

# A Study of the Relationship between Diabetes Mellitus and Tooth Loss among Diabetic Patients in Garki General Hospital Garki Abuja, Fct Nigeria

Nathan U Ikimi<sup>1\*</sup>, Modupeore E Sorunke<sup>2</sup>, Olubunmi O Onigbinde<sup>2</sup>, Johnson O Adetoye<sup>3</sup>, Irene Amrore<sup>4</sup> and Olanrewaju O Jacob<sup>2</sup>

<sup>1</sup>Oral and Maxillofacial Department, State House Medical Center, Aso Rock, Abuja, FCT Nigeria

<sup>2</sup>Department of Periodontology, Lagos State University Teaching Hospital, Ikeja, Lagos

<sup>3</sup>Dental Clinic, Garki General Hospital, Garki, Abuja FCT Nigeria

<sup>4</sup>Barbara Castle Dental Practice, Broadley Road, Harlow Essex, United Kingdom, CM19 5SJ

\*Corresponding author: Dr. Nathan U Ikimi, Oral and maxillofacial Department State House Medical Centre, Abuja FCT, Nigeria, Tel: +23480230222903; E-mail: familydentist3@gmail.com

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## Abstract

**Study background:** This research is to assess the number of missing teeth and to examine the relationship between age and tooth-loss in diabetic patients.

**Methods:** The study consisted of 201 diabetic patients and an equal number of non-diabetic patients as control. Self-administered questionnaires were distributed which contained close-ended questions and this was followed by an oral examination of each patient; number of missing teeth were recorded in a data collecting sheet. Data was evaluated using SPSS 20 version.

**Results:** Respondents were within age-group 30-73years for diabetics and 32-68years for non-diabetics. The mean number of missing teeth in diabetics was  $5.22 \pm 0.73$  while non-diabetics had  $3.17 \pm 0.53$  which was statistically significant when p-value was  $\leq 0.005$ . Diabetic patients, within the age-group of 35-44 had 3.21 mean missing teeth and those within the age-group of 64-75 years had 7.31 mean missing teeth.

**Conclusion:** The mean number of missing teeth in the diabetic patient and the control increased gradually as patients grew older but tooth loss was more pronounced in the diabetics. The result here agrees with results in other parts of Nigeria and worldwide. Within the limitations of this study, tooth loss is more in diabetic patients than non-diabetics and increases more in diabetics as both groups grow older.

**Keywords:** Age-group; Diabetes mellitus; Gingivitis; Periodontitis; Periodontal disease

## Introduction

Diabetes mellitus (DM) is a chronic, non-communicable, systemic disease and it is known as one of the major international public health issues [1]. Periodontal disease is one of the major causes of tooth loss and this refers to gingivitis, which is an exaggerated inflammatory condition of the gingiva and periodontitis, which is the destruction of the periodontal ligament, bone and cementum [2].

Epidemiological data suggest that diabetes mellitus is a major risk factor for periodontitis and it has been reported that the susceptibility of the periodontal tissue to periodontitis is increased by approximately threefold in people with diabetes mellitus [3]. On the other hand, periodontal disease has been described as the "Sixth Complication" of diabetes mellitus [4] and it is initiated by an overgrowth of a group of bacterial species, largely gram-negative anaerobic microaerophilic bacteria populating the subgingival sites [5]. The host response to these assaults of periodontal pathogens is persistent inflammation which progress to the destruction of periodontal ligament, the cementum, alveolar bone with the resultant tooth loss [2,5].

A number of factors have been investigated to explain the reasons for the influence of DM on the periodontium and they include: the altered host immune response; [6] the role of cytokines; [7] as well as the implication of advanced glycation end-products [8]. Two hundred and twenty one million (221 million) people were diabetic by 2010 and an estimated three hundred million (300 million) would be diabetic in 2025 according to a report from the World Health Organization's (WHO) [9]. A huge number of both diagnosed and undiagnosed patients with DM are not aware of the possibility of developing periodontal diseases which would ultimately result in tooth loss [10].

As a result of the above prevalence, it is believed that a study of tooth loss in diabetic patients would create greater awareness amongst patients and health providers on the role of periodontal health in the care of diabetic patients. Hence, our objectives are to assess the number of missing teeth in the patients with diabetes mellitus (DM) attending the diabetic clinic in Garki General Hospital, Garki Abuja and determine if there is any difference of tooth loss among different age-group.

