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We, the undersigned, are the principal investigator and advisor for this study. We declare that this thesis is our original work.

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Abbreviations

AGEs - Advanced Glycation End-products

BMI – Body Mass Index

CDC/AAP - Center for Disease Control/American Academy of Periodontology

CPI – Community Periodontal Index

CPITN - Community Periodontal Index Treatment Needs

CAL – Clinical Attachment Level/loss

DDS- Doctor of Dental Surgery

FBS – Fasting Blood sugar levels

HbA1c – Glycated hemoglobin

IDF – International Diabetes Federation

NCD – Non communicable Disease

OpenEpi - Open Source Epidemiologic Statistics for Public Health, Version.

RANKL/OPG - Receptor Activator of Nuclear Factor kappa beta/ Osteoprotegerin

SPSS- Statistical package for social sciences

STEPS - STEPwise approach to NCD risk factor surveillance

TASH - Tikur Anbessa specialized hospital

WHO – World Health Organization

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Abstract

Introduction: Diabetes and periodontal disease are chronic diseases with a significant impact on public health. The relationship between these two diseases has been well established and is said to be bi-directional. Diabetes is a risk factor for periodontal disease, and periodontal disease may have impact on glycemic status and other diabetic complications. There is a paucity of data related to the prevalence and associated factors of periodontal disease among Ethiopian diabetic patients.

Objective: The main objective of this study is to determine the prevalence of periodontal disease and associated factors of periodontitis in diabetic patients attending their treatment and follow up at Tikur Anbessa Specialized Hospital

Methods: An institution based cross sectional study was conducted from June 1-July 31, 2023 on sampled diabetic patients following in the endocrine clinic of Tikur Anbessa specialized hospital during the study period. The study enrolled 216 diabetic patients in total. To examine the prevalence of periodontal disease and associated factors for periodontits, data were collected using a pretested questionnaire to assess sociodemographic, physical features, clinical parameters, glycemic profile (FBS & HgA1C), and oral hygiene practices. Following that, an oral examination was performed to determine bleeding on probing, community periodontal index (CPI) and clinical attachment loss (CAL). The logistic regression analysis was used to examine factors associated with periodontitis, and the ordinal regression analysis was used to estimate severity based on CAL. Data collected was analysed using STATA version 14 software and outcomes were presented by tables, figures and statements.

Results: The overall prevalence of periodontal disease (either gingivitis or periodontitis) was 100%, with gingivitis affecting 98.6% of subjects and periodontitis affecting 91.7%. Multivariate analysis revealed Increasing age (AOR=1.06, 95% CI:1.01-1.11), use of combination antihyperglycemic medications (either combination oral or combination oral & insulin) (AOR=4.85, 95%:1.3-17.9), spironolactone use (AOR-0.21, 95% CI: 0.014-0.78) and presence of dentures (AOR-0.34; 95% CI: 0.04-0.65) to be significantly associated with periodontitis.
In addition, bleeding on brushing was found to be significant indicator of periodontitis (AOR-6.6; 95% CI: 1.5-34.5). Male gender (AOR-2.4, 95% CI: 1.08-5.36), lack of flossing (AOR-4.1, 95% CI: 0.04-1.04), and poor self perception of gum health (AOR-2.82, 95% CI: 1.25-6.38) were variables significantly associated with the risk of developing generalized periodontitis. Ordinal regression analysis showed that male gender (AOR-3.5, 95% CI: 1.4-8.7) and age ≥40 years (AOR-5.3, 95% CI: 1.4-20) were significantly related to periodontitis severity.

Conclusion: The finding of this study showed that the magnitude of periodontal disease among diabetic patients was high. Increasing age, use of combination anti hyperglycemic drugs, spironolactone use, presence of dentures, and bleeding on brushing were independently associated with the occurrence of periodontitis. Furthermore, male gender and increasing age were found to be significant predictors of the severity and development of generalized periodontitis.

Key words: Diabetes, periodontal disease, periodontitis, gingivitis

Introduction

1.1 Background

Diabetes is a serious, chronic metabolic disease characterized by elevated blood glucose levels caused by the body's inability to produce any or enough of the hormone insulin or to effectively use the insulin that it does produce, resulting in serious damage to the heart, blood vessels, eyes, kidneys, and nerves over time.(8,9)

Diabetes is one of the fastest growing global health emergencies of the 21st century, affecting over half a billion people worldwide, with the majority of those affected living in low and middle income countries. Latest IDF report stated that 24 million people in Africa and 1.9 million people in Ethiopia were living with diabetes in 2021with Ethiopia being among the top 5 African countries in terms of number of people affected with diabetes.(9) According to the 2015 Ethiopian National NCDs STEPS Survey, the prevalence of diabetes was 3.2%, with IFG affecting 9.1% of the population.(10) According to recent published reports, the prevalence of diabetes in Ethiopia ranged from 2.0%-6.5% in 2019 systematic review, with a low of 2% in smaller rural areas, whereas a 2022 nationwide cross-sectional survey revealed a prevalence of 2.8%, with the Somali region having the highest prevalence (8.7%).(11-12)

Diabetes is one of the top four noncommunicable diseases, which together account for the vast majority of premature deaths caused by chronic diseases.(6) One of the major characteristics of the disease is its association with chronic vascular and non-vascular complications, which cause morbidity and mortality.(2)

There are several oral diseases that are more common in diabetic patients such as burning mouth syndrome, gingival overgrowth from concomitant drugs for other co morbidities, lichenoid mucosal reactions, xerostomia, candidal infections, and chronic mouth ulcers.(5–7) Periodontal disease has been shown in various studies to be more prevalent and severe in diabetic patients and is regarded as the sixth complication of diabetes following the classic complications.(4)

Periodontal disease is a chronic inflammatory disease caused by bacteria that affects the tissues that surround and support the teeth, resulting in the destruction of tooth-supporting structures.(15,16) The disease spectrum ranges from gingivitis in the early stages, which is associated with poor oral hygiene, which can lead to more severe infection and inflammation, eventually leading to periodontitis and subsequent tooth loss.(1) It is also associated with nutritional compromise, altered speech, low self-esteem, a lower overall quality of life, and independently linked to increased mortality.(13,14)

Oral diseases affect 3.5 billion people globally, accounting for 45% of the population. Periodontal disease is the most common cause of adult tooth loss and is one of the most common oral health problems worldwide. Severe periodontal diseases are estimated to affect around 19% of the global adult population, with over 1 billion cases worldwide.(17) According to recent

studies done in Ethiopia; prevalence of periodontal disease is reported to range from 10.8% to 83%.(20–24)

There are modifiable and non modifiable risk factors for periodontal disease. Smoking is one of the major risk factor; others include low educational and socioeconomic status, poor oral hygiene, certain drugs, genetic predisposition, male sex and hormonal changes in females.(15,25–27)

Several studies have shown a bidirectional relationship between diabetes and periodontal disease. Diabetes increases prevalence and severity of periodontal disease. It contributes to increased inflammation in periodontal tissues by increasing the deposition of advanced glycation end-products (AGEs) in periodontal tissues, and interactions between AGEs and their receptors cause local immune and inflammatory responses, as well as increased oxidative stress and disruption of the RANKL/OPG axis, which can cause local tissue damage, increased breakdown of periodontal connective tissues, and alveolar bone resorption. As periodontal disease is an infectious disease associated with chronic inflammation, and inflammation has been linked to a decrease in insulin sensitivity, it has the potential to worsen blood glucose control.(1,3,5,29–33)

Multiple studies, including systematic reviews and meta-analyses, cross-sectional and case control studies, found that periodontal disease is significantly more prevalent in type 1 and type 2 diabetic patients, especially those with poor control.(35–40) Furthermore, medical treatment of periodontal disease has been shown to have a modest glycemic benefit in type 2 diabetic patients, though data in type 1 diabetic individuals is limited.(3,5,14)

Smoking, low level of education, male sex, poor oral hygiene practices, increasing age, poor glycemic control, and the use of combination anti-diabetic agents have all been shown in studies to increase risk of periodontal disease in both type 1 and type 2 diabetic patients, with poor oral hygiene contributing to the severity of periodontal damage.(38–41) Furthermore, studies involving type 1 diabetes patients found additional risk factors such as increased annual emergency visits and hospitalizations, diabetes duration, diabetes-related chronic complications (microvascular), hospitalization for hyperglycemia and ketoacidosis, and other comorbidities (Hypertension, dyslipidemia), age, low level of education, and less frequent tooth brushing with poor metabolic control, smoking, and poor oral hygiene contributing to increased severity of periodontal destruction.(50–53)

1.2 Statement of the problem

Prevalence of diabetes is increasing worldwide with major burden in low and middle income countries.(9) Rising prevalence comes with a consequence of increased morbidity and mortality associated with chronic complications of the disease. Diabetes education should include an explanation of the implications of diabetes, particularly poorly controlled diabetes, for oral health, particularly gum disease.(1)

Diabetic care and guideline updates primarily focus on the vascular complications of the disease and oral health is relatively neglected as compared to the traditional associated complications. According to IDF guideline on oral health care, diabetic patients should have annual or biannual

oral health check-ups by a dental professional, be assessed for gum disease symptoms at least once a year, be reminded that inadequate daily dental care is a normal part of diabetes self-management, and be informed about the importance of having regular check-ups.(1)

Despite the fact that a recent study found a low oral health screening status in diabetic patients, studies on the prevalence of periodontal disease in diabetic populations in Ethiopia are limited, and no recent published data are available.(54) A study done in 2000, showed higher prevalence and severity of periodontal disease in diabetic patients while a recent unpublished abstract paper done at 2 public hospitals in Addis Ababa in 2018 also reported 91% prevalence rate in diabetic patients.(55,56)

1.3 Significance of the study

Due to an increased burden of periodontal disease globally and its negative association with metabolic control of diabetes, quality of life and morbidity especially tooth loss, it is prudent to study prevalence in our set up. This study will assess the prevalence and associated factors of periodontal disease, particularly periodontitis in diabetic patients and help improve the quality of diabetic care and the importance of routine oral health care as part of comprehensive diabetic education in order to prevent serious complications of the disease by detecting and treating it early.

Given the reversible nature of some of the factors leading to periodontal disease, providing appropriate education on oral care, routine screening and dental evaluation likely prevents the devastating manifestations of the disease and improve quality of life of diabetic individuals.

1. Literature Review

2.1 Introduction

Noncommunicable diseases (NCDs) or chronic diseases are long-term illnesses caused by a combination of genetic, physiological, environmental, and behavioral factors. Cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes are the most common types of NCD; which account for more than 80% of all premature NCD deaths. According to WHO 2022 report, NCDs kill 41 million people each year, accounting for 74% of all deaths worldwide and disproportionately affect people in low- and middle-income countries, where more than three quarters of global NCD deaths (31.4 million) occur.(2)

Periodontitis and diabetes are two complex, prevalent chronic, noncommunicable diseases that have a well-established bidirectional relationship and pose significant public health challenge in populations worldwide.(3)

It is generally accepted that periodontal disease is more prevalent and more severe in persons with diabetes than in non diabetic individuals. Periodontal signs and symptoms are now considered the "sixth complication" of diabetes following the classic complications.(4)

Diabetes may increase the risk of a variety of oral diseases in addition to periodontitis, such as burning mouth syndrome, gingival overgrowth from concomitant drugs for other comorbidities,

lichenoid mucosal reactions from metformin, and xerostomia, which increases the risk of caries, candidal infections, and chronic mouth ulcers.(5–7)

2.1.1 Diabetes definition & prevalence

Diabetes is a serious, chronic metabolic disease characterized by elevated blood glucose levels caused by the body's inability to produce any or enough of the hormone insulin or to effectively use the insulin that it does produce, resulting in serious damage to the heart, blood vessels, eyes, kidneys, and nerves over time.(8,9)

It is one of the fastest growing global health emergencies of the 21st century with an estimated 537 million adults aged 20–79 years living with the disease in 2021, accounting for 10.5% of the world's population. In addition, 4 out of 5 individuals reside in nations with low and middle incomes. Approximately 6.7 million adults between 20–79 years are estimated to have died as a result of diabetes or its complications in 2021, corresponding to 12.2% of all fatalities in this age group worldwide.(9)

Latest IDF report stated that 24 million people in Africa and 1.9 million people in Ethiopia were living with diabetes in 2021. The same report stated that Ethiopia is among the top 5 countries in Africa in terms of number of people affected with diabetes trailing South Africa, Nigeria and United Republic of Tanzania.(9) According to the 2015 Ethiopian National NCDs STEPS Survey, the prevalence of diabetes mellitus, including those on medication, was 3.2%, with impaired fasting glucose at 9.1% according to ADA criteria and 3.8% according to WHO criteria.(10) According to recent published reports, the prevalence of diabetes in Ethiopia ranged from 2.0%-6.5% in 2019 systematic review, with a low of 2% in smaller rural areas, whereas a 2022 nationwide cross-sectional survey revealed a prevalence of 2.8%, with the Somali region having the highest prevalence (8.7%).(11,12)

2.1.2 Periodontal disease definition and prevalence

Periodontitis is a major cause of tooth loss in adults, as well as nutritional compromise, altered speech, low self-esteem, and a lower overall quality of life. It has also been independently linked to mortality in several different populations.(13,14)

