Original

Bridging Diabetes and Dental Care: Undiagnosed Diabetes Risk Among Dental Patients Using FINDRISC Questionnaire in a Tertiary Hospital, Nigeria

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ABSTRACT

Background: Diabetes risk assessment is vital to the prevention of complications arising from diabetes mellitus. Finish diabetes risk score (FINDRISC) is one of the vital instruments for diabetes risk evaluation. The aim of the study was to determine the risk scores and risk factors of diabetes mellitus among participants using FINDRISC and self-designed questionnaires.

Methods: The study was a cross sectional, analytic study in which 239 patients participated after obtaining informed consent. The FINDRISC questionnaires were self- administered to the participants and analysed using SPSS version 25.

Results: The participants included 111 males and 128 females respectively. The average age of participants was 38.3±13.9 years. Majority (70.7%) of participants had low risk score for diabetes. Mild and moderate risk scores were obtained in 22.6% and 3.8% of participants respectively. The average risk score for Type 2 DM using FINDRISC score was 4.9±3.9 with a range of 0.0 to19.0. The predictors of type 2 DM were: age ≥ 38 years, non-involvement in exercise for 30 minutes for a period of 5 days, higher than normal BMI, and central obesity. The self- reported prevalence of diabetes was 3.9%. Among those with family history of diabetes, 4.2%, 4.6% and 2.9% involved the father, mother and siblings respectively. About 54.8% of 221 respondents have never been screened for diabetes

Conclusion: FINDRISC scoring can be used to obtain a 10-year risk of developing diabetes mellitus thus, very effective in counselling participants**.** Dental clinic can be used as a focal point for DM screening**.**

Keywords: FINDRISC, undiagnosed, diabetes risk, dental clinic.

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INTRODUCTION

Diabetes mellitus is a metabolic disorder characterized by chronic hyperglycemia due to relative or absolute insulin deficiency.[1] The prevalence of diabetes mellitus is increasing in both developing and developed nations of the world. The current statistics shows that about 422 million people have diabetes mellitus and by the year 2045, it is estimated that 700 million people will have developed diabetes.[2] A significant part of this population resides in low-and-middle-income countries of the world.[2]

In view of the persistent rise in prevalence of diabetes, it is therefore, imperative, to utilize every available contact with patients in health care facilities to institute screening for diabetes. These facilities include: General outpatient department, medical outpatient clinic, Ophthalmology outpatient clinic, Dental outpatient clinic among others. This study was carried out among patients presenting at dental clinic of the hospital.

The choice of dental clinic was informed by literature reports of interplay between diabetes mellitus and dental infective pathologies especially periodontitis. (3,4) Diabetes mellitus has been shown to be complicated by dental/oral diseases such as dental caries, periodontitis, aphthous stomatitis among others.[3,4] Unfortunately, the dental complications in patients with diabetes mellitus are not adequately reported compared to other established vascular- related complications such as retinopathy, nephropathy, neuropathy, peripheral artery disease and stroke. Periodontal disease is regarded as the sixth complication of diabetes mellitus.[5] Periodontal diseases can also affect glycemic control in those with diabetes mellitus. Altamash *et al* [6] have demonstrated a reduction in Hba1c of 0.4% among patients with diabetes mellitus treated for periodontal diseases. In another study done in Germany, 75% of patients with Stage III or IV periodontitis who had FINDRISC score ≥ 12 were noted to have HbA1C ≥ 5.7 thus corroborating the link between periodontitis and diabetes.[7]

It has also been shown that periodontal disease is a risk factor for diabetes and other cardiovascular diseases. (8) The effects of periodontal diseases are not restricted to the periodontal tissues as some of the bacterial pathogens and inflammatory cytokines exhibit some systemic effects causing some cardiovascular diseases and diabetes.[9, 10]

The interplay between diabetes mellitus and periodontal diseases has made the screening of diabetes among attendees to a dental clinic very crucial. In developed countries dental offices are crucial centres for identifying patients at risk of developing type II diabetes using various screening instruments.[11, 12]