## Method and Materials

This is an observational case-controlled study consisting of 201 diabetic patients and an equal number of non-diabetic patients as control; ethical clearance was applied for and given by the Federal

Capital Territory (FCT) health and ethics committee with permission from the Garki General Hospital Management. Included in this study are respondents who are 16 years and above at the time of the examination, voluntary participation, confirmed diabetic not less than 6 months and controlled of other systemic diseases (e.g. hypertension). Patients excluded are subjects who would not participate voluntarily, have systemic conditions that could have similar effects like diabetes mellitus, on the periodontium (e.g. lupus, Blood diseases, HIV/AIDS), known smokers, subjects who have used antibiotics or anti-inflammatory agents in the last three months and pregnant subjects.

A data collection sheet was filled for each patient, containing information such as age, sex, occupation, marital and educational status. In both the diabetic and non-diabetic group, blood sugar level was confirmed from patient's results of fasting blood sugar and two hours post-prandial. Self-administered questionnaires were distributed which contained close-ended questions such as "have you ever had gum swelling", "have you ever extracted a tooth as a result of gum swelling". These questions were asked to determine the previous health status of periodontal tissues and respondents were required to answer "Yes" or "No". This was followed by an oral examination of each patient done by one examiner using a mouth mirror and a World Health Organization (WHO) periodontal dental probe. Subjects were examined sitting in an upright position under over-head electric light and the number of teeth present and missing were counted and recorded to assess tooth loss. Data was statistically evaluated using SPSS 20 version. (IBM Corp., Armonk, NY, USA).

## Result

The number of subjects in this study was 402 (four hundred and two) which was made up of an equal number diabetics and non-diabetics. The diabetic patients consisted of 99 males (49.3%) and 102 (50.7%) females while the non-diabetics were 96 males (47.8%) and 105 (52.2%) females. The age-group of the diabetics was 30-73years old with a mean age of  $49.6 \pm 10.3$  and the non-diabetic had age from 32-68years old with a mean age of  $48.4 \pm 10.5$  years old. Details in **Table 1** below:

Variables	Socio demographic variables		Total	P-value
	Diabetic	Non diabetic	n=402(%)	
	n=201 (%)	n=201 (%)		
<b>Gender</b>				0.777
<b>Male</b>	99(49.3)	96(47.8)	195(40.5)	
<b>Female</b>	102(50.7)	105(52.2)	207(51.5)	
<b>Age group (years)</b>				0.257
35-44	31(15.4)	37(18.4)	68(16.9)	
45-54	101(50.3)	95(47.3)	196(48.8)	
55-64	45(22.4)	50(24.8)	95(23.6)	
65-74	24 (11.9)	19(9.5)	43(10.7)	
<b>Ethnic group</b>				0.383

<b>Hausa§</b>	91(45.3)	94(46.8)	185(46.0)	
<b>Igbo</b>	41(20.4)	31(15.4)	72(17.9)	
<b>Yoruba</b>	64(31.8)	67(33.3)	131(32.6)	
<b>Others</b>	5(2.5)	9(4.5)	14(3.5)	
<b>Highest education level</b>				0.781
<b>Primary</b>	62(30.8)	61(30.3)	123(30.6)	
<b>Secondary</b>	74(36.8)	73(36.3)	147(36.5)	
<b>Tertiary</b>	58(28.9)	60(29.9)	118(29.4)	
<b>Others</b>	7(3.5)	7(3.5)	14(3.5)	

**Table 1:** Social Demographic Characteristics of Respondents, Statistically Significant @  $P < 0.05$ ; §=Hausa ethnic group are the largest number of diabetic patients and this has no statistical significance to diabetes mellitus.

The mean fasting blood glucose recorded for non-diabetics was  $70.86 \pm 13.71$  and  $114.39 \pm 23.51$  at 2 hours post-prandial; the diabetic group had a mean of  $123 \pm 15.37$  recorded as fasting and  $209.94 \pm 18.60$  at 2 hrs post-prandial. Details in **Table 2** below:

	Mean blood glucose (mg/dl)	
	fasting	Post-prandial
<b>Non-diabetics</b>		
35-44	$68.20 \pm 9.91$	$112.10 \pm 13.12$
45-54	$68.50 \pm 10.37$	$112.22 \pm 28.90$
55-64	$72.22 \pm 15.75$	$116.15 \pm 40.80$
65-74¶	$74.50 \pm 39.10$	$117.07 \pm 11.20$
<b>Mean</b>	$70.86 \pm 13.71$	$114.39 \pm 23.51$
<b>Diabetics</b>		
35-44§	$103.40 \pm 10.91$	$172.10 \pm 13.62$
45-54§	$113.30 \pm 10.77$	$199.42 \pm 10.90$
55-64	$125.52 \pm 20.71$	$201.17 \pm 40.83$
65-74¶	$153.52 \pm 19.10$	$267.07 \pm 18.60$
<b>Mean</b>	$123.94 \pm 15.37$	$209.94 \pm 20.99$

**Table 2:** Mean Blood Glucose for non-diabetics and diabetics before Oral examination¶=the fasting blood glucose increased as patient's age increased. §=132 of Diabetic patients within age groups 35-44 and 45-54years had controlled DM before oral examination.