Periodontal disease is a general term used to describe specific diseases that affect the gingiva, as well as the supporting connective tissue and alveolar bone that anchor the teeth in the jaws.(13) It is a bacterial-caused chronic inflammatory disease that affects the tissues that surround and support the teeth, which can result in the destruction of tooth-supporting structures (such as the gingiva, periodontal ligament, and/or alveolar bone) and eventual tooth loss. (15,16) The host response to the bacterial challenge leads to clinical signs such as deep pockets, bleeding on probing, gingival recession, and tooth mobility, which can ultimately cause tooth loss. (16)

The WHO Global Oral Health Status Report (2022) estimated that oral diseases affect close to 3.5 billion people (45%) worldwide, with 3 out of 4 people affected living in middle-income countries. Severe periodontal diseases are estimated to affect around 19% of the global adult population, with over 1 billion cases worldwide.(17) In Africa, oral diseases affected an

estimated 490 million people (43.7% of the population) in 2019 and 44% according to 2023 report. In addition, it was estimated that 22.8% of persons aged 15 years or more suffered from severe periodontal disease that could lead to tooth loss in 2019.(18,19)

Ethiopian Study

Community and institutional-based studies on the prevalence of periodontal disease in Addis Ababa and regional Ethiopian sites revealed a significant burden, with a prevalence ranging from 10.8% to 83%; a recent study (2018) conducted in a single Humanitarian Association on geriatric patients (>=65 years old) revealed a magnitude of 64.8%.(20–24)

2.2 Risk factors for periodontal Disease

Risk factors for periodontal disease can be categorized as modifiable and non modifiable.(15) Smoking is a major modifiable risk factor, others also include low educational level and socioeconomic status (related to poor oral hygiene and health seeking behavior), poor oral hygiene, certain medications (due to effect on decreased salivary flow with consequent dry mouth such as tricyclic antidepressants, atropine, antihistamine, beta blockers while others like phenytoin, cyclosporine, and calcium channel blockers can induce gingival hypertrophy which frequently complicates the appropriate removal of dental plaque underneath the enlarged gingival mass), stress and some systemic diseases. (25–27)

Non modifiable risk factors include genetic predisposition, increasing age (greater periodontal destruction in the elderly is due to lifetime disease accumulation rather than an age-specific condition), male sex (CAL of all levels of severity is generally more prevalent in males than in females; which is thought to be more related to poorer oral hygiene, less positive attitudes toward oral health, and dental-visit behavior) and hormonal changes in females (before menstruation, during ovulation and pregnancy).(15,25–27)

2.3 Diabetes and periodontitis

Diabetes is the most prevalent and well-studied systemic disease that predisposes to periodontitis.(15). Hyperglycemia is associated with a variety of acute and chronic complications and can eventually affect all organs in the body, including gingival and periodontal tissues.(28)

Relationship between periodontal disease and diabetes mellitus appears to be bidirectional. Studies suggest that diabetes increases the prevalence (susceptibility to periodontitis is increased by approximately threefold in people with diabetes), extent and severity of periodontitis particularly if poorly controlled and of long duration; while emerging evidence supports an increased risk for diabetes onset in patients with severe periodontitis. Periodontal inflammation has a negative impact on metabolic control as it contributes to an increased inflammatory burden and increased insulin resistance and treatment has been linked to 0.4% HbA1c reductions in the short term.(5,29–33)

Diabetic patients with severe periodontitis have twice the risk of macroalbuminuria and three times the risk of end-stage renal disease as those without severe periodontitis. Furthermore, the

risk of cardio renal mortality is three times higher (ischemic heart disease and diabetic nephropathy combined).(30)

2.3.1 Pathophysiology linking diabetes and periodontitis

The mechanisms underlying the link between diabetes and periodontitis are not fully understood, but they involve aspects of inflammation, immune function, neutrophil activity, and cytokine biology.(5)

Periodontitis is a chronic inflammatory disease initiated by the buildup of dental plaque biofilm, in which microbial dysbiosis results in a chronic, non-resolving, and destructive inflammatory response. The host's inflammatory response to the bacterial challenge presented by the biofilm is primarily responsible for tissue destruction. Each condition's upregulated inflammation is likely to have a negative impact on the other.(3)

2.3.1.1 Impact of diabetes on periodontitis

Diabetes increases the risk for periodontitis by contributing to increased inflammation in the periodontal tissues. It causes an increase in the deposition of advanced glycation end-products (AGEs) in periodontal tissues, and interactions between AGEs and their receptor (RAGE, the AGE receptor found primarily on macrophages) activate local immune and inflammatory responses. These upregulated responses result in increased secretion of cytokines such as interleukin-1 (IL-1), tumor necrosis factor- (TNF-), and IL-6, as well as increased oxidative stress and disruption of the receptor activator of NF-B ligand/osteoprotegerin (RANKL/OPG) axis. All of these factors cause local tissue damage, increased breakdown of periodontal connective tissues, and alveolar bone resorption, exacerbating periodontitis.(3)

2.3.1.2 Impact of periodontitis on diabetes

Periodontal bacteria and their products, along with inflammatory cytokines and other mediators produced locally in inflamed periodontal tissues, are thought to enter the circulation and contribute to upregulated systemic inflammation. This leads to impaired insulin signaling and insulin resistance, thus exacerbation of diabetes; increased HbA1c levels, in turn, contribute to increased risk of diabetes complications (including periodontitis), creating bidirectional relationship.(3)

There is mechanistic evidence that better diabetes control reduces oxidative stress, improves lipid profiles, and lowers circulating cytokine levels.(14) Systematic reviews and meta-analyses have consistently provided evidence for a clinically meaningful and statistically significant short-term reduction in HbA1C levels in people with type 2 diabetes with reported HbA1C reductions ranging from 0.27% to 0.49% 3-4 months after periodontal therapy, whereas there is insufficient evidence due to a lack of data on the effect of periodontal therapy on HbA1C reduction in type 1 diabetic patients.(3,5,14)

A recent systematic review and meta-analysis of seven RCTs involving 940 type 2 diabetic patients in 2017 found a significant reduction in HbA1C of 0.49% after three months of follow-up and 0.53% at the end of the intervention period; and a significant reduction in fasting plasma glucose level of 8.95 mg/dl in the intervention group after the end of the intervention with non-surgical periodontal treatment.(34)

2.3.1.3 Studies

Studies on type 1 and type 2 diabetes

The majority of periodontal disease prevalence studies used CPI and CPITN; some of them also included CAL to assess presence of periodontal disease.

Recent meta-analyses and systematic reviews of observational and longitudinal prospective studies found an association between peiodontitis and both type 1 and type 2 diabetes. Nascimento et al. reported 86% increase in the incidence or progression of periodontitis among poorly controlled diabetics when compared to non-diabetics or well-controlled diabetics.(35) According to a subsequent report by Zheng et al., the prevalence and severity of periodontitis are higher in diabetic patients than in non-diabetic populations, with prevalences of 67.8% and 35.5%, respectively.(36) Stohr et al.found a 24% increase in the incidence of periodontal disease in diabetics, with a relative risk for incident periodontitis of 1.24 when compared to non diabetic subjects.(37)

A nationwide comparative study in Korea found significantly higher prevalence of periodontal disease of 43.7% in diabetic patients compared to those without diabetes, with smoking, oral pain, and not-using an oral hygiene product being significant risk factors.(38). In addition, in Saudi Arabia, a recent cross-sectional, institution based study indicated that the overall prevalence of periodontal disease was 34.9%, with a prevalence of 7.4% in people with type 1 diabetes and 46.4% in people with type 2 diabetes. In both groups, smoking and aging were risk factors for periodontal disease development. Sex, smoking, and glycemic control did not significantly affect the severity of periodontal disease in either type of diabetes; however, in type 2 diabetic patients, those who were 37 years of age or older had considerably worse periodontal disease than those who were younger than 37.(39)

In Africa, according to recent institution based cross sectional study done in Uganda, prevalence of periodontal disease among both type 1 and type 2 diabetic patients was found to be 85% with lower level of education contributing to greater prevalence.(40) Furthermore, cross sectional study done in Zambia among both type 1 and type 2 diabetic patients, patients 55 years or more and those reporting to brush less than twice per day had significantly higher severity of periodontal disease with deep pockets.(41)

Type 2 Diabetes & periodontitis

Periodontal disease was found to be prevalent in type 2 diabetic patients in a number of studies. Comparative studies involving type 2 diabetic patients showed that type 2 diabetic patients had a higher periodontal disease burden than non diabetic individuals. Studies done in Sudan, Brazil, Nepal, and South Africa found a higher prevalence, as well as increased severity and tooth loss among type 2 diabetic subjects in the later three.(42–45) A cross-sectional study of type 2

diabetic patients in Japan found an association with periodontal disease severity classification using the combination of ABL and hs-CRP.(46)

Institution based cross-sectional studies conducted in Germany, Gullah African Americans (population of African descent in the USA) and India found 60 to100% prevalence of periodontal disease in type 2 diabetic patients. Periodontal disease severity was related to oral hygiene status, and increased periodontal disease severity was associated with poor metabolic control.(47–49) Clinically diagnosed periodontitis was associated with male sex and oral health-related quality of life in the German study.(47).

Type 1 Diabetes & periodontitis

There is also evidence of a link between type 1 diabetes and periodontal disease. In case-control and nationwide comparative studies of type 1 diabetic patients, the prevalence of periodontal disease ranged from 4.7% to 57.9%. Increased annual emergency visits and hospitalizations, increased age, diabetes duration, diabetes-related chronic complications (microvascular), hospitalization for hyperglycemia and ketoacidosis, and other comorbidities (Hypertension, dyslipidemia) were factors associated with an increased prevalence.(50–52) Another cross-sectional study in Bangladesh of type 1 diabetic patients identified factors related with increased prevalence to include increasing age, duration of diabetes, lesser education, and less frequent tooth brushing (once per day).(53) Furthermore, one study found that poor metabolic control, smoking, and poor oral hygiene were associated with an increased risk of severe periodontal destruction.(52)

Studies on prevalence of periodontal disease in Ethiopia

Although diabetes is associated with poor oral health, a recent institution-based cross-sectional study conducted in Addis Ababa found that diabetic patients' oral health screening status was low. A higher educational level, a lower monthly income, a higher frequency of tooth brushing per day, positive perceptions of susceptibility, severity, and benefits, and the presence of malocclusions were factors significantly associated with a higher frequency of oral health screening.(54)

A previous institution-based cross-sectional study done in TASH among diabetic patients 23 years ago found gingivitis in 96.5%, gingival recession in 94.8%, abnormal mobility in 19%, bone loss in 62.1%, with 20.5% of patients losing incisors, 5.9% canine, 17.0% premolar, and 56.6% molar teeth. The mean duration of diabetes was significantly related to oral hygiene, gingival recession, probing depth, and bone loss severity; concluding periodontal diseases were severe and more common in diabetes.(55)

Recent unpublished institution-based cross-sectional study conducted in 2018 at two public hospitals in Addis Ababa, Ethiopia found periodontal disease in 91% of diabetic patients. Periodontal disease was associated with factors such as brushing frequency, brushing technique, malocclusion, and defective fillings.(56)

3 Objectives of the study

3.1 General objective

- To assess prevalence of periodontal disease and associated factors for periodontitis among diabetic patients attending diabetic Clinic in Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

3.2 Specific objectives

- To assess prevalence of periodontal disease among diabetic patients visiting Tikur Anbessa Specialized Hospital in Addis Ababa, Ethiopia
- To assess associated factors that may contribute to periodontitis
- To compare glycemic status of those with and without periodontitis among the studied population
- To assess associated comorbidities and chronic complications of diabetes with relation to periodontal status specifically periodontitis
- To assess extent of involvement of periodontitis
- To assess clinical attachment loss and associated factors contributing to severity.

4 Methodology

4.1 Study Area

This study was carried out at Tikur Anbessa Specialized Hospital's diabetic clinic, the largest tertiary referral hospital in Addis Ababa, Ethiopia and also the main teaching hospital for Addis Ababa University's College of Health Sciences. Its diabetic clinic serves patients on three working days of the week, with an average of 200 to 220 patients visiting the clinic each week. The hospital has been using a digital recording system to store and retrieve clinical data and other essential patient information since 2018.

4.2 Study time

The study was conducted from June 1, 2023 to July 31, 2023

4.3 Study Design

A prospective cross sectional study design was used to assess prevalence of periodontal disease & associated factors for periodontitis among diabetic patients

4.4 Source and Study population

4.4.1 Source Population

All type 1 and type 2 diabetic patients who attended the diabetic clinic in TASH, Addis Ababa Ethiopia

4.4.2 Study Population

Randomly selected type1 and type 2 diabetic patients who attended the diabetic clinic for clinical follow up in TASH during the study period.

4.5 Eligibility criteria

4.5.1 Inclusion criteria

All Diabetic patients on follow up (new or existing, type 1 and type 2) in the diabetic follow up clinic:

- Age 18 and above
- Willing to participate in the study and sign consent form

4.5.2 Exclusion criteria

- Unwilling to participate in the study or seriously ill
- Pregnant patients
- On antibiotics for related or unrelated illness
- History of periodontal treatment in the last 6 months
- Those patients with incomplete medical records.

4.6 Sample Size Determination

- The least sample size (n) required for the study was calculated using the formula to estimate a single population proportion for prevalence of periodontal disease.

$$n = \frac{Z_{\frac{\alpha}{2}}^{2} P (1 - P)}{d^{2}}$$

Where;

n = required sample size

P = Proportion = 50%

d = margin of error= 5%

$\mathbf{Z_{\alpha/2}}$ **=** critical value for normal distribution at 95% confidence interval= 1.96 ($\alpha = 0.05$).