Finish Diabetes Assessment Risk Questionnaire is an easy to administer instrument which has been validated to ascertain risk of type 2 diabetes mellitus among a given population. The questionnaire can be discussed with participants to ensure better understanding of the items. Lindstrom and Tuomilehto developed the questionnaire for the Finish Diabetes Association.[13] FINDRISC incorporates key risk factors such as age, physical activity, body mass index (BMI) central obesity,family history of diabetes and dietary habits to estimate diabetes risk.[13] In low- and middle- income countries, the use of FINDRISC questionnaire has been a cost-effective screening modality.[14] The original FINDRISC questionnaire has been reviewed giving rise to a modified FINDRISC and simplified FINDRISC questionnaires.[15] The original, modified and simplified FINDRISC questionnaires have 26, 20 and 18 as their maximum scores respectively.[15]

Alebiosu *et al*[16] showed that using FINDRISC questionnaire among 58,567 participants in a state wide survey, 58.1% of the participants were within the <7 risk group, 26.9% had diabetes risk of 7-11% while 5.6% had the highest risk of greater than 20%. Females also had a higher risk of developing diabetes. The prevalence of obesity was 19.2% while 28.9% of participants were overweight in their study. Similar study by Opara *et al*[17] in Umudike, South East Nigeria among 165 participants showed 66.7% with low risk, 24.2% with slightly elevated risk and 8.5% with moderately elevated risk.

Similar study carried out in a local market among 197 participants showed that 57.9% had low risk, 17.8% had slightly elevated risk, 12.2% had moderate risk, 10.7% were with high risk, and 1.5% had very high risk of developing diabetes.[18]

A study conducted Saudi Arabia using the FINDRISC questionnaire revealed a 10-year risk of developing T2DM, with 6.05% of 15,509 participants identified as being at high risk.[19] Factors such as lower education, reduced daily physical activity, poor intake of fruits and vegetables, family history of diabetes, higher BMI and hypertension were significantly higher in females than males ($p< 0.001$).[19]

FINDRISC questionnaire has been extensively used utilized in various populations, its use in Nigeria, especially in dental clinics has not been explored. This study was therefore set out to evaluate the 10 year-

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diabetic risk score, self- reported prevalence of diabetes and associated factors in patients attending dental clinic using validated FINDRISC Diabetes score questionnaire and self -constructed questionnaire respectively. By leveraging the dental clinic setting, the study focused on highlighting the potential of integrating diabetes risk assessment into routine dental care, thereby contributing to early detection and preventive interventions.

METHODS

Study area: The study was carried out at the Dental Clinic of Alex-Ekwueme Federal University Teaching Hospital, Abakaliki, (AEFUTHA) Ebonyi State. The AEFUTHA serves as a referral centre for adjoining states such as Cross River and Enugu.

Study design: The study was conducted using cross-sectional analytic design.

Sample size: This was estimated using the Cochran formula: $n = Z^2pq/e^2$ (20)

Where n= sample size, Z- standard normal deviate at 95% confidence level (Z=1.96), p=prevalence, q=1-p, e = standard error of 0.05. Using a prevalence rate of 7% for diabetes mellitus reported in a previous study, (21), a sample size of 112 was estimated thus: N= 1.96x1.96x0.07x (1-0.07)/(0.05x0.05) = 112. However, 239 participants were recruited in the study which increased the power of the study.

Sampling technique: A simple random sampling technique was used to select 3 patients per day with 15 patients selected in 5 working days in a week. The recruitment of participants continued for four months until the sample size was met. The FINDRISC and self-designed questionnaires were interviewer-administered to the participants after obtaining informed consent Dental interns were trained and used as research assistants.

Inclusion criteria

1. Adults aged 20 years and above attending Dental Clinic of AEFUTHA.
2. Those who gave consent to participate and do not have debilitating illness.

Exclusion criteria

Non-consenting attendees to Dental Clinic of AEFUTHA.

Ethical consideration: An ethical clearance for the study was obtained from the Ethics and Research Committee of Alex-Ekwueme Federal University Teaching Hospital, Abakaliki with reference number: NHREC/16/05/22/442. Those who gave consent continued with the study but those who did not give consent still received normal dental care.