The mean number of missing teeth in diabetic patients was  $5.22 \pm 0.73$  and  $3.17 \pm 0.53$  in non-diabetic. The difference in the two groups was statistically significant. Details in **Table 3** and **Table 4** below:

Variables	Health of Gingiva		Total	P-value
	Diabetic	Non diabetic		
	n=201 (%)	n=201 (%)	n=402(%)	
<b>Suffer from painful gum §</b>				
Yes	137(68.2)	97(48.3)	234(58.2)	0.000*
No	64(31.8)	104(51.7)	168(41.8)	
<b>Ever had gum swelling §</b>				
Yes	128(63.7)	91(45.3)	219(54.5)	0.000*
No	73(36.3)	110(54.7)	183(45.5)	
<b>Ever extract any tooth because of gum problem</b>				
Yes				0.207
No	44(21.9)	34(16.9)	79(19.4)	
<b>Impression of foul mouth odor</b>	157(78.1)	167(83.1)	324(80.6)	
Yes				0.325
No	35(17.4)	26(12.9)	70 (17.4)	
	166(82.6)	175(87.1)	332(82.6)	

**Table 3:** Previous Periodontal Health Status, \*Statistically Significant at P-value<0.05§= Past dental history indicates that diabetic patients may have suffered from periodontal disease and this is statistically significant.

	Mean	Standard deviation	Mean difference	Confidence interval		P-value
				Lower	Upper	
Diabetic patients (n=201)	5.22	0.73	2.05	1.76	2.44	0.032*
Non diabetic patients (n=201)	3.17	0.53				
Total	4.2	0.63				

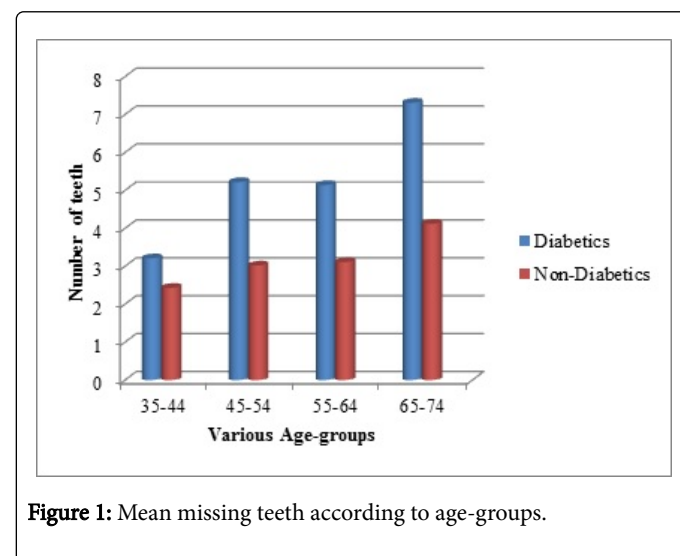
**Table 4:** Mean missing teeth in diabetic and non-diabetic patients.

Age group 64-75 years had an average of 7.31 missing teeth in diabetic patients compared to the average of 4.12 in non-diabetic patients. Details in **Figure 1** below.

## Discussion

This study investigated tooth loss among diabetic patients attending the Diabetic Clinic in Garki General Hospital, Abuja FCT. The higher percentage of females recorded here more than males **Table 1** is striking and agrees with the study of Ogunbodede et al. [11] who gave a higher female to male ratio in his study. Also, Chinenye et al. [12] in a multi-center study in Nigeria reported a ratio of 2:1, female: male

ratio of diabetic patients; however, these results do not reflect the pattern observed in other studies involving diabetic patients with periodontal diseases outside the tertiary health centers in Nigeria where the male: female ratio is reported to be close to 1:1[13-15].