Remarks:

- ✓ Although there is unpublished abstract paper with similar study focus done in Addis Ababa, Ethiopia in 2018, the whole study paper is not available though reported prevalence was 91% (which will make the sample size determination of 126) .(56)

A study published in 2022 in Uganda was used to calculate sample size for this research, as Uganda is one of the south eastern African countries that may have the same socio demographic as well as economic status as ours; study was done in one of the national referral centers in the capital city and involved both type 1 and type 2 patients, with a reported prevalence of 85%.(40)

So, $\mathbf{n = \frac{(1.96)^2 * (0.85)(1-0.85)}{(0.05)^2} = 196}$

Taking 10% non-responders rate, the study would require a total sample size of **216**.

- For associated factors, double proportion formula using openEpi for unmatched case-control studies was used.(57)

Sample size calculation for the associated factors:

Variables	CI	Power	Unexposed: exposed	Control With exposure (%)	Cases With exposure (%)	OR	Sample Size	Reference
Smoking (T1DM)	95%	80	1	5.8	33.3	8.2	78	(39)
Smoking (T2DM)	95%	80	1	37.7	78.7	2.1	54	
Age (T2DM)	95%	80	1	15.3	23.5	4	104	
Tooth brushing behavior	95%	80	1	7	82.4	0	16	(58)
Income (GDP)	95%	80	1	0	56.7	0	24	
Gender (Male)	95%	80	1	19.5	47.4	0	102	
Educational status	95%	80	1	76.2	97.3	10.77	100	(40)
Experience of oral pain	95%	80	1	31.5	50.4	2.383	194	(38)

• A final sample size of 216 was used because it was the largest when compared to associated factor determinations.

4.7 Sampling Techniques and Procedures

4.8 Study Variables

4.8.1 Dependent/outcome Variables

- Prevalence of periodontal disease & periodontitis among diabetic patients attending Tikur Anbessa Specialized Hospital
- Clinical attachment loss

4.8.2 Independent/ Explanatory Variables

- Sociodemographic variables: age, sex, educational status, marital status, occupation, monthly household income, religion and residence
- Oral hygiene status: habit of tooth brushing, frequency and mode of cleaning, use of tooth paste for cleaning, other agents used for cleaning, frequency of replacement of tooth brush, flossing, missed/loose tooth, bleeding on brushing and self perception of gum health
- Life style factors: cigarette smoking, alcohol use, dietary habits (consumption of simple sugars and carbonated drinks)
- Clinical and laboratory measures: type of diabetes, duration of diabetes, glycemic control/ status (FBS & HgA1C) , current medications, possible diabetes related complications and comorbidities, common non anti hyperglycemic agents, BMI, BP, waist circumference, lipid profile.

4.9 Data collection

Face to face interview method was used, with a structured electronic questionnaire using KOBO adapted from "WHO STEPS Instrument for Chronic Disease Risk Factor Surveillance" for socio-demographic characteristics and "WHO oral health surveillance" for oral hygiene status.(59,60) The questionnaire was written in English and translated into Amharic. To ensure consistency, the Amharic version was back-translated into English. Before data collection, the questionnaire was reviewed for understandability, clarity, and how well it addressed the study's objective.

Data on clinical and laboratory profiles of the participants was obtained through review of electronic medical records and anthropometric measurements by trained dental interns, nurses & principal investigator. The data was collected by trained dental interns and was supervised by the principal investigator. The training of data collectors was done over 1 day.

After patients completed their follow-up visits at TASH's medical outpatient clinic, the data was collected in the dental clinic on the same building to the outpatient diabetic clinic. This was followed by comprehensive dental examination by 3 dental interns, each supervised by experienced senior dentists (Doctors Of Dental Surgery) using calibrated WHO periodontal probe, mouth mirror, dental light source to determine bleeding on probing, periodontal pocket depth (measured at 6 sextants of each tooth except for the 3rd molars, then the largest score at each tooth was taken for recording) as well as CAL (measured at 6 sextants of the index teeth with the largest score taken). Recording was done on a format provided using "WHO oral health surveillance"(60) and the participants were categorized based on their CPI results.

4.10 Data Quality Control

Maximum effort was applied to ensure data quality. All data was checked for accuracy, completeness and consistency at the end of each day by the PI, and any identified errors will be corrected in real time.

4.11 Data Processing and Analysis

Following data collection, each completed form was checked for completeness and exported to STATA Version 14 for analysis. All continuous variables were summarized using means and standard deviations or medians and inter-quartile ranges, while categorical variables were summarized using proportions or percentages. Prevalence was reported with 95% confidence intervals. Bivariate analysis was performed to identify potential risk factors for periodontitis and CAL. Variables with P<0.25 on bivariate analysis were entered on multivariate logistic regression to identify independently associated factors affecting periodontitis & CAL. The significance of Odds Ratio (OR) was determined with 95% CI and P value of less than 0.05.

4.12 Ethical Considerations

The ethical clearance was obtained from the department of internal medicine Institutional Review Board. Written informed consent was obtained from each patient. All data collected were maintained confidential.

4.13 Operational Definitions

1. Periodontal disease: A chronic inflammatory disease caused by bacteria that affects the tissues that surround and support the teeth, leading to the destruction of tooth-supporting structures (such as the gingiva, periodontal ligament, and/or alveolar bone). (15,16)

- ✓ Encompasses gingivitis and periodontitis

2. Community Periodontal Index (CPI): is a tool used to assess the periodontal health of a population or community. It is a standardized way of measuring the prevalence and severity of periodontal disease and gingivitis.

- ✓ The Modified Community Periodontal Index (mCPI) is a modification of the original CPI that is used to assess population periodontal health.
- ✓ The mCPI employs a scoring system to classify individuals' periodontal health status based on the presence and severity of periodontal disease.
- ✓ The Modified CPI classifies periodontal disease into five categories based on the CPI score and the presence or absence of clinical attachment loss.

The classification of the mCPI scores(60)

Codes and criteria for Community Periodontal Index (CPI) modified in 2013 by WHO	**Definitions used in this study:**
Gingival Bleeding (All Teeth Present) 0: Absence of condition 1: Presence of condition 9: Tooth excluded X: Tooth not present **Periodontal Pocket (All Teeth Present)** 0: Absence of condition 1: Pocket 4–5 mm 2: Pocket >6 mm 9: Tooth excluded X: Tooth not present **Loss of Attachment (6 Index Teeth)** 0: 0–3 mm 1: 4–5 mm (CEJ within black band) 2: 6–8 mm (CEJ between upper limit of black band and 8.5 mm ring) 3: 9–11 mm (CEJ between 8.5 and 11.5 mm ring) >12 mm (CEJ beyond 11.5 mm ring) X: Excluded	**Severity classification based on CAL** **No CAL**: 0-3 mm **Mild to moderate CAL (CAL-1)**: 4-5 mm **Severe CAL (CAL ≥2)**: ≥6 mm **Chronic periodontitis classification** ✓ **Localized:** affecting ≤ 30% of sites ✓ **Generalized**: affecting >30% of sites **Pocket depth**: ✓ **No pocket**: 3 mm or less ✓ **Shallow pocket**: 4-5 mm ✓ **Deep pocket**: 6 mm or more

Case Definitions for Population-Based Surveillance of Periodontitis CDC–AAP case definitions(61,62)

Case	**Definition**
No periodontitis	No evidence of mild, moderate, or severe periodontitis
Mild periodontitis	≥2 interproximal sites with AL ≥3 mm, and ≥2 interproximal sites with PD ≥4 mm (not on same tooth) or one site with PD ≥5 mm
Moderate periodontitis	≥2 interproximal sites with AL ≥4 mm (not on same tooth), or ≥2 interproximal sites with PD ≥5 mm (not on same tooth)
Severe periodontitis	≥2 interproximal sites with AL ≥6 mm (not on same tooth) and ≥1 interproximal site with PD ≥5 mm

3. Oral hygiene practice

- ✓ Good oral hygiene: Brushing twice daily; replacing tooth brush every 3 months; use of tooth paste for cleaning; with or without flossing
- ✓ Poor oral hygiene: irregular brushing or no brushing, less than once daily; irregular replacement of tooth brush (>6 months); not using tooth paste for cleaning
- ✓ Fair oral hygiene: Brushing at least once daily; replacing tooth brush every 4-6 months; anything in between good & poor oral hygiene practice

4.14 Dissemination of research finding

The results of the study will be presented to Addis Ababa University, college of medicine and health science and department of Internal Medicine as well as Endocrinology and metabolism unit. The finding of this research will be disseminated to concerned bodies. Thereafter, the manuscript will be sent for publication on peer-reviewed journal.

5. Results

5.1 Sociodemographic characteristics & life style factors

This study enrolled 216 diabetic patients, 56.9% (123/216) of whom were females and 43.1% (93/216) were males. The mean age of the participants was 54.5±12.2 years (range 20-82) with 46.8% (101/216) between the ages of 50 and 64. 81.5% (176/216) were married, whereas 11.1% (24/216) were single and 7.4% (16/216) were divorced/widowed. 3.7% (8/126) had no formal education and 96.3% (208/216) had some type of formal education, with 24.5% (53/216) having higher level of education (college and beyond).
The majorities (72.69 %) were orthodox Christians, 95.4% (206/216) lived in the country's urban/ semi-urban areas. 28.2% (61/216) had a monthly household income of 2000 ETB or less, whereas 23.6% (51/216) had a monthly household income of more than 6000 ETB. The majority of participants (32.4%) were housewives while 28.2% were self-employed or had a private business, 26.4% worked as a government employee, 8.8% were retired and 4.2% were students or unemployed. Only 3 patients (1.4%) were smokers (all were active smokers) and 4.6% (10/216) were taking alcohol regularly once a week and more, with 10.2% (22/216) consuming 2 or more drinks in the previous 30 days.

Table 1. Sociodemographic characteristics and life style factors (N-216)

Variables		Number	Percentage
Sex	Male	93	43.1
	Female	123	56.9
Age (Years)	20-34	13	6
	35-49	53	24.5
	50-64	101	46.8
	65+	49	22.7
Age (Years)	**Mean**: 54.5 (±12.2)		
Marital status	Single	24	11.1
	Married	176	81.5
	Divorced/widowed	16	7.4
Educational status	No formal education	8	3.7
	Primary school	63	29.2
	Secondary & Preparatory school	92	42.6
	college diploma or 1st Degree	40	18.5
	Post graduate (2nd degree & above)	13	6
Religion	Orthodox Christian	157	72.69
	Muslim	23	10.65
	Protestant Christian	25	11.57
	Catholic Christian	2	0.93
	Other	9	4.17
Residency	Urban/semi urban	206	95.4
	Rural	10	4.6
House hold monthly income (ETB)	<=2000	61	28.2
	2001-4000	60	27.8
	4001-6000	44	20.4
	>6000	51	23.6
Occupation	House wife	70	32.4
	Private business/ self employed	61	28.2
	Government employee	57	26.4
	Retired	19	8.8
	Student & unemployed	9	4.2
Smoking	Yes	3	1.4
	No	213	98.6
Current alcohol use (2 or more drinks/day)	Yes	22	10.2
	No	194	89.8

5.2 physical characteristics & glycemic profile

5.2.1 Physical characteristics

In this study, 31.9% (69/216) of the study subjects had a normal BMI, 43.1% (93/216) were overweight, and 25% (54/216) were obese. Furthermore, the median waist circumference of the study population was 99 cm (IQR: 93-107 cm), with 69.4% of participants, 85.4% females (105/123) and 49.4% males (45/93) meeting the WHO criteria for central obesity, defined as a waist circumference >94 cm for males and >80 cm for females. The mean systolic BP was 136.2 ±17.8 mmHg and the mean diastolic BP was 79.6±9.6 mmHg, with 77.8% (168/216) of the participants having raised BP >=130/80 mmHg of either/both of systolic and diastolic BP. In terms of lipid profiles and statin use, 84.7% (183/216) were on statin and median total cholesterol was 139.5 mg/dl (IQR: 113.2-165.2); median triglyceride was 114 mg/dl (IQR: 79-163); mean HDL was 42.2±10.6 and mean LDL was 84.2± 30.6 mg/dl. The proportion of participants having optimal targets according to ADA, specific for the diabetic population were 94.4% (total cholesterol), 69.4% (triglyceride), 32.4% (HDL) (with 22.8% females and 45.2% males), 69.9% (LDL <100) and 36.1% (LDL<70) mg/dl.

5.2.2 Glycemic profile

The median plasma FBS level was 147 mg/dl (IQR: 120-192 mg/dl), with 32.4% (70/216) of the participants having FBS ≤130 mg/dl and 67.6% (146/216) having FBS >130 mg/dl (52% with FBS 131-180 mg/dl and 49% with FBS >180 mg/dl). Average HgA1C over the past 6 months was available for 79.2% (171/216) of the subjects and the median value was 8% (IQR: 6.9-9.3%) with 25.7% (44/171) having HgA1C< 7% and 74.3% (127/171) having HgA1C ≥7% (52% with HgA1C 7-8.5% and 49% with HgA1C >8.5%).