Statistical analysis: The data obtained from the study were analysed using IBM- SPSS-Statistics version 25. Following entry into the software, data was cleaned, some variables were recoded into new ones while others were computed from primary variables. Socio-demographic variables were represented as frequencies and percentages. Bivariate and multivariate analysis were conducted to identify significant risk factors associated with 10-year diabetes risk scores among the participants. Factors with p -values < 0.05 were considered significant. Missing responses were not imputed. Analyses were conducted using available –case analysis, whereby only respondents with complete data for a given variable were included in the analysis for that variable.

This study followed the Strengthening Reporting of Observational Studies in Epidemiology (STROBE) guidelines for observational research, ensuring transparency and reliability in study design, data collection and reporting.

RESULTS

Two hundred and thirty-nine subjects participated in the study with 128 females and 111 males. Majority of the participants were aged 35-44 years. This is shown in table 1.

Table 1. Socio-demographic characteristics of attendees to dental clinic at AEFUTHA

Variable	Frequency N=239	Percent
Age group in years		
24 years or less	35	14.6
25-34	63	26.4
35-44	81	33.9
45-54	25	10.5
55-64	21	8.8
65 years or more	14	5.9
Mean age in years	38.3±13.9*	
Sex		
Female	128	53.6
Male	111	46.4
Marital status		
Single	90	37.7
Married	145	60.7

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Widowed	4	1.7
Occupation		
Civil service	77	32.2
Trading	62	25.9
Student	32	13.4
Farming	23	9.6
Retired	6	2.5
Health worker	2	.8
Others	21	8.8
Unemployed	16	6.7

*Mean ± Standard Deviation

About 71% of patients presenting to dental clinic had low risk of developing diabetes mellitus in a period of 10 years while 2.9% had high risk. This is shown in table 2 and Figure 1.

Table 2. The categorization of diabetes risk of attendees to dental clinic at AEFUTHA
Using the Finnish Diabetes Risk Score questionnaire

Scores	Risk category	Frequency N=239	Percent
< 7	Low	169	70.7
7 – 11	Slightly elevated	54	22.6
12 – 14	Moderate	9	3.8
15 – 20	High	7	2.9
> 20	Very high	0	0

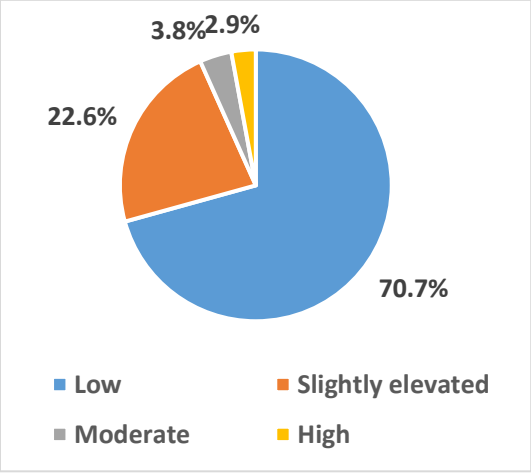

Figure 1. Ten-year risk level of developing type 2 DM among attendees to dental clinic at AEFUTHA, using Finnish questionnaire

Table 3 shows the factors influencing a 10-year risk of Type 2 diabetes mellitus among attendees at dental clinic AEFUTHA. The risk of type 2 DM in individuals older than 38 years is six and a half times the risk in those who are 38 years or less (AOR=6.573; 95% CI = 2.9-14.4). Individuals who do not engage in at least 30 minutes of physical activity a day are over four times more at risk of type 2 DM than those who do physical exercise (AOR = 4.393, 95% CI = 1.9-9.8). Again, individuals with higher-than-normal body mass index are approximately seven times at risk of type 2 DM compared to those who have normal BMI (AOR = 7.148, 95% CI = 2.9-17.4), and those with central obesity are over six times more at risk of the disease compared to those who have normal waist circumference (AOR = 6.340; 95% CI = 2.6-15.4).
About 80.3% of participants have heard of diabetes while nine of the participants (3.9%) have been previously diagnosed to have diabetes. More than half of the participants have never been undergone diabetes screening. These characteristics are shown in table 4.