**Figure 1:** Mean missing teeth according to age-groups.

The normal fasting blood glucose is below 100 mg/dl; 100 mg/dl-125 mg/dl is indicative of pre-diabetes and above 126 mg/dl is diabetes mellitus. Below 140 mg/dl 2hours post-prandial is normal,

above 140 mg/dl-199 mg/dl is pre-diabetes and above 200 mg/dl is indicative of type 2 diabetes mellitus [16]. The blood sugar level recorded in this study at 2 hrs post-prandial implied that the patients may have type 2 diabetes mellitus. The study of Ochoa et al. in Columbia reported that 47.4% of diabetic patients had a higher number of missing and were also reported to have suffered from gum problems in the past [17].

The mean number of missing teeth reported in this study was statistically significant with a steady increase as patient grew older. This is in agreement with the World Health Organization (WHO) statement that up to age thirty four (34), teeth are usually extracted as a result of caries but later as a result of periodontal disease as the individual grows older [18]. In addition, research on an Irish population reported that the number of missing teeth increased with increase in age of the patient and duration of diabetes mellitus [19]. That Irish study is in consonance with the result here where the 65-74years age-group who might had suffered from diabetes mellitus for a longer number of years, recorded the highest number of missing teeth with an average of 7.31 in diabetic patients. Also in agreement with our present study is the study of Bacic et al. [20] in Croatia who reported 16.2 as the mean number of missing teeth for diabetic patients which was higher than non-diabetic; 34.4% of those patients older than 54 years old were partially edentulous while 60.9% of the same studied group older than 64 years were completely edentulous. Similarly, Kapp et al. [21] reported that respondents with diabetes showed a considerably higher prevalence of tooth loss of up to 5 and 6 or more teeth, compared with no tooth loss in non-diabetic respondents. Studies in a Nigerian population in Ile-Ife reported that the mean number of missing teeth was higher for diabetic subjects  $1.56 \pm 2.39$ , than the non-diabetic subjects  $0.96 \pm 1.64$  [11]. The reason for these higher number of tooth loss in diabetic patients has been attributed to a lack of knowledge of the undesirable bi-directional relationship between diabetes mellitus and periodontal disease such that hyperglycemic environment will result in periodontal disease and periodontal disease on the other hand, will increase insulin resistance which could lead to tooth loss if left unchecked [1,22]. Different mechanisms such as the production of advance glycation end-product, cytokines and the alter host microflora may contribute independently or synergistically and eventually lead to periodontitis as a complication of diabetes mellitus [6-8]. The altered microflora in diabetics greatly affects host defenses and accelerates the progression of periodontal infection. Host response is further compromised by the inhibitory effects of elevated glucose concentration on polymorphonuclear leucocytes function [23]. Additionally, the polymorphonuclear leukocytes from diabetic patients, produced less free oxygen radicals and exhibits reduced phagocytosis and defective chemotactic effects [4]. Consequently, the periodontal tissue is unable to carry out reparative functions in a hyperglycemic environment and this leads to increase in pockets depths, bone loss and finally tooth loss [23].

Diabetic patients with poor metabolic control should be seen more often in the dental clinic, especially if periodontal disease is already present because periodontal treatment comprising motivation and debridement of periodontal pockets would resulted in improved metabolic control of the diabetes mellitus and decrease in tooth loss [24]. Thus, patients with well-controlled diabetes mellitus who have good oral hygiene and who are on regular periodontal preventive appointments have the same risk of severe periodontitis and tooth loss as non-diabetic patients.

## Conclusion

At the end of this study on tooth loss in Diabetic patients attending the diabetic clinic in Garki General Hospital Abuja, it can be stated that the higher number of missing teeth in the diabetic patients than the non-diabetic patients suggests that tooth loss has a direct relationship with diabetes mellitus. In addition, within the limitations of this study, it is believed that the number of tooth lost is directly related to the age of the diabetic patient. Therefore, the dental surgeon has an important role in the early detection of clinical features of diabetes mellitus in patients reporting to the dental clinic for oral health care. Prompt referral of such cases to the endocrinologist for expert management is imperative. Early treatment of oral infections like periodontal diseases is an effective way of preventing tooth loss, insulin resistance and complications like hyperglycemic coma.

Further studies should be carried out to ascertain how long patient had suffered from diabetes mellitus, the level of control achieved and the relationship of these variables to tooth loss.

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## Conflict of Interest

There is no conflict of interest to declare.