Table 2. Physical characteristics and laboratory profile of the study participants

Variables			Number	Percentage
BMI	Normal		69	31.9
	Overweight		93	43.1
	Obese		54	25
Waist circumference	Normal		66	30.6
	Abnormal (Raised)		150	69.4
Waist circumference (stratified by gender)	Male	Normal	49	51.6
		Abnormal	45	49.4
	Female	Normal	18	14.6
		Abnormal	105	85.4
Plasma FBS (mg/dl) (stratified)	≤130		70	32.4
	131-180		76	35.2
	> 180		70	32.4
HgA1C (%) (stratified)	<7		44	25.7
	≥ 7		127	74.3
	✓ 45 missed/not done			

Variables		Mean (±SD) & Median (with IQR)
Body habitus	Weight (kg)	**Mean:** 72.2 (±13.3)
	Height (cm)	**Mean:** 162.7 (±9.3)
Waist circumference (cm)	**Median**: 99 (IQR:93-107)	
Blood pressure (mmHg)	SBP	**Mean:** 136.2 (±17.8)
	DBP	**Mean:** 79.6 (±9.6)
Lipid panel	Total cholesterol	**Median:** 139.5 (IQR:113.2-165.2)
	Triglyceride	**Median:** 114 (IQR:79-163)
	HDL Cholesterol	**Mean:** 42.2 (±10.6)
	LDL Cholesterol	**Mean:** 84.2 (±30.6)
Plasma FBS (mg/dl)	**Median**: 147 (IQR:120-192)	
HgA1C (%)	**Median:** 8 (IQR:6.9-9.3)	

5.3 Clinical characteristics

5.3.1 Diabetes status

86.1% (186/216) of the participants were having type 2 diabetes and 13.9% (30/216) having type 1 diabetes. The mean duration of diabetes was 12.8 years with 51.9% having the disease for more than 10 years, 22.7% for 6-10 years and 25.5% for 5 years and less. 99% (214/216) were on anti diabetic agents, with 37.9% (81/216) on monotherapy (44.4% on oral agent and 55.6% on insulin), 62.1% (133/216) on combination therapies (40.6% were on combination oral agents and 59.4% on oral agent in combination with insulin). 21% (45/216) of the subjects were on insulin alone. Metformin (77.6%) was the most common medication, followed by insulin (57.9%), sulphonylureas (22.9%), SGLT-2 inhibitors (15%), and DPP4-inhibitors (2.8%).

Table 3 Clinical characteristics of the study participants (N-216) (Diabetes status)

Variable		Number	Percentage
Type of diabetes	Type 1	30	13.9
	Type 2	186	86.1
Duration of diabetes	<=5 years	55	25.5
	6-10 years	49	22.7
	10+ years	112	51.9
Medications for diabetes	Yes	214	99.1
	No	2	0.9
Diabetes medications	Monotherapy (either oral agent or insulin)	81	37.9
	Combination (any type)	133	62.1
Diabetes medications (stratified)	Oral agent monotherapy	36	16.8
	Insulin monotherapy	45	21
	Combination oral agents	54	25.2
	Oral agent/s and insulin combination	79	37
Type of diabetes medications	Metformin	166	77.6
	Sulphonylurea	49	22.9
	DPP4-I	6	2.8
	SGLT2-I	32	15
	Insulin	124	57.9

5.3.2 Documented diabetic complications and comorbidities

Regarding documented diabetic complications, diabetic retinopathy was found in 25.9% (4.6%/10 patients were not screened), chronic kidney disease in 21.8% (8.8%/19 patients were not screened) and peripheral neuropathy in 23.6%. Concomitant comorbidities and macrovascular complications were present in 87% (188/216), 40% had single comorbidity while 60% had 2 or more comorbidities. Among the comorbidities, hypertension accounted for the majority (63.4%), followed by IHD (8.8%), RVI (5.6%), PAD (3.7%), and cerebrovascular disease (3.2%).

85.6% (184/216) were taking other medications for comorbidities, with ACE-I/ARBS (58.3%) being the most commonly used, followed by calcium channel blockers (41.3%), aspirin (27.3%), amitriptyline (22.3%), thiazide diuretics (13.9%), and beta blockers (12%).

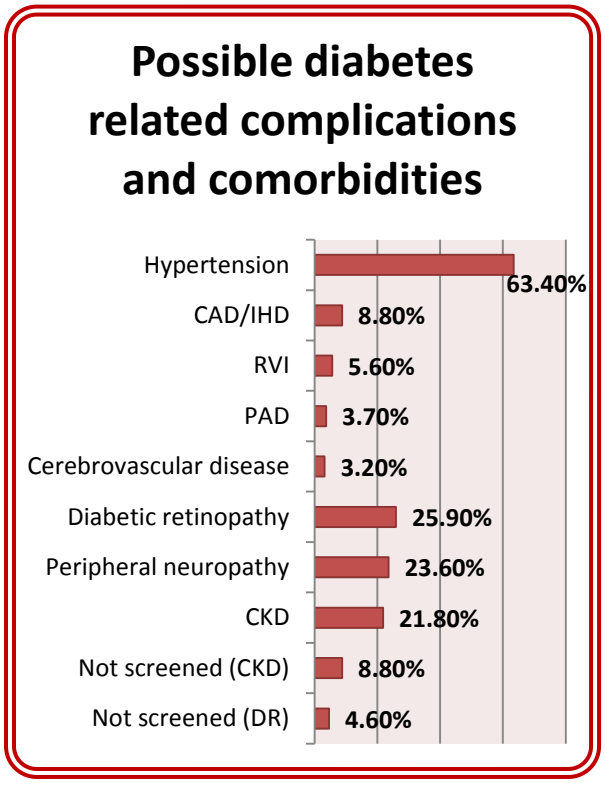


Figure 1. Possible diabetes related complications & comorbidities

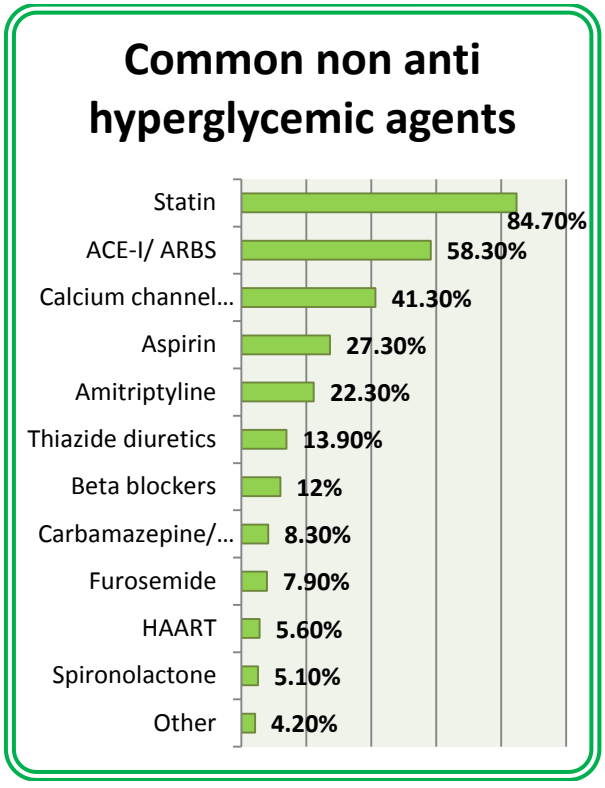


Figure 2. Common non antihyperglycemic drugs

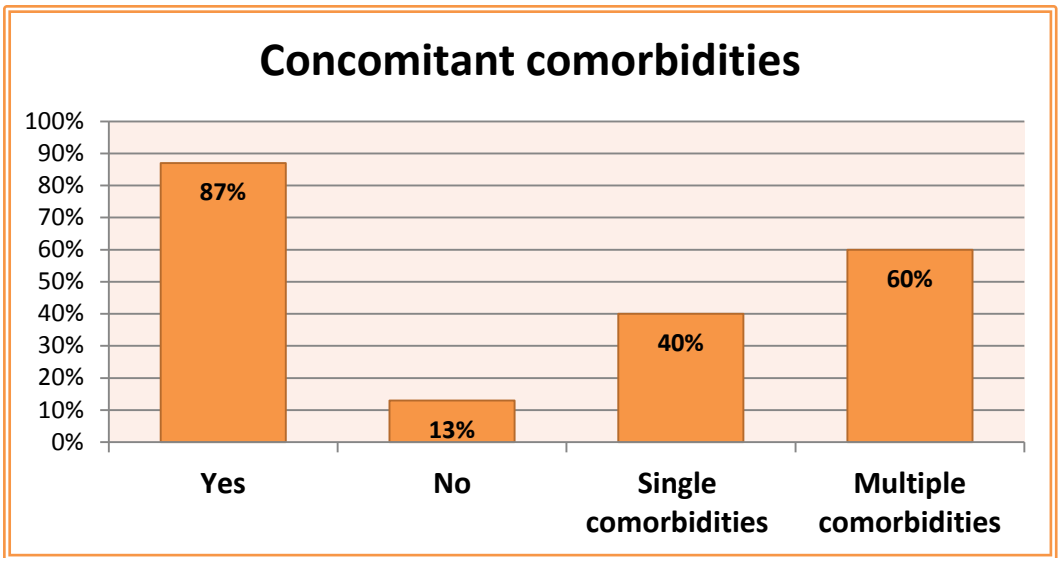


Figure 3. Presence of comorbidities

5.4 Oral health practice

44.4% (96/216) of study participants had habit of regular teeth cleaning (at least once per day), while 55.6% (120/216) did not (either irregular/ none). The majority (49.1%) practiced poor oral hygiene, whereas 46.8% and 5.1% practiced fair and good oral hygiene, respectively. Among the 96.3% (208/216) who cleaned their teeth either regularly or irregularly, 52.4% cleaned irregularly, 35.1% once daily, and just 12.5% twice daily as recommended by dental health professionals. 75.9% of the participants used a tooth brush for cleaning, 67.1% used a wooden piece cleaner, and 45.8% utilized both. Agents such as stekini, charcoal, and gauze/cotton were used for cleaning by 49.2%, 0.9%, and 4.6% of participants, respectively. 33.5% replaced their toothbrushes every 3 months or less, 30.5% replaced them every 4-6 months, and 36% replaced them more than 6 months or never. Vertical brushing was used by 28% and horizontal/semicircular brushing was used by 72%. 72.2% (156/216) of the participants used tooth paste for cleaning.

Only 7% of participants had habit of flossing (1 participant flossed twice daily and 14 flossed irregularly), while 63.4% did not floss and 29.6% were unfamiliar with flossing.

55.8% (116/208) reported bleeding when brushing, 60.2% thought their gums were in good condition, 25.9% thought their gum health was poor, and 13.9% couldn't tell. 81% reported no or seldom consumption of simple sugars and carbonated drinks, while 19% consumed them frequently once a week or more.

Dentures were worn by 13% of the participants, with 71.4% being fixed and 28.6% being removable. Non-traumatic tooth loss affected 69.9% (151/216), with tooth decay (74.2%), spontaneous tooth loss (26.5%), and previously diagnosed periodontal disease (12.2%) being the most common causes. The median number of teeth lost was 2 (IQR: 1-15), while the maximum tooth lost was 24.

Table 4. Oral hygiene status & practice (N-216)

Variable		Number	Percentage
Habit of regular tooth brushing	Yes	96	44.4
	No	120	55.6
Oral hygiene practice	Poor	104	49.1
	Fair	101	46.8
	Good	11	5.1
Frequency of brushing	Irregular/occasional (less than once a day)	109	52.4
	Once per day	73	35.1
	Twice/ more per day	26	12.5
Mode of brushing/cleaning	Tooth brush (1)	164	75.9
	Traditional stick/ wooden piece cleaner(2)	145	67.1
	Both* (1 & 2)	99	45.8
	Charcoal	10	4.6
	Tooth picks	104	49.2
	Gauze/cotton	2	0.9
Other agents used for cleaning	Ginger	3	1.4
	Salt	5	2.3
	Lemon	16	7.4
Way of tooth brushing	Horizontal/semi circular	149	72
	vertical	58	28
Flossing	Yes	15	7.0
	No	137	63.4
	Not familiar	64	29.6
Frequency of replacing tooth brush	Not replacing regularly (>6 months)	59	36.0
	Every 4 to 6 month	50	30.5
	Every 3 month	55	33.5
Use of tooth paste	Yes	156	72.2
	No	60	27.8
Bleeding on brushing	Yes	95	44
	No	113	52.3
	Didn't brush at all	8	3.7

Variable		Number	Percentage
Missed/loose tooth (non traumatic)	Yes	151	69.9
	No	65	30.1
Number of missed teeth	**Median:** 2 (IQR:1-15) (Maximum:24)		
Cause of tooth loss	Spontaneous	39	26.5
	Tooth decay	109	74.2
	Prior diagnosed periodontal disease	18	12.2
	Other	6	4.1
*Other- wisdom teeth impaction; biting on hard food; after presenting with tooth pain			
Dentures	None	188	87
	Fixed denture	20	9.3
	Removable denture	8	3.7
Self perception of gum health	Don't know/ can't describe	30	13.9
	Poor	56	25.9
	Good	109	50.5
	Very good	21	9.7
Habit of simple sugar intake & carbonated drinks	Frequent	41	19
	None/infrequent	175	81

5.5 Periodontal status

5.5.1 Prevalence of periodontal disease of the study subjects

In this study, the prevalence of periodontal disease among diabetic patients was 100%, with all subjects having either gingivitis or periodontitis. In terms of its individual components, the prevalence of gingivitis was 98.6% (95% CI 0.97, 1) and periodontitis was 91.7 (95% CI 0.88, 0.95). From those who had periodontitis, 63.6% had generalized periodontitis (>30% of sites affected) while 36.4% had localized periodontitis (30% or less of sites affected). Participants with shallow pockets comprised 63.6% of the total, whereas participants with deep pockets comprised 36.4%. Clinical attachment loss was detected in 91.2% of the subjects, with 47.2% having mild to moderate clinical attachment loss, 44% having severe clinical attachment loss, and 8.8% having none.

