as a means of prevention of periodontal diseases. The awareness about the changes in the periodontium should be created; prevention and control of periodontal disease must be considered an integral part of diabetes control.

In our study, only 12.7% of DM patients have regular yearly dental visits, similar to 12.9% reported from the study of Çankaya et al.15In a study sample, 57.2% of the participants had regular dental checkup. [36]

Regular dental appointments are important for DM patients. They provide early detection of diabetes related oral complications; also eliminate any occurrence of oro-dental foci of pain and infection that may lead to difficulties in metabolic control.

BMI was not significantly associated with periodontitis. The overweight and the obese participants have more periodontitis than the normal weight participants. It has been suggested that overweight individuals have double the incidence of periodontitis, and obese have triple the incidence of periodontitis. [27]

Duration of diabetes and diabetic control was not significantly associated with periodontitis. This was similar to the report of Han et al. [11] who also suggested that individuals with poorly controlled diabetes are more likely to have periodontitis than those with good or moderate control. [11]

A study by Denisse et al. 37 showed that patients who had diabetes for a longer period had more severe periodontitis and a higher prevalence of periodontitis as compared with patients who had diabetes for a shorter period.

To establish the magnitude of periodontal diseases and its determinants among these diabetic patients, males and increased age and oral hygiene behavior are important in proper planning of their dental care. Due to higher risk of impaired oral health, the diabetic patients may require more regular dental care than the general population. [17]

The main limitation of this study was that the sample was a one hospital-based sample; this study therefore represents a selected population and is not representative of all DM patients.

CONCLUSIONS

In conclusion, the results of the present study indicate that age, sex, and oral health behavior are risk indicators of periodontitis in a selected adult population living in Lagos with diabetes.

The present study suggests that an increased age, being male and engaging in poor oral health behavior increases the risk of periodontitis in participants with diabetes

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