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Table 3. Factors associated with a 10-year risk for Type 2 DM among attendees at dental clinic AEFUTHA

Variable	Risk of Type 2 DM n (%)		Bivariate analysis		Multivariate analysis		
	Low n (%)	Elevated to high n (%)	cOR	p-values	aOR	95% CI for aOR	p-value
Age	**N=169**	**N=70**					
≤38 years	122 (72.2)	24 (34.3)	29.916	<0.001	1		
>38 years	47 (27.8)	46 (65.7)			6.573	2.9-14.4	<0.001
Sex							
Male	83 (49.1)	28 (40.0)	1.652	0.199	1		
Female	86 (50.9)	42 (60.0)			0.904	0.4-1.9	0.801
Daily at least 30 minutes of physical activity	**N=138**	**N=64**					
Yes	98 (71.0)	28 (43.8)	13.849	<0.001	1		
No	40 (29.0)	36 (56.3)			4.393	1.9-9.8	<0.001
Frequency of eating vegetables, fruit or berries	**N=153**	**N=68**					
Every day	50 (32.7)	26 (38.2)	0.644	0.422	NA		
Not every day	103 (67.3)	42 (61.8)					
Body Mass Index	**N=169**	**N=70**					
≤ Normal	87 (51.5)	12 (17.1)	24.051	<0.001	1		
> Normal	82 (48.5)	58 (82.9)			7.148	2.9-17.4	<0.001
Waist circumference							
Normal	148 (87.6)	39 (55.7)	29.513	<0.001	1		
Centrally obese	21 (12.4)	31 (44.3)			6.340	2.6-15.4	<0.001

cOR = crude odds ratio, CI = confidence interval; aOR = adjusted odds ratio; NA = Not applicable.

Table 4. Knowledge, prevalence, symptoms and signs of diabetes mellitus among attendees to dental clinic at AEFUTHA

Variable	Frequency	Percent
Ever heard about diabetes mellitus (DM)	**N=233**	
Yes	187	80.3
No	46	19.7
Source of knowledge about DM	**N=113**	
Friends/relations	28	24.8
Health workers	55	48.7
Radio, TV or Newspapers	30	26.5
Symptoms/signs of DM known	**N=236**	
Polyuria	115	48.7
Polydipsia	60	25.4
Weight loss	59	25.0
Knowledge of someone with DM	**N=230**	
Yes	101	43.9
No	129	56.1
Are you diabetic?	**N=232**	
Yes	9	3.9
No	223	96.1

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Duration of DM	**N=8**	
<5years	4	50.0
5 - 10 years	1	12.5
>10 years	3	37.5
Ever been screened for DM	**N=221**	
Yes	100	45.2
No	121	54.8
Symptoms/signs of DM being experienced	**N=235**	
Polyuria	11	4.7
Polydipsia	12	5.1
Weight loss	6	2.6
Family history of DM in first degree relatives of respondents	**N=239**	
Father	10	4.2
Mother	11	4.6
Siblings	7	2.9
History of DM in pregnancy (females only)	**N=106**	
Yes	4	3.8
No	102	96.2
History of delivery of babies with birth weight ≥4kg	**N=89**	
Yes	12	13.5
No	77	86.5

DISCUSSION

The findings of this study provided significant insights into the diabetes risk profile of patients attending a dental clinic in South- East Nigeria. The study showed a low risk of developing diabetes in 71% of the study participants which suggests a generally favourable risk profile among the study population. The presence of mild and moderate risk scores in 22.6% and 3. 8% of participants respectively, which underscores the need for targeted interventions for at- risk individuals. This is similar to the findings by Opara *et al* [17] though the latter was a community survey. However, a similar study carried out in a Jordan dental clinic showed that about 50% of 1,247 attendees were at moderate to high risk of developing type II diabetes in a 10-year period.[22] The predominantly low risk of diabetes mellitus obtained from this study may be related to the low prevalence of diabetes-risk factors such as obesity among the participants. In the study carried out in a Jordan dental clinic, obese participants constituted about 59.2% while the prevalence of obesity in this study was 21.75% using waist circumference as a measure of central obesity. Obesity is one of the notable risk factors for diabetes mellitus.