Table 5 Periodontal disease status and severity (N-216)

Variables			Number	Percentage (%)	95% CI
Periodontal disease (Either Gingivitis or periodontitis)			216	100	
Periodontal disease	Gingivitis	Yes	213	**98.6**	(0.97, 1)
		No	3	1.4	
	Periodontitis	Yes	198	**91.7**	(0.88, 0.95)
		No	18	8.3	
Periodontitis (Extent)	Localized periodontitis		72	36.4	
	Generalized periodontitis		126	63.6	
Periodontitis (Depth)	Mild/Moderate (shallow pocket)		126	63.6	
	Severe (deep pocket)		72	36.4	
Clinical attachment loss	No attachment loss		19	8.8	
	Mild/Moderate		102	47.2	
	Severe		95	44	

5.5.2 Association of risk factors with periodontitis and generalized periodontitis

The bivariate analysis included all sociodemographic and behavioral factors, clinical characteristics, glycemic status, medication related factors, and oral health status/practice; variables with $p<0.25$ on the bivariate analysis were entered into multivariate logistic regression to identify independently associated factors affecting periodontitis (backward regression analysis was done to identify variables with significant association on multivariate analysis). Age (AOR=1.06), use of combination antihyperglycemic medications (either combination oral or combination oral & insulin) (AOR=4.85), spironolactone use (AOR-0.21), presence of dentures (AOR-0.34), and bleeding on brushing (AOR-6.6) were factors associated with periodontitis. The risk of developing periodontitis increases by 6% for every year of age. Furthermore, diabetic participants on combination antihyperglycemic agents were 4.85 times more likely to develop periodontitis, and those who experienced bleeding when brushing were 6.6 times more likely to have periodontitis. Participants using spironolactone, on the other hand, had 21% lower odds of having periodontitis, while those wearing dentures had a 34% reduction in risk of developing periodontitis.

Gender (AOR-2.4), flossing (AOR-4.1), and poor self perception of gum health (AOR-2.82) were variables associated with the probability of developing generalized periodontitis on multivariate analysis. When compared to females and participants with flossing experience, males were 2.4 times more likely to have generalized periodontitis and those who did not floss were 4.1 times more likely to have generalized periodontitis respectively. Furthermore, diabetic participants who self perceived poor gum health were 2.82 times more likely to have generalized periodontitis than those who self perceived good/ very good gum health status.

Table 6. Bivariate and multivariate analysis of study subjects for identifying Risk factors of periodontitis (N-216)

Characteristics	N (%)	Periodontitis			
		COR (95% CI)	p value	AOR (95% CI)	p value
Age	**Mean:** 54.5 (±12.2)	1.049	**0.017**	1.06 (1.01-1.11)	**0.014**
Type of diabetic drugs	**Monotherapy (either oral agent or insulin)**	1		1	
	Combination (any type)	4.75 (1.6-13.9)	**0.004**	4.85 (1.3-17.9)	**0.018**
Spironolactone	**No**	1		1	
	Yes	0.21 (0.05-0.88)	**0.032**	0.1 (0.014-0.78)	**0.028**
Presence of dentures	**No**	1		1	
	Yes	0.34 (0.11-1.05)	0.06	0.16 (0.04-0.65)	**0.01**
Bleeding on brushing	**No**	1		1	
	Yes	6.6 (1.5-29.7)	**0.014**	7.1 (1.5-34.5)	**0.015**
	Doesn't brush at all	0.4 (0.08-2.31)	0.322	0.33 (0.03-3.29)	0.347

- Shown are only variables which showed significant association with p value <0.05
- Additional variables which showed significance on bivariate analysis: Metformin use and taking other drugs for comorbidities

Table 7. Bivariate & Multivariate analysis of study subjects for identifying risk factors for generalized chronic periodontitis (N-216)

Characteristics	N (%)	Generalized chronic periodontitis			
		COR (95% CI)	p value	AOR (95% CI)	p value
Gender	**Female**	1	**0.000**	1	**0.032**
	Male	3.05 (1.7-5.4)		2.4 (1.08-5.36)	
Flossing	**Yes**	1		1	
	No	4.25 (1.3-13.8)	**0.016**	4.1 (0.04-1.04)	**0.044**
Self perception of gum health	**Good/ very good**	1		1	
	Poor	2.7 (1.5-4.8)	**0.001**	2.82 (1.25-6.38)	**0.013**
*Shown are only variables which showed significant association with p value <0.05					

5.5.3 Association of risk factors with clinical attachment loss (periodontitis severity)

Ordinal logistic regression was used to analyze related factors for periodontitis severity based on CAL, prediction probability and model accuracy was checked. Age, gender, occupation, educational status, income, comorbidities, microvascular complications, diabetes duration, oral hygiene status, BMI, and drugs were all variables included. Furthermore association of severity with glycemic profile was analyzed.

Only age (AOR-5.3) and Gender (AOR-3.5) were variables significantly associated with severity. Age 40 years or older was associated with a 5.3-fold higher risk of clinical attachment loss severity, indicating that advancing age is a significant determinant for increased severity. When compared to females, males had a 3.5 times higher risk of severe clinical attachment loss.

Table 8. Ordinal logistic regression & predictive margins of associated factors of periodontitis severity (based on CAL) (N-216)

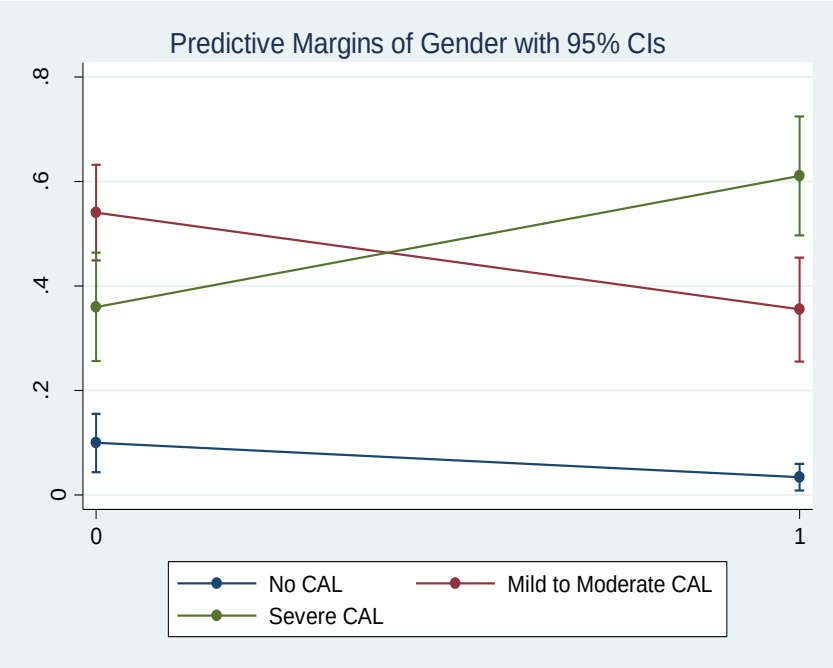
Variables	N (%)	Clinical attachment loss (severity)	
		AOR (95% CI)	p value
Gender	**Female**	1	
	Male	3.5 (1.4-8.7)	**0.007**
Age (Years)	**<40**	1	
	≥ 40	5.3 (1.4-20)	**0.013**

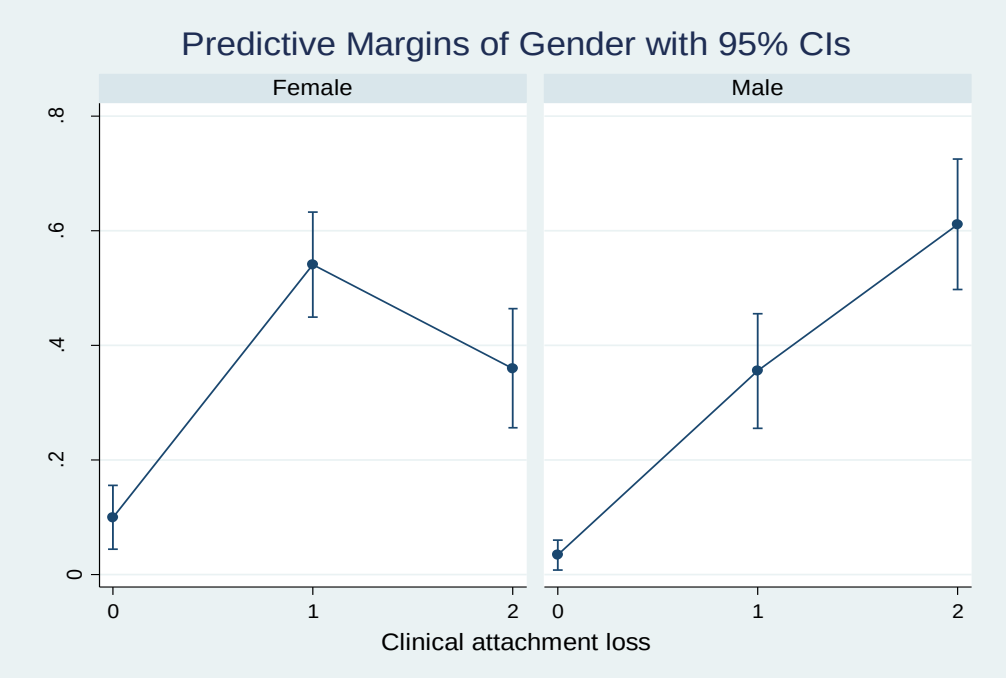
Table 9. Predictive margins of Age

	Delta-method					
	Margin	Std. Err.	z	P>|z|	[95% Conf. Interval]	
predict#Age40cutoff						
1 0	.217317	.0926669	2.35	0.019	.0356932	.3989408
1 1	.0615056	.0163541	3.76	0.000	.0294522	.093559
2 0	.576117	.0465158	12.39	0.000	.4849477	.6672863
2 1	.4422004	.0344073	12.85	0.000	.3747633	.5096374
3 0	.206566	.0860792	2.40	0.016	.0378539	.375278
3 1	.496294	.0339906	14.60	0.000	.4296737	.5629144

Table 10. Predictive margins of Gender

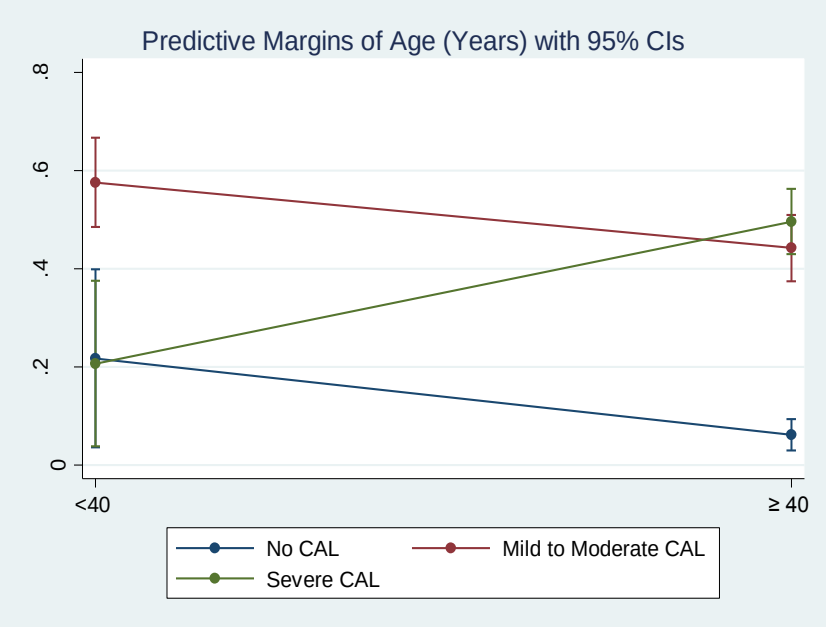
	Delta-method					
	Margin	Std. Err.	z	P>|z|	[95% Conf. Interval]	
predict#Gender						
1 0	.0998793	.0284917	3.51	0.000	.0440365	.1557221
1 1	.0339433	.0132087	2.57	0.010	.0080547	.0598319
2 0	.5403399	.0467293	11.56	0.000	.4487522	.6319276
2 1	.3550878	.0508905	6.98	0.000	.2553442	.4548314
3 0	.3597808	.0528688	6.81	0.000	.2561598	.4634018
3 1	.6109689	.0582503	10.49	0.000	.4968004	.7251374

