

DETERMINANTS OF PERIODONTITIS AMONG DIABETIC PATIENTS IN UGANDA

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Submission: September 27, 2018; Published: November 16, 2018

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The authors declare no conflict of interest.

ABSTRACT

Background

The global burden of diabetes mellitus is on increase and it is projected that by 2030, over 36 million people will be living with diabetes. Periodontitis is ranked 6th among the top complications related with diabetes. The current study investigated periodontitis risk and factors associated with periodontitis among diabetic patients visiting a diabetic ward at the National Referral Hospital in Uganda (Mulago Hospital).

Methods

A cross-sectional study design was applied among 130 adult diabetic patients at Mulago hospital between February and March 2018. Data was collected via a questionnaire covering Risk of Periodontitis, demographic, behavioral, nutritional, dental and medical characteristics of the patients. Associations between Periodontitis risk and demographic, behavioral, nutritional, dental and medical factors was assessed using T-test, correlation and ANOVA at the bivariate level, and Multiple Linear Regression at the multivariable level.

Results

The risk of periodontitis was relatively high (19.26, on a scale ranging between -5 being the lowest and 29 being the highest). The bivariate analyses suggested variations in periodontitis risk by demographic, nutritional, behavioral and medical factors. The multivariate analyses confirmed a higher risk for periodontitis among diabetic patients who visited the dentist regularly, alcohol and tobacco users, patients with bad breath, and patients having a history of osteoporosis and family history of diabetes.

Conclusion

Medico-dental, genetic and behavioral factors, may account for increased risk of periodontitis among diabetic patients. Behavioral change interventions, and dental health awareness campaigns among diabetic patients could reduce the risk for periodontitis in this special patient group.

Key words: Diabetes, Periodontitis, Diabetic Patients, Risk Factors, Mulago Hospital Uganda.

INTRODUCTION

The burden of diabetes is on the rise worldwide, with projections indicating that by the year 2030, 36.6 million people will be affected. In 2016 there was a total of 4,690 deaths due to diabetes in Uganda, contributing to 1% of total mortality in the country (WHO, 2016). Diabetes is characterized by high blood glucose levels resulting from defects in insulin production, insulin action, or both. Diabetes has complications such as cardiovascular diseases, nephropathy, neuropathy and retinopathy, gum disease (also known as periodontitis) among others.

Periodontal disease is the most common oral complication in Diabetics and has been ranked as the "Sixth complication of Diabetes" (Rao, 2016). Periodontitis is a chronic inflammatory disease resulting in destruction of tissues and structures surrounding the teeth and manifests as a condition affecting the periodontium, gingiva and periodontal ligament, cementum and the alveolar bone pocket formation, recession and eventually tooth loss (Nunn 2012). The World Health Organization WHO (2016) estimated the global prevalence of periodontitis to be 10-15%, which is relatively higher than observations from Sub-Saharan Africa (prevalence of 4.1%) and East Africa (4.6%), (Abid, 2015). To reduce the burden of periodontitis WHO underlined among others the importance of identification of populations and individuals at risk. The risk factors of periodontitis are well investigated and include demographic factors such as age and education, poor nutritional practices, oral hygiene, hyperglycemia, genetic factors, tobacco use, poor nutrition and oral hygiene, crowded gums, diabetes,

osteoporosis and other diseases (CDC, 2015) (Nagelberg, 2017, Biolot 2011, Aljehani 2014, Mehta, 2015, Meisel, 2008, Esfanhanian 2012). These reports notwithstanding, limited number of studies reported the existing risk factors for periodontitis among diabetic patients, particularly in the Sub-Saharan African context where diabetes risk is rapidly on the increase. Such data can be important in identification of groups at risk, and entry points for interventions to reduce multi-morbidity and improve the quality of life of diabetic patients.

This paper investigated the risk for and determinants of periodontitis among diabetic patients in Uganda. Specifically, the following research questions were addressed:

- 1) To what extent are diabetic patients at risk of periodontitis?
- 2) Are there demographic inequalities in periodontitis risk among diabetic patients in Uganda?
- 3) Are there behavioral inequalities in periodontitis risk among diabetic patients in Uganda?
- 4) Is there variation in periodontitis risk among diabetic patients depending on medical history?
- 5) Is there variation in periodontitis risk among diabetic patients depending on nutritional factors?
- 6)

METHODS

Data source, study design, setting and population

The study utilized a cross-sectional design with a sample size of 130 patients, based on Kish Leslie sample size formula, drawn from diabetic patients visiting Mulago National Referral Hospital Diabetic clinic between February and March 2018.

Permission was obtained from Mulago Research and Ethics committee.

The study population was diabetic patient ages 18 and above from Mulago Hospital diabetic clinic. The selection of this group was based on prior knowledge of risk of periodontitis. A total of 130 patients were interviewed.