## References

1. Azodo CC (2009) Current trends in the management of diabetes mellitus: The Dentist's Perspective. *Journal of Postgraduate Medicine* 11: 113-129.
2. Kinane DF (2001) Causation and pathogenesis of periodontal disease. *J Periodontol* 2000 25: 8-20.
3. Preshaw PM, Alba AL, Herrera D, Jepsen S, Konstantinidis A (2012) Periodontitis and diabetes: a two-way relationship. *Diabetologia* 55: 21-31.
4. Grossi SG, Skrepcinski FB, DeCaro T, Zambon JJ, Cummins D (1996) Response to periodontal therapy in diabetics and smokers. *J periodontal* 67: 1094-1102.
5. Kornman KS, Page RC and Tonetti MS (1997) The host response to the microbial challenge in periodontitis: assembling the players. *J Periodontol* 14: 33-53.
6. Lamster IB, Lalla E, Borqnakke WS, Taylor GW (2008) The relationship between oral Health and Diabetes mellitus. *J Am Dent Assoc* 139: 19S-24S.
7. Lalla E, Lamster IB, Feit M, Huang L, Spessot A (2000) Blockage of RAGE suppresses periodontitis-associated bone loss in diabetic mice. *J Clin Invest* 105: 1117-1124.
8. Hughes FJ (1995) Cytokines and cell signaling in the periodontium. *Oral Dis* 1: 259-265.
9. Petersen PE (2003) Continuous improvement of oral health in the 21st century - the approach of the WHO Global Oral Health Program. *Community Dent Oral Epidemiol Suppl* 1: 3-23. Abdulramah K (2006) Diabetes Mellitus and its Oral Complications: A Brief Review. *Pakistan Oral & Dent* 21: 145-156.

10. Ogunbodede EO, Fatusi OA, Akintomide A, Kolawole K, Ajayi A (2005) Oral health status in a population of Nigerian diabetics. *J Contemp Dent Pract* 6: 75-84.
11. Chinenye S, Uloko AE, Agbera AO, Ofoegbu EN, Fasanmade OA (2012) Profile of Nigerians with Diabetes mellitus- Diabcare Nigerian study group ; Results of a multicentre study. *Indian J Endocrinol Metab* 16: 558-564.
12. Acharya A, VanWormer JJ, Waring SC, Miller AW, Fuehrer JT (2013) Regional Epidemiologic Assessment of Prevalent Periodontitis Using an Electronic Health Record System. *Am J Epidemiol* 177: 700-707.
13. Okoro EO, Adejumo AO, Oyejola BA (2002) Diabetic care in Nigeria: Report of a self-audit. *J Diabet Complications* 16: 159-164.
14. Amos AF, McCarty DJ, Zimmet P (1997) The rising global burden of diabetes and its complications. Estimates and projections to the year 2000. *Diabet Med* 14: 1-85.
15. American Diabetes Association (1998) *Therapy for Diabetes Mellitus and Related Disorders*, (3rd Edn), pp: 20-26.
16. Ochoa SP, Ospina CA, Colorado KJ, Montoya YP, Saldarriaga AF (2012) Periodontal status and tooth loss in diabetic patients at the University Hospital San Vicente de Paul. *Biomedica* 32: 52-59.
17. WHO Scientific Group on Epidemiology, Etiology and Prevention of Periodontal Diseases (1978) *Epidemiology, etiology and prevention of periodontal disease: a report of WHO scientific group [meeting held in Moscow from 23 Nov-2 Dec.1977]*. World Health Organ Tech Rep Ser No.621 Geneva.
18. Hayden P, Buckley LA (1989) Diabetes mellitus and periodontal disease in an Irish population. *J Periodontol Res* 24: 298-302.
19. Bačić M, Plančak D, Granić M (1988) CPITN Assessment of Periodontal Disease in Diabetic Patients. *J Periodontol* 59: 816-822.
20. Kapp JM, Boren SA, Yun S, LeMaster J (2007) Diabetes and tooth loss in a national sample of dentate adults reporting annual dental visits. *Prev Chronic Dis* 4: A59.
21. Taiwo JO (2000) Oral health education needs of diabetic patients in Ibadan. *Afr J Med Sci* 29: 269-274.
22. Oliver RC, Tervonen T (1994) Diabetes, A risk factor for Periodontitis in adults. *J periodontal* 65: 530-538.
23. Varon F, Mack-Shipman L (2000) The role of the dental professional in diabetes care. *J Contemp Dent Pract* 1: 1-27.
24. Matthews DC (2002) The Relationship between Diabetes and Periodontal Disease. *J Can Dent Assoc* 68: 161-164.