Alebiosu *et al* [16] and Ugwueze *et al* [18] found lower percentage of participants in the low-risk group in a community survey, even though low risk category still predominates. The study reported moderate risk in 3.8% of the participants which was lower than the findings of other researchers who reported 12.2% and 10.5% respectively. [18, 23]

The mean FINDRISC score of 4.9 ±3.9 from this study was comparatively lower than the findings of Cosansu *et al*, (24) who reported a mean score of 7.46± 4.62. However, the mean score for women was higher than that of men which is similar to what Cosansu *et al*, reported. (24) The mean FINDRISC score from the study of Allazam and colleagues[22] in a Jordan dental clinic also showed higher values for females (11.3± 4.3) versus (10.4± 4.9) for males.

Concerning factors associated with 10-year risk, significant ones included: age >38 years, p, 0.001), daily physical activities for at least 30 minutes (p< 0.001), BMI (p< 0.001) and waist circumference (p< 0.001). These variables were significant at both bivariate and multivariate analysis. These factors highlight modifiable lifestyle behaviours which if properly addressed through public health strategies could reduce the future burden of diabetes. Similarly, Sagilk *et al*, [25] showed that high BMI, lack of exercise and family history of diabetes contribute significantly to development of diabetes.

The self- reported prevalence of T2DM among the study cohorts was 3.9% which is lower than 7.3% reported by Agaba *et al*, [26] among university employees in Jos. The higher prevalence among university employees may be related to the greater sample size and their higher educational status. The latter factor is informed by the health seeking behaviour of the educated class. In a

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household survey in Ghana, the self- reported prevalence of diabetes was 9% of 3873 study participants.[27] The finding from the study is similar to 3.5% found among a study carried out by Azuogu *et al* [28] among 282 secondary school teachers in Ebonyi state.

More than half of the participants have never been screened of diabetes in the past. This population is very high and suggests a potentially high burden of undiagnosed diabetes in our environment. Many cases of undiagnosed diabetes in Nigeria are due to ignorance and poverty.[29] A study carried out in Sweden by Gudjonsdottir *et al*, [30] revealed that nearly 50% of those who suffer from diabetes in a period of 10 years in Stockholm County were undiagnosed which emphasizes the need for intensified screening. Africa has the highest burden of undiagnosed diabetes reported as 53.6% while Western Pacific and South East Asia accounts for 52.8% and 51.3% respectively. It is only with regular screening and advocacy that the burden and mortality of undiagnosed diabetes mellitus can be reduced.

Limitations

The study is a one -centre study and may require more studies for generalization. FINDRISC scoring is a questionnaire-based study which has some limitations. Self- reported prevalence of diabetes is subject to individuals' bias.

Implications of the findings of the study.

The study findings have emphasized the need for using dental clinics as routine sites for diabetes screening. The identified predictors of diabetes from the study should be used in educating the populace on the risk factors for diabetes. Interventions targeting modifiable risk factors should be integrated into diabetes prevention programs Moreover, there is a need for more regular screening for diabetes mellitus in the general population.

Conclusion: The study has shown a low 10 -year risk of developing diabetes as well as a low self- reported prevalence of diabetes among the participants. The identified predictors of type 2 DM were: age ≥ 38 years, non-involvement in exercise for 30 minutes for a period of 5 days, higher than normal BMI, and central obesity. The finding of low, moderate and high diabetes risk highlights the critical need to leverage dental clinics as focal points for diabetes screening particularly in resource- poor settings. Future researches should explore the long- term impact of integrating diabetes risk assessment into dental practice and its potential to improve health outcomes

What the study adds**:** The use of FINDRISC questionnaire in assessing diabetes risk in dental clinics in Nigeria has been scarcely carried out. It is therefore necessary to focus screening for diabetes in dental clinics for early diabetes diagnosis and follow up. The study also established that more than half of the participants were never screened which underscores the fact that efforts should be geared towards massive screening in dental clinics. However, an appreciable percentage of participants (70.7%) have low risk of developing diabetes in a period of 10 years which is encouraging.

Declarations

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Ethical clearance: An ethical clearance for the study was obtained from the Ethics and Research Committee of Alex-Ekwueme Federal University Teaching Hospital, Abakaliki with reference number: NHREC/16/05/22/442

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