Dependent variable

Periodontitis risk was estimated using the Cigna validated questionnaire (Cigna, 2016), which rates risk on a scale ranging between -5 and 29. Higher scores on this scale are in indication of higher risk of periodontitis. Based on the scale, the level of risk for periodontitis was rated as -5 – 3 low risk, 4 – 11 moderate risk and 12- 29 is high risk.

Independent variables (risk factors)

The choice of the risk factors for periodontitis was based on previous research in the field. The variables included demographic, nutritional, behavioral and medical characteristics.

Patients' demographic characteristics were provided by the patients and included age, gender, education, and marital status

Patients' behavioral characteristics covered frequency of dental visits, frequency of brushing per day use of antimicrobial mouth wash, smoking and alcohol consumption. For smoking and alcohol consumption patients had to answer 'No' or 'Yes' which were recorded as 0=No and 1=Yes.

For nutritional characteristics, patients indicated what kind of food they normally eat from three options 'Home cooked', 'Fast food' and 'Restaurant food'.

Patients' dental characteristics captured missing teeth, bleeding gums, bad breath, change in tooth appearance, painful gums and loose teeth, with response options in a 'No' or 'Yes' format.

Patients' medical characteristics including family history of diabetes, history of heart disease, history of osteoporosis, history of hypertension and stroke and family history of gum disease were captured in the interviews. Response options were in yes/no format.

Statistical Analysis

Data was analyzed using SPSSv20. T-test, correlation and ANOVA were applied to assess associations between dependent and independent variables at the bivariate level. Significant associations in the bivariate analyses were further analyzed using Multiple Linear Regression, to assess the independent associations between the risk factors and the outcomes. Statistical significant significance level of $P \leq 0.05$ was assumed.

Ethical considerations

Permission to collect data from Mulago National Referral Hospital was granted by the Research and Ethics Committee of the hospital. In order to collect the primary data, the participants were assigned identification numbers and no specific identification details were received. Voluntary participation was emphasized and all the participants provided written consent.

RESULTS

SAMPLE CHARACTERISTICS

The average age of the sample was 45 years old. As exhibited in table 1, with 45% of the sample were married, with over half (52%) having a primary education. The majority of the participants had Diabetes Type 2 (69%) and more than half (53%) were on oral hypoglycemic drugs, with most of them (33.8%) having been diagnosed more than five years ago. Almost half (46%) had never visited the dentist. Fifty percent brushed their teeth twice or more per day. The majority (66.9%) did not floss compare to 4.6% who flossed two to three times per week. Antimicrobial use was low (75% not using) and the majority (94%) did not smoke or take alcohol (91%). Majority (82% consumed mainly home-cooked food. About 70% reported missing teeth, with 20% reporting bleeding gums and 45% reporting loose teeth. Almost 60% had a family history of diabetes and 12% had a family history for gum disease. About 25% and 35% respectively had a family history of heart disease and osteoporosis, and 23% respectively 17% had a family history of hypertension and stroke.

Bivariate associations between Periodontitis risk and demographic, behavioral, nutrition and medical factors

As exhibited by the mean scores in table 2, the risk for periodontitis was significantly higher among women than men, reduced with higher education, and increased with increasing years since diagnosis of diabetes. Patients with poor dental care, dental conditions, smokers and alcohol users generally scored higher on Periodontitis risk. Diabetics with a history of diabetes, osteoporosis and gum disease in the family scored higher on average on periodontitis risk than peers without such history.

Multivariable model for risk factors for Periodontitis

As exhibited by the positive standardized beta coefficients, Periodontitis risk was higher among patients using alcohol and tobacco, patients with missing teeth, bleeding and painful gums, and patients with bad breath, a family history of osteoporosis and diabetes. As exhibited by the negative standardized beta coefficients, the risk of periodontitis reduced with increasing frequency of brushing teeth and visits to the dentist. Age, gender, education, and family history of gum disease were not significantly associated with periodontitis risk in the multivariate analysis.

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Table 1. Sample characteristics with regard to studied variable

VARIABLES	N	PERCENTAGE
GENDER		
MALE	49	37.7
FEMALE	81	62.3
EDUCATION		
PRIMARY	66	52.4
SECONDARY	55	43.7
UNIVERSITY	1	0.8
OTHER	4	3.2
YEAR OF DIAGNOSIS		
LESS THAN SIX MONTHS	13	10
6-11 MONTHS	12	9.2
1-2 YEARS	20	15.4
2.5-3.5 YEARS	21	16.2
4-5 YEARS	20	15.4
MORE THAN 5 YEARS	44	33.8
TYPE OF MEDICATION		
CONTROLLED BY DIET	6	4.6
ORAL HYPOGLYCEMIC	69	53.1
INSULIN INJECTIONS	55	42.3
TYPE OF DIABETES		
TYPE 1	38	30.6
TYPE 2	86	69.4
DENTAL VISITS		
NEVER	58	45.7
ON NEED	35	27.6
REGULARLY	34	26.8