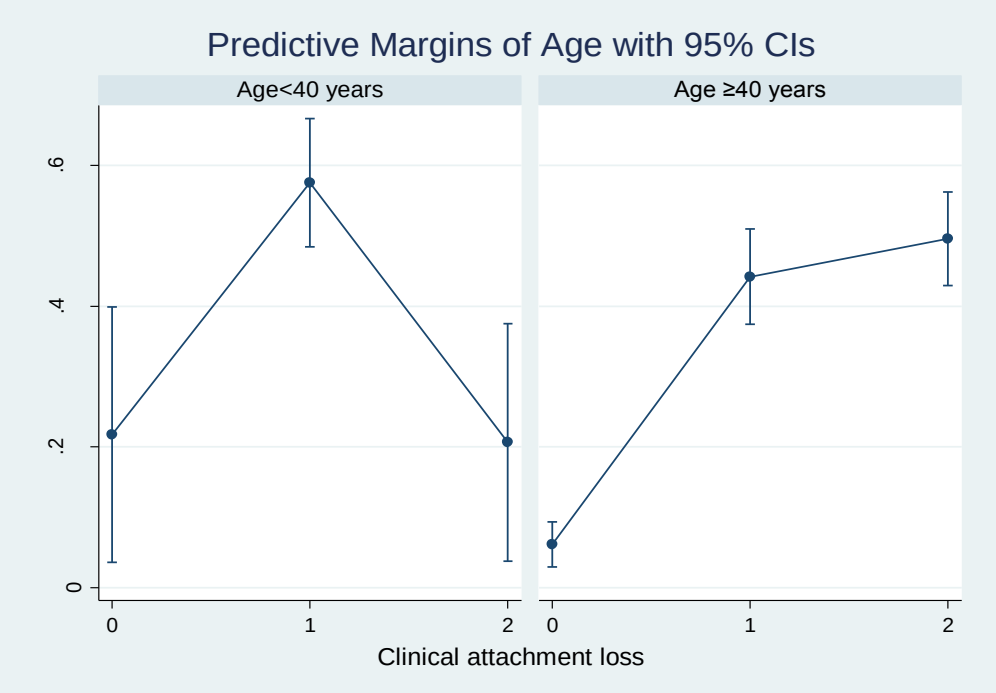




Outcome 0- no CAL
Outcome 1- Mild to Moderate CAL
Outcome 3- Severe CAL

Figure 4. Predictive margins of gender & periodontitis severity (based on CAL)





Outcome 0- no CAL
Outcome 1- Mild to Moderate CAL
Outcome 3- Severe CAL

Figure 5. Predictive margins of age & periodontitis severity (based on CAL)

6. Discussion

Diabetes and periodontal disease are two of the most prevalent noncommunicable diseases. Periodontal disease affects the majority of the world's population, with gingivitis, an earlier and reversible form of the illness, affecting 50%-90% of the adult population worldwide. All periodontal soft and hard tissues are harmed by hyperglycemia. People with diabetes mellitus, particularly those with poorly controlled diabetes, have more gingivitis, a higher prevalence, severity, and progression of periodontitis, and have lost many more teeth as a result of unmanaged periodontitis.(63)

Due to limited recent published studies, this study aimed to assess the prevalence of periodontal disease and associated factors for periodontitis among diabetic patients. The findings of this study revealed a high prevalence of periodontal disease, which was significantly associated with increasing age, use of combination anti hyperglycemic agents and bleeding on brushing, whereas Spironolactone use and presence of dentures were associated with a lower risk.

In this study, the prevalence of periodontal disease was 100%, with 98.6% of participants having gingivitis and 91.7% having periodontitis, underscoring the importance of appropriate management and preventive interventions. In terms of type of diabetes and periodontal disease, 83.3% of type 1 diabetic subjects had periodontitis while 100% had gingivitis; 93% of type 2 diabetic subjects had periodontitis while 98.4% had gingivitis. This prevalence is higher than the recent metanalysis (35,36); as well as in studies conducted in Korea (43.7%), Saudi Arabia (34.9%), South Africa (68.3%-gingivitis, 56.7%-periodontitis), Uganda (85%) and Addis Ababa (91%-unpublished data).(38–40,56,64) When compared to studies done specifically in type 2 diabetic patients, prevalence of periodontitis is higher than study done in Germany (56.7%) while it corresponds with study done in India (95.1%-periodontitis) and Gullah African Americans (100%-periodontal disease)(47,49,49). Regarding prevalence in type 1 diabetes, finding is higher than study done in Germany (60%-periodontitis) and Bangladesh (58.8%)(47,53). The prevalence of gingivitis corresponds to previous study done in TASH, Addis Ababa (96.5%).(55)

The study employed clinical attachment loss (CAL) as a measure of periodontitis severity.
It was found that 8.8% of the participants had no CAL, indicating no or minimal periodontal attachment loss. However, 47.2% of the patients had mild to moderate CAL, suggesting moderate periodontal attachment loss, while 44% had severe CAL, indicating significant attachment loss and advanced periodontitis. These findings indicate a substantial burden of severe periodontal disease among diabetic patients. This finding is higher than study done in Uganda (31.8%-mild & 28.4%- severe) and lower for moderate (70.6%) and higher for severe periodontitis (28.4%) than study done in Gullah African Americans (70.6%-moderate & 28.5).(40,48)

The study also investigated the associated factors for periodontitis among diabetic patients. Increasing age (for every year increase in age, risk of periodontitis increased by 6%) & use of combination drugs were identified as significant risk factors for periodontitis, while bleeding on brushing was found to be significant indicator of periodontitis. Increasing age was also found to be significantly associated with periodontal disease in studies conducted in Saudi Arabia and Bangladesh.(39,53) On univariate analysis, the use of combination antihyperglycemic drugs was

found to have a significant association in a study in Uganda.(40) The finding in this study may be explained by the majority of patients (62.1%) being on combination treatment, which may translate to either increased duration of diabetes (in this study, 59.4% on combination group vs 54.3% on monotherapy group had diabetes duration 10 years, similarly, the combination group had higher glycemic profiles (FBS-70.7% vs 64.2% with FBS >130 mg/dl; HgA1C-65.4% vs 56.4% with HgA1C >7%, missed values for HgA1C were comparable). Similar to this study, self reported gingival bleeding on brushing was shown to have low to moderate accuracy for discriminating periodontitis and gingivitis from periodontal health, with a sensitivity of 37.1% and 61.3% and a specificity of 84.8% and 84.4%, respectively (408 participants in China; not DM specific).(65)

On the other hand, the use of spironolactone and wearing dentures were found to be protective factors against periodontitis. There is no other study that found a similar association with Spironolactone use in diabetic patients, though there was an older study (2005) that assessed the possible effect of Spironolactone on the progression of experimental periodontitis in rats due to previous in vitro studies that show the drug may have an anti TNF role, but the study found insignificant effect & suggested explanations for lack of efficacy, such as additional inflammatory pathways that the medication could not address and its rapid metabolism(66); a later study with same interest was likewise unable to confirm the drug's role in modulating the host immune-inflammatory response in periodontal disease.(67) In our study, subjects on spironolactone had higher FBS, HgA1C, and a higher percentage had poor oral hygiene practice, and many participants had diabetes for more than 10 years in comparison to those who did not take the drug, indicating that the beneficial effect is not explained by a relatively better glycemic control, diabetes duration, or good oral hygiene practice. In previous studies, no such association was found in diabetic individuals; while dentures do not increase the incidence of periodontitis, they do increase plaque and gingivitis in the mouth.(68) This study's findings may be explained by the large number of subjects wearing dentures who had a habit of regular tooth brushing with fair or good oral hygiene practice when compared to those who did not wear dentures (75% vs 49.4).

Furthermore, the study explored factors associated with generalized periodontitis and severe clinical attachment loss. Male gender, lack of flossing, and poor perception of gum health were found to be significant risk factors for generalized periodontitis while the results showed that age ≥ 40 years and male gender were associated with more severe CAL, indicating a higher risk for advanced periodontitis with increasing age and male gender. Increasing age, similar to our finding was significantly associated with severity of periodontitis in studies done in Saudi Arabia, Bangladesh, Lithuania & Zambia,(39,41,53,69) similarly flossing which is fundamental part of good oral hygiene was shown to be positively linked with periodontal disease protection in large US study (not specific diabetic patients) and was shown to reduce bacteria responsible for periodontal disease.(70,71)

Finally, the majority of the study participants, 69.9%, had non-traumatic tooth loss with a median number of missing teeth of 2 (IQR:1-15) and a maximum tooth loss of 24, indicating a significant burden. In this study, 76.8% of people with missing teeth had diabetes for more than 5 years, 60% had diabetes for more than 10 years, and 88.7% were over the age of 40. This higher rate of tooth loss in diabetic patients is similar to findings reported in systematic reviews

and metaanalysis. (72,73)Retrospective study done in Saudi Arabia , cross sectional study in Thailand, population based survey in Japan also showed higher risk of tooth loss in diabetic patients compared with non diabetic patients. (74–76)Similarly, another population based study in Hispanic/Latino reported significantly increased likelihood of missing > 9 teeth and being edentulous in persons with uncontrolled diabetes compared with persons with normal glycemic status.(77) Cosmetic value and nutritional compromise are among the common anticipated adverse effects of missed tooth, in addition, studies also reported further risk of having a few missing teeth indicating, an increased risk of CVD, or all-cause mortality in Finnish population–based survey. (78) Furthermore, a recent 12 year prospective cohort study in US reported that the co-occurrence of DM and edentulism led to a worse cognitive function and a faster cognitive decline in older adults aged 65 to 74 y.(79)

On the other hand, a number of studies have found an association between periodontal disease and its severity in smokers, but this study was unable to analyze this association because there were only three smokers (current & ex smokers). Furthermore, no association was found with regard to oral hygiene status, which may be attributed to less than half of participants (44.4%) practicing regular teeth cleaning at least once daily, with an even smaller percentage of subjects (12.5%) brushing their teeth twice daily, and only 7% had habit of flossing (15 subjects flossed; 14 of them irregularly, and only 1 subject flossed regularly) according to guideline recommendations. Taking into account the various components of oral hygiene practice, only 5.1% of participants had good oral hygiene practice, not including flossing, which may have contributed to the lack of association with periodontal disease. Furthermore, there were no significant associations with characteristics such as type and duration of diabetes, glycemic status, or income, which have been proven to have associations in previous studies. Finally, amitriptyline and furosemide, both of which can lead to dry mouth, did not exhibit a significant association in our analysis, nor did the usage of calcium channel blockers, which can promote gingival hypertrophy and risk of periodontal disease.

7. Conclusion and Recommendations

7.1 Conclusion

When comparing these findings to research conducted in other parts of the world, differences in demographic characteristics, healthcare systems, and cultural factors must be considered. Nonetheless, the significant magnitude of periodontal disease among diabetic individuals found in this study is comparable with prior research from other countries. Age, gender, and poor oral hygiene practices have all been found as risk factors in different groups. However, spironolactone's preventive impact and relationship with pharmacologic regimens may require further exploration and validation in diverse circumstances. To summarize, this study found a high prevalence of periodontal disease among diabetes patients at Tikur Anbessa Specialized Hospital in Ethiopia. The findings highlight the necessity of including complete dental healthcare into diabetes management to prevent and control periodontal disease. Age, gender, medication use, and oral hygiene practices are all known risk factors that might be used to build tailored interventions and preventive initiatives. More study is needed to confirm these findings and investigate other factors that may contribute to the burden of periodontal disease among diabetic people in Ethiopia and other parts of the world.

7.2 Strength

- To the best of the investigators' knowledge, this is one of the few studies done in Ethiopia that focused on an underrepresented diabetic complication (there was one done 23 years ago and another unpublished abstract paper, but no recent published study other than the mentioned).(55,56)
- The study used WHO oral health surveillance form and WHO modified CPI score, which is the protocol used in the majority of studies.

7.3 Limitations

This study has several limitations:

- Cross-sectional nature, single-center institution-based design, and small sample size, which may not be generalizable to the country's larger diabetes population.
- Sample size is limited due to financial constraint.
- As it is done in the largest referral hospitals in Ethiopia, the concomitant presence of higher comorbidities (either single or multiple of 87%) might have influenced the result and subjects may not be representative of the population outside of tertiary center with lesser duration, better glycemic profile and less or no comorbidity.
- Severity assessment was based on clinical attachment loss and extent of pocket depth, whereas the gold standard would have included imaging (X-ray) to detect precise alveolar bone loss and severity of periodontitis in addition to clinical assessment.

7.4 Recommendations

- The findings highlight the necessity of including complete dental healthcare into diabetes management to prevent and control periodontal disease as well as its complications.
- Age, gender, medication use, and oral hygiene practices are all known risk factors that might be used to build tailored interventions and preventive initiatives.
- More study, preferably large scale multicenter national study is needed to confirm these findings and investigate other factors that may contribute to the burden of periodontal disease among diabetic people in Ethiopia.

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Annexes

Annex 1: Assurance of Principal Investigator

My name is Beza Leulseged. I am the researcher. I put my signature below to confirm that I take over the responsibility for the scientific, ethical and technical conduct of the research project and for provision of progress reports for all stakeholders of the research project.

Signature: _____ Date: _____

Contact Address of Principal Investigator:

Phone number: +251913066244
Email: bezaleulsege@gmail.com

TASH, ADDIS ABABA, ETHIOPIA

Annex 2: information and consent sheet

Information sheet

Dear participant, the purpose of this study is to assess the prevalence and associated factors of periodontal disease in diabetic patients which is known as one of the complications of the disease. Since the findings of this study are very important in determining future decisions regarding diabetic education and periodic screening, I kindly request your genuine participation.

For this reason, we kindly request you to participate in the study by responding to the interview and have subsequent oral examination by experienced dentists. We assure you that the information obtained is kept confidential. If you have any question we will be so happy to respond now and at any time during the process of data collection.

Consent form

I, the undersigned, have heard the information in the information sheet and understood the purpose and significance of the study. I agree to participate in the research voluntarily with the hope of contributing to the prevalence and associated factors of periodontal disease in diabetic patients.