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FREQUENCY OF BRUSHING		
PER DAY	15	11.5
NOT AT ALL	49	37.7
ONCE A DAY	66	50.8
TWICE OR MORE		
USE OF ANTIMICROBIAL MOUTH WASH		
NOT AT ALL	87	75.0
LESS THAN 5 TIMES A WEEK	16	13.8
MORE THAN 5 TIMES A WEEK	13	11.2
SMOKING		
NO	121	94.5
YES	7	5.5
ALCOHOL CONSUMPTION		
NO	117	91.4
YES	11	8.6
TYPE OF FOOD EATEN		
HOME COOKED	107	82.6
FAST FOODS	10	7.8
RESTAURANT FOOD	11	8.6
MISSING TEETH		
NO	40	30.8
YES	90	69.2
BLEEDING GUMS		
NO	103	80.5
YES	25	19.5

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PAINFUL GUMS		
NO	67	51.9
YES	62	48.1
BAD BREATH		
NO	112	88.8
YES	17	13.2
LOOSE TEETH		
NO	70	54.7
YES	58	45.3
FAMILY HISTORY OF		
DIABETES	53	41.1
NO	76	58.9
YES		
HISTORY OF OSTEOPOROSIS		
NO	87	69.6
YES	38	30.4
FAMILY HISTORY OF GUM		
DISEASE	40	30.8
NO	90	69.2
YES		

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Table 2. Distribution of association at bivariate level of each variable to the outcome (Periodontitis).

VARIABLE	N	MEAN	STANDARD ERROR	P-VALUE
GENDER				
MALE	130	15.24	0.922	0.042
FEMALE		17.73	0.758	
EDUCATION				
PRIMARY		17.98	0.780	
SECONDARY	126	15.36	0.889	0.041
UNIVERSITY		7.00	.	
YEAR OF DIAGNOSIS				
> 6 MONTHS		18.08	1.356	
6-11 MONTHS		15.42	1.743	0.000
1-2 YEARS	130	12.30	1.518	
2.5-3.5 YEARS		14.95	1.288	
4-5 YEARS		16.15	1.455	
MORE THAN 5 YEARS		20.00	0.993	
TYPE OF MEDICATION				
		17.00	2.875	0.005
	130	15.04	0.794	

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CONTROLLED BY DIET		18.96	0.868	
ORAL HYPOGLYCEMIC				
INSULIN INJECTIONS				
TYPE OF DIABETES				
TYPE 1	130	17.16	1.030	0.557
TYPE 2		16.41	0.716	
DENTAL VISITS				
NEVER	127	18.10	6.181	0.000
ON NEED		18.66	6.868	
REGULAR		12.74	6.379	
FREQUENCY OF BRUSHING PER DAY				
NOT AT ALL	130	19.93	2.170	0.007
ONCE A DAY		18.20	0.964	
TWICE OR MORE		15.03	0.730	

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FREQUENCY OF FLOSSING PER WEEK	115	16.92	0.730	0.583
NOT AT ALL		15.73	1.399	
ONCE A WEEK		14.67	1.542	
2-3 TIMES				
USE OF ANTIMICROBIAL MOUTHWASH		17.34	0.707	
NOT AT ALL	116	15.50	2.019	0.202
LESS THAN 5 TIMES		14.00	2.006	
MORE THAN 5 TIMES				
SMOKING				
NO	128	16.25	0.578	0.000
YES		27.29	2.020	
ALCOHOL CONSUMPTION				
NO	128	16.22	0.597	0.000
YES		23.73	1.987	

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TYPE OF FOOD EATEN				
HOME COOKED		16.70	0.647	
FAST FOODS	128	15.80	2.687	0.529
RESTAURANT FOOD		18.91	2.007	
MISSING ANY TEETH				
NO	130	10.98	0.724	0.000
YES		19.38	0.626	
BLEEDING GUMS				
NO	128	15.34	0.608	0.000
YES		22.76	1.240	
PAINFUL GUMS				0.000
NO	129	13.40	0.672	
YES		20.44	0.783	
BAD BREATH				
NO	129	15.66	0.609	0.000
YES		23.59	0.959	
LOOSE TEETH				
NO	128	13.94	0.763	0.000

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YES		20.14	0.752	
FAMILY HISTORY OF DIABETES				
NO	129	14.34	0.703	0.000
YES		18.54	0.837	
HISTORY OF OSTEOPOROSIS				
NO	125	14.66	0.697	0.000
YES		21.58	0.785	
FAMILY HISTORY OF GUM DISEASE				
NO	129	16.19	0.610	0.003
YES		21.50	1.777	

Table 3. Multivariable Linear Regression Model for risk factor for Periodontitis among diabetes patients

VARIABLE	STANDARDIZED COEFFICIENT BETA	P-VALUE
AGE	0.04	0.441
GENDER	0.032	0.439
MALE		
FEMALE		
EDUCATION	0.008	0.855
PRIMARY		
SECONDARY		
UNIVERSITY		
YEAR OF DIAGNOSIS	0.102	0.069
> 6 MONTHS		
6-11 MONTHS		
1-2 YEARS		
2.5-3.5 YEARS		
4-5 YEARS		
MORE THAN 5 YEARS		
TYPE OF MEDICATION	0.204	0.000
CONTROLLED BY DIET		
ORAL HYPOGLYCEMIC		
INSULIN INJECTIONS		

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DENTAL VISITS NEVER	-0.186	0.000
ON NEED		
REGULAR FREQUENCY OF BRUSHING NOT AT ALL	-0.182	0.000
ONCE A DAY		
TWICE OR MORE		
SMOKING NO		
YES	0.119	0.038
ALCOHOL CONSUMPTION NO		
YES	0.136	0.023
MISSING TEETH NO		
YES	0.259	0.000
BLEEDING GUMS NO		
YES	0.160	0.000
PAINFUL GUMS NO		
YES	0.250	0.000
BAD BREATH NO		
YES	0.159	0.006

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LOOSE TEETH		
NO		
YES	0.075	0.175
HISTORY OF		
OSTEOPOROSIS		
NO	0.201	0.000
YES		
FAMILY HISTORY OF		
DIABETES		
NO	0.128	0.003
YES		
FAMILY HISTORY OF GUM		
DISEASE		
NO	-0.15	0.781
YES		

DISCUSSION

The current study investigated the risk of Periodontitis among diabetic patients in Uganda, and scrutinized its association with demographic, behavioral, nutritional and medical factors. The study found that- type of medication, dental visits dental conditions (painful and bleeding gums, missing teeth and bad breath), and smoking, alcohol consumption, history of osteoporosis and family history of diabetes were significantly associated with an increased Periodontitis risk.

The finding that dental problems were associated with increased risk of periodontitis are consistent with previous studies (e.g. Lertpimonchai *et al*, 2017) and underline the significance of incorporating dental care as part of a comprehensive diabetes care package.

Tobacco and alcohol consumption increased Periodontitis risk among diabetic patients in this study, in agreement with previous works suggesting the these behaviors may trigger chemical interactions to increase periodontitis risk (Hassan, 2015), (Colgate, 2013), but contrary with other results (Lertpimonchai *et al*, (2017), where such associations could not be confirmed. The discrepancies could be a result of methodological differences between the studies, or contextual. In any case, the study underpins the importance of behavior change interventions and health education for diabetic patients, if periodontitis risk is to be controlled in this specific population. Motivational interviewing and other counseling strategies that are based on stages of change principles have previously been successful interventions in behavioral change among patients (Baker et al., 2002), and could be

applied to the Periodontitis population to control alcohol and tobacco use.

A family history of diabetes and history of osteoporosis increased the risk of periodontitis in line with the notion of cross-generational transmission of disease including diabetes (Colgate, 2013). Moreover, other studies on osteoporosis suggest the disease is a significant risk factor for periodontitis as it leads to a greater tendency to lose alveolar bone and thus increasing the risk of progression to periodontal disease (Esfanhanian 2012). The interface between diabetes, periodontitis and osteoporosis across generations appears complex warranting more detailed research. In any case, a family history of these diseases among diabetics should be a early indication of heightened risk for periodontitis and trigger early intervention to detect and control disease progression.

CONCLUSION

Medico-dental, genetic and behavioral factors, may account for increased risk of periodontitis among diabetic patients. Behavioral change interventions such as visiting the dentist more regularly or reducing the number of cigarette one smokes in a day and dental health awareness campaigns among diabetic patients could reduce the risk for periodontitis in this special patient group.

LIMITATIONS OF THE STUDY

The cross-sectional study design does not allow for causal interpretation of the results. For example, it is difficult to determine whether periodontitis risk preceded or

occurred concurrently or after the dental conditions reported in this study. Studies of longitudinal design will be important to firmly establish causality. Self-reported data may have some element of subjectivity. I would have been better to corroborate self-reported risk with more objectively obtained data (e.g. biomarkers). Despite the weaknesses the validity of the results are to a large extent confirmed as it corroborates much of the previous research in the field.

ACKNOWLEDGEMENTS

We wish to acknowledge Mulago Hospital for granting the access to carry out the study. In addition we acknowledge Victoria University Uganda for the institutional support rendered for this work.

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