Signature: _____ Date: _____

Annex 3: Questionnaire

I care no._____Date of interview_____Interviewer name_____

Ser. No	Questions	Response and coding	Skip
Section 1: demographic data			
101	How old are you?	_____yrs	
102	Gender	1. Male 2. Female	
103	Where is your residence?	1. Urban 2. Semi urban 3. Rural	
104	What is your religion?	1. Orthodox 2. Muslim 3. Protestant 4. Catholic 5. Other (specify)…….	
105	What is your current marital status?	1. Single 2. Married 3. Divorced 4. Widowed	
106	Which of the following best describes your main work status over the past 12 months?	1. Government employee 2. Self-employed 3. House wife 4. Farmer 5. Others (specify)……	
107	What is your level of education	1. No formal education 2. Primary school 3. Secondary school 4. Preparatory school 5. College/ University completed 6. Post graduate degree	
108	What is your average household monthly income?	_____(Birr)	

Ser. No	Questions	Response and coding	Skip
Section 2: diabetes			
201	How long have you had diabetes?		
202	Are you currently taking any medication for diabetes?	1. Yes 2. No If yes, type of medication? ☐ Metformin ☐ sulfonylureas (specify) ☐ DPP4-I (specify) ☐ SGLT2-I (specify) ☐ Insulin ☐ Other (specify)	
203	What is the recent average blood glucose at home?	Average FBS at home _____	
204	Do you have other co morbidities?	1. Yes 2. No If yes, specify? _____	
205	**Diabetes related complications**		

Complications	Yes	No
Diabetic retinopathy		
Diabetic kidney Disease		
Diabetic peripheral neuropathy		
Diabetic foot ulcer		
Amputation		
Musculoskeletal complications		
Others (specify)		

Section 3: Oral Health Assessment				
Ser. No	Questions	Response and coding		Skip
301	How many natural teeth do you have?	0. No natural teeth 1. 1-9 teeth 2. 10-19 teeth 3. 20 teeth or more		
302	During the past 12 months, did your teeth or mouth cause any pain or discomfort?	1. Yes 2. No 9. Don't know 0. No answer		
303	Do you have any removable dentures?	1. Yes	2. No	
	A partial Denture?			
	A full upper Denture?			
	A full lower Denture?			
304	How would you describe the state of your teeth and gums?	Teeth 1. Excellent 2. Very good 3. Good 4. Average 5. Poor 6. Very poor 7. Don't Know	Gums 1. Excellent 2. Very good 3. Good 4. Average 5. Poor 6. Very poor 7. Don't Know	
305	Do you currently have any oral health issues?	1. Yes (specify) _____ 2. No		
306	Do you experience bleeding or pain when brushing or flossing your teeth?	1. Yes 2. No		
307	Have you ever been diagnosed with periodontal disease?	1. Yes 2. No		

308	Have you ever received treatment for periodontal disease?	1. Yes (if so, when?) 2. No	
309	Do you have any missing teeth or loose teeth?	1. Yes 2. No If yes, how many? _____	
310	Do you clean/brush your teeth?	1.yes 2. No	
	If yes: How often do you brush your teeth?	1. Once a month 2. 2-3 times a month 3. Once a week 4. 2-6 times a week 5. Once a day 6. Twice or more a day	
311	Do you floss your teeth?	1.yes 2. No 3. Not familiar	
	If yes: How often do you floss your teeth?	1. Once a month 2. 2-3 times a month 3. Once a week 4. 2-6 times a week 5. Once a day 6. Twice or more a day	
312	Do you use any of the following to clean your teeth? 1. Tooth brush 2. Traditional stick (Mefakia) 3. Both (1 & 2) 4. Rinse with water	1. yes	2. No

	5. Wooden tooth picks 6. Charcoal 7. Other (specify)_____			
313	If using tooth brush: How often do you replace you tooth brush?	1. Every 3 to 4 months 2. Every 6 months 3. Not replacing regularly		
314	Do you use tooth paste to clean your teeth?	1. Yes 2. No	9.Don't know	
315	Do you use a tooth paste that contains fluoride?	1. Yes 2. No	9.don't know	
316	How long is it since you last saw a dentist?	1. Less than 6 months 2. 6-12 months 3. More than 1 year but less than 2 years 4. 2 years or more but less than 5 years 5. 5 years or more 6. Never received dental care		
317	What was the reason of your last visit to the dentist?	1. Consultation/advise 2. Pain or trouble with teeth, gums or mouth 3. Treatment/ follow-up treatment 4. Routine check-up/treatment 5. Don't know/don't remember		

318	Do you smoke?					1.yes 2. No	
	If yes: How often do you use any of the types of tobacco? Cigarettes or if other (specify)_____					1. Never 2. Seldom 3. Several times a month 4. Once a week 5. Several times a week 6. Every day If every day: How many cigarettes per day (specify)?_____	
	If your answer is yes: How long have you smoked?					_____	
318	During the past 30 days, on the days you drank alcohol, how many drinks did you usually drink per day?					1. Less than 1 drink 2. 1 drink 3. 2 drinks 4. 3 drinks 5. 4 drinks 6. 5 or more drinks 9.Did not drink alcohol during the past 30 days	
319	Because of the state of your teeth or mouth, how often have you experienced any of the following problems during the past 12 months?						
		Very often (4)	Fairly often (3)	Sometimes (2)	No (1)	Don't know (0)	
	(a) Difficulty in biting foods						
	(b) Difficulty chewing foods						
	(c) Difficulty with speech/trouble pronouncing words						
	(d) Dry mouth						
	(e) Felt embarrassed due to appearance of teeth						

	(f) Felt tense because of problems with teeth or mouth						
	(g) Have avoided smiling because of teeth						
	(h) Had sleep that is often interrupted						
	(i) Have taken days off work						
	(j) Difficulty doing usual activities						
	(k) Felt less tolerant of spouse or people who are close to you						
	(l) Have reduced participation in social activities						

320 How often do you eat or drink any of the following foods, even in small quantities?

	Several times a day (6)	Every day (5)	Several times a week (4)	Once a week (3)	Several times a month (2)	Seldom/ Never (1)
Fresh fruit						
Biscuits, cakes						
Sweet pies, buns						
Jam or honey						
Chewing gum containing sugar						
Sweets/candy						
Lemonade, Coca Cola or other soft drinks						
Tea with sugar						
Coffee with sugar						

Thank you very much for your cooperation! Your participation is greatly appreciated.

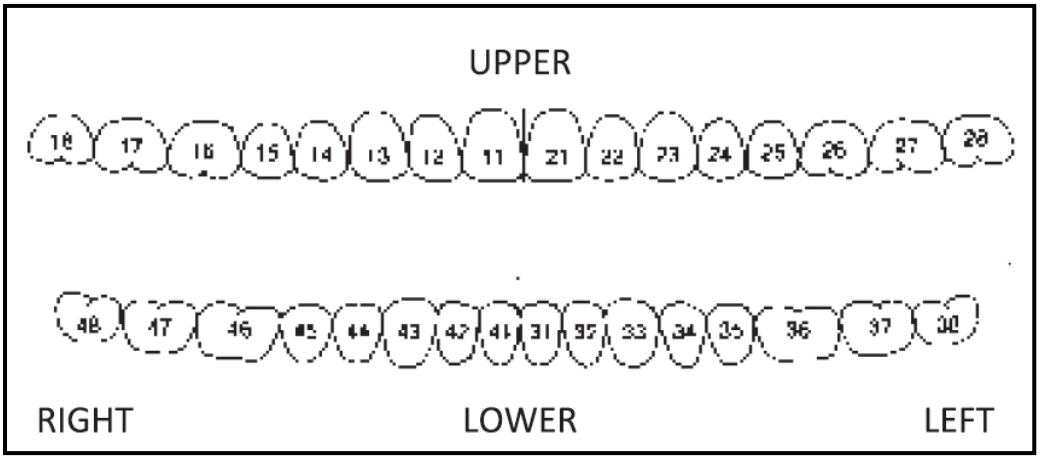
	Section 4: physical exam	
401	Office BP	_____mmHg
402	Weight	_____ kg
403	Height	_____ cm
404	BMI	_____kg/m²
405	Waist circumference	_____ cm
	Section 5: lab tests	
501	HbA1c	Recent _____% The past 3 months _____%
502	FBS	_____mg/dl

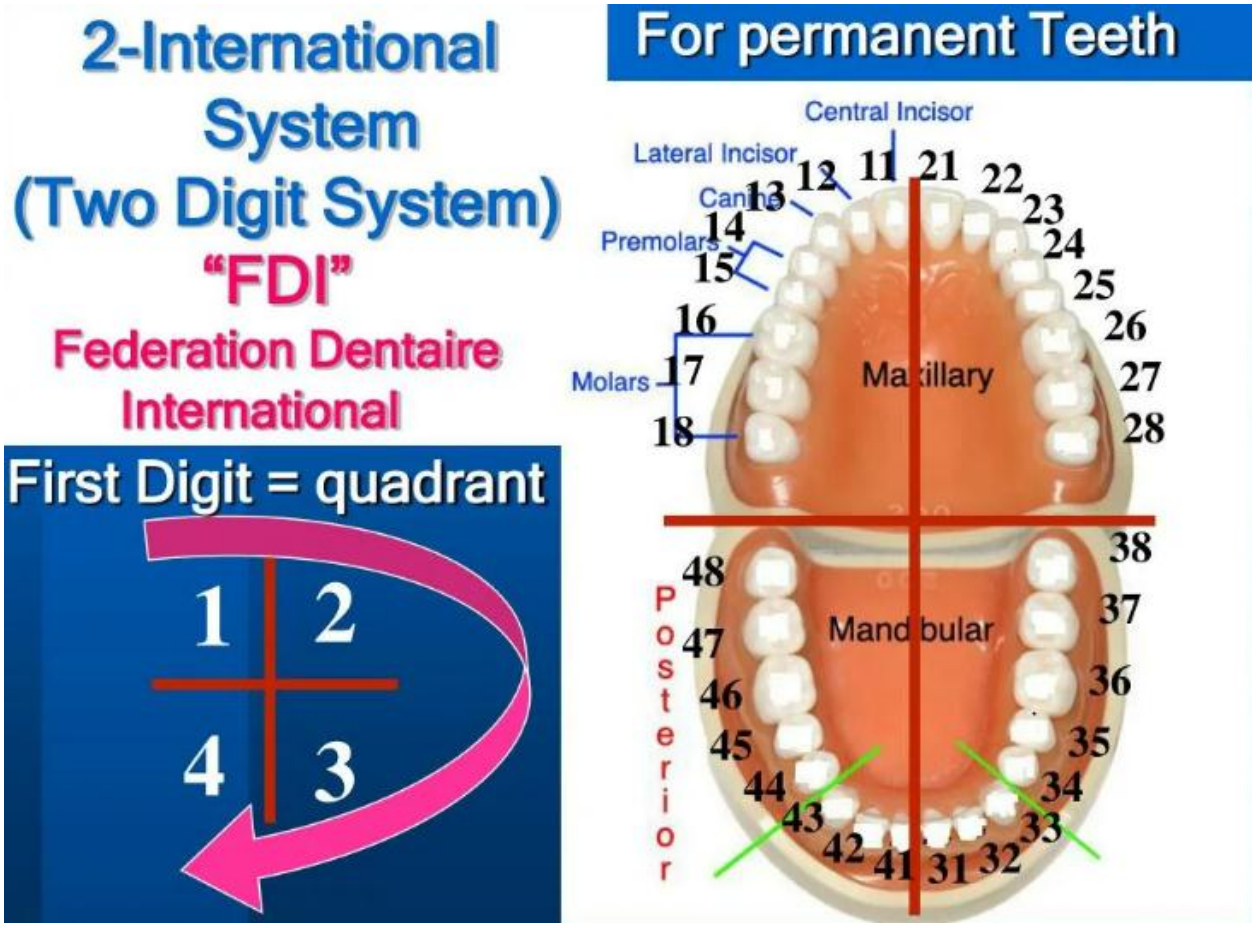
Name of the person who collected the information_____

Date _____

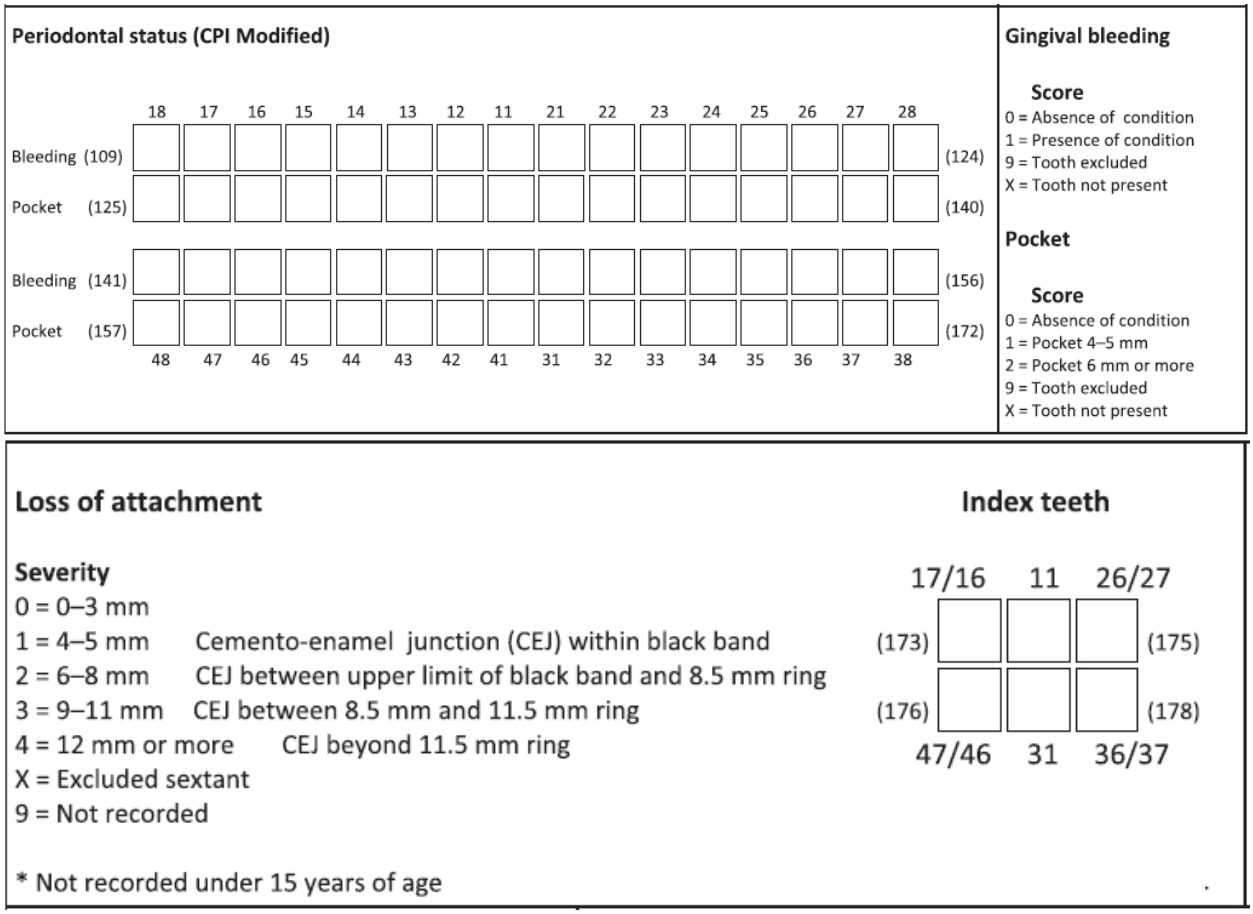
Signature _____

Annex 4: WHO/ FDI tooth notation used for coding of teeth





Annex 5: Modified CPI and CAL recording format



Periodontal status (CPI Modified)

	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28	
Bleeding (109)																	(124)
Pocket (125)																	(140)
Bleeding (141)																	(156)
Pocket (157)																	(172)
	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38	

Gingival bleeding

Score
0 = Absence of condition
1 = Presence of condition
9 = Tooth excluded
X = Tooth not present

Pocket

Score
0 = Absence of condition
1 = Pocket 4–5 mm
2 = Pocket 6 mm or more
9 = Tooth excluded
X = Tooth not present

Loss of attachment

Severity
0 = 0–3 mm
1 = 4–5 mm Cemento-enamel junction (CEJ) within black band
2 = 6–8 mm CEJ between upper limit of black band and 8.5 mm ring
3 = 9–11 mm CEJ between 8.5 mm and 11.5 mm ring
4 = 12 mm or more CEJ beyond 11.5 mm ring
X = Excluded sextant
9 = Not recorded

* Not recorded under 15 years of age

Index teeth

	17/16	11	26/27	
(173)				(175)
(176)				(178)
	47/46	31	36/37	

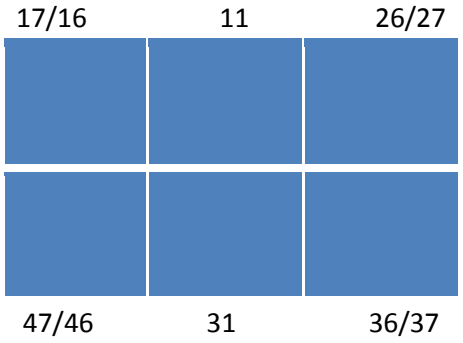
Annex 6: Classification of chronic periodontitis and severity

Classification of Chronic Periodontitis

Extent	Severity & Definitions
Localized ≤ 30% of sites involved Generalized > 30% of sites involved	**Definitions used in this study:** **Severity classification based on CAL** **No CAL**: 0-3 mm **Mild to moderate CAL (CAL-1)**: 4-5 mm **Severe CAL (CAL ≥2)**: ≥6 mm

INDEX TEETH

(For adults aged 20 years and over, the teeth to be examined are:)



አባሪ

አባሪ ፣፡ የዋና ጥናት አድራጊ ማረጋገጫ

የጥናቱ ርዕስ፡ በስኳር ህመምተኞች ላይ የፔሮዶንታል በሽታ ስርጭት እና ተያያዥ ምክንያቶች

ቤዛ ልዑልሰገድ እባላለሁ። እኔ ነኝ ተመራማሪው። ። ለምርምር ፕሮጀክቱ ሳይንሳዊ፣ ስነምግባር እና ቴክኒካል ምግባር እና ለምርምር ፕሮጀክቱ ባለድርሻ አካላት የሂደት ሪፖርቶችን ለማቅረብ ሀላፊነቴን እንደምወስድ ለማረጋገጥ ፊርማዬን ከዚህ በታች አስቀምጫለሁ።

ፊርማ፡ _____ ቀን፡ _____

የዋናው ተመርማሪ አድራሻ፡-

ስልክ ቁጥር፡ +251913066244
ኢሜል ፡ bezaleulsege@gmail.com

ጥቁር አንበሳ ሆስፒታል፣ አዲስ አበባ፣ ኢትዮጵያ

አባሪ 2፡ መረጃ እና የፍቃድ ወረቀት

የመረጃ ወረቀት

ውድ ተሳታፊ፣ የዚህ ጥናት አላማ ከበሽታው ከሚያስከትላቸው ችግሮች አንዱ ተብሎ በሚታወቀው የስኳር ህመምተኞች ላይ የፔሮዶንታል በሽታ ስርጭትን እና ተያያዥ ምክንያቶችን ለመገምገም ነው። የዚህ ጥናት ግኝቶች የስኳር በሽታ ትምህርትን እና ወቅታዊ ምርመራን በተመለከተ የወደፊት ውሳኔዎችን ለመወሰን በጣም አስፈላጊ ስለሆኑ እውነተኛ ተሳትፎዎን በአክብሮት እጠይቃለሁ.

በዚህ ምክንያት ለቃለ መጠይቁ ምላሽ በመስጠት በጥናቱ ላይ እንድትሳተፉ በትህትና እንጠይቃለን። የተገኘው መረጃ በሚስጥር የተያዘ መሆኑን እናረጋግጥልዎታለን። ማንኛውም ጥያቄ ካለዎት አሁን እና በማንኛውም ጊዜ በመረጃ አሰባሰብ ሂደት ውስጥ ምላሽ ለመስጠት በጣም ደስተኞች ነን።

የፍቃድ ቅፅ

እኔ, በስሩ የተፈረመ, በመረጃ ወረቀቱ ውስጥ ያለውን መረጃ ሰምቻለሁ እና የጥናቱ ዓላማ እና አስፈላጊነት ተረድቻለሁ. በስኳር ህመምተኞች ላይ የፔሮዶንታል በሽታ ስርጭትን እና ተያያዥ ምክንያቶችን ለማበርከት ተስፋ በማድረግ በፈቃደኝነት በምርምር ለመሳተፍ ተስማምቻለሁ።

ፊርማ : _____ ቀን : _____

አባሪ 3፡ መጠይቅ

የታካሚ icare ቁጥር።_____ የቃለ መጠይቁ ቀን_____የጠያቂው ስም_____

ሰር. አይ	ጥያቄዎች	ምላሽ እና ኮድ መስጠት	ዝለል
ክፍል ፡ የሰነ ሕዝብ አወቃቀር መረጃ			
101	ስንት አመትዎ ነው?	_____ ዓመት	
102	ጾታ	3. ወንድ 4. ሴት	
103	አድራሻዎት/ መኖሪያዎት የት ነው?	4. ከተማ 5. ከፊል ከተማ 6. ገጠር	
104	ሃይማኖትዎ ምንድን ነው?	6. ኦርቶዶክስ 7. ሙስሊም 8. ፕሮቴስታንት 9. ካቶሊክ 10. ሌላ (ይግለጹ)_____	
105	የአሁኑ የጋብቻ ሁኔታዎ ምንድነው?	5. ነጠላ 6. ያገባ 7. የተፋታ 8. ባል/ ሚስት የሞተበት	
106	ከሚከተሉት ውስጥ ባለፉት 12 ወራት ውስጥ የእርስዎን ዋና የስራ ሁኔታ በተሻለ ሁኔታ የሚገልጸው የትኛው ነው?	6. የመንግስት ሰራተኛ 7. በግል ተዳዳሪ 8. የቤት እመቤት 9. ገበሬ 10. ሌሎች (ይጥቀሱ)_____	
107	የትምህርት ደረጃዎ ምን ያህል ነው?	7. መደበኛ ትምህርት የለም 8. የመጀመሪያ ደረጃ ትምህርት ቤት 9. ሁለተኛ ደረጃ ትምህርት ቤት 10. መሰናዶ ትምህርት ቤት 11. ኮሌጅ/ ዩኒቨርሲቲ ያጠናቀቀ 12. የድህረ ምረቃ ዲግሪ	
108	የእርስዎ ቤተሰብ አማካይ ወርሃዊ ገቢ ስንት ነው?	_____(ብር)	
ሰር. አይ	ጥያቄዎች	ምላሽ እና ኮድ መስጠት	ዝለል

ክፍል 2: የስኳር በሽታ

201	ለምን ያህል ጊዜ ከስኳር ህመም ጋር ኖረዋል?	_____ ወራት _____ ዓመታት	
202	በአሁኑ ጊዜ ለስኳር በሽታ የትኛውን መድሃኒት እየወሰዱ ነው?	3. አዎ 4. አይ አዎ ከሆነ፣ የመድኃኒት ዓይነት? ☐ ሜትፎርሚን ☐ ሰልፎናይልዩሪያ (አይነት ይግለጹ) ☐ DPP4-I (አይነት ይግለጹ) ☐ SGLT2-I (አይነት ይግለጹ) ☐ ኢንሱሊን ☐ ሌላ (ይግለጹ)_____	
203	በቤት ውስጥ የቅርብ ጊዜ አማካይ የደም ስኳር ምን ያህል ነው?	ጠዋት በባዶ ሆድ አማካይ የስኳር መጠን _____ሚግ/ዴሊ	
204	ሌሎች ተጓዳኝ በሽታዎች አሉዎት?	3. አዎ 4. አይ አዎ ከሆነ ይግለጹ? _____	

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ከስኳር በሽታ ጋር የተዛመዱ ችግሮች

	አዎ	አይ
ውስብስቦች		
የስኳር በሽታ ሬቲኖፓቲ		
የስኳር በሽታ የኩላሊት በሽታ		
የስኳር በሽታ ፔሪፈራል ኒውሮፓቲ		
የስኳር በሽታ እግር ቁስለት		
መቆረጥ		
የጡንቻ እና የአጥንት ችግሮች		
ሌሎች ካሉ ይጥቀሱ		

ክፍል 3 : የአፍ ጤና ግምገማ

ሰር. አይ	ጥያቄዎች	ምላሽ እና ኮድ መስጠት		ዝለል
301	ስንት የተፈጥሮ ጥርሶች አሉዎት?	4. ምንም ተፈጥሯዊ ጥርሶች የሉም 5. 1-9 ጥርሶች 6. 10-19 ጥርሶች 7. 20 ጥርስ ወይም ከዚያ በላይ		
302	ባለፉት 12 ወራት ውስጥ ጥርሶችዎ ወይም አፍዎ ህመም ወይም አለመመቸት አምጥትዎቦት ያውቃል?	3. አዎ 4. አይ 9. አላውቅም 3. መልስ የለም		
303	የሰው ሰራሽ ጥርስ አለዎት? ከፊል የሰው ሰራሽ ጥርስ? ሙሉ የላይኛው ጥርስ? ሙሉ የታችኛው ጥርስ?	4. አዎ	5. አይ	
304	የጥርስና እና የድድዎን ሁኔታ እንዴት ይገልጹታል?	ጥርስ 8. እጅግ በጣም ጥሩ 9. በጣም ጥሩ 10. ጥሩ 11. አማካኝ 12. ደካማ 13. በጣም ደካማ 14. አላውቅም	ድድ 8. እጅግ በጣም ጥሩ 9. በጣም ጥሩ 10. ጥሩ 11. አማካኝ 15. ደካማ 16. በጣም ደካማ 12. አላውቅም	
305	በአሁኑ ጊዜ የአፍ ጤንነት ችግር አለብዎት?	3. አዎ (ይግለጹ) _____ 4. አይ		
306	ጥርስዎን ሲቦርሹ ወይም ፍሎስ ሲያደርጉ መድማት ወይም ህመም ይሰማዎታል?	3. አዎ 4. አይ		
307	የፔሮደንታል በሽታ አለብዎት ተብለው ያውቃሉ?	3. አዎ(ካለ፣ መቼ?)_____ 4. አይ		
308	ለፔሮደንታል በሽታ ሕክምና ወስደው ያውቃሉ?	3. አዎ (ካለ፣ መቼ?)_____ 4. አይ		
309	የጎደሉ/የወለቁ ወይም የተነቃነቁ ጥርሶች አሉዎት?	3. አዎ 4. አይ አዎ ከሆነ ስንት ነው?		

		_____	
310	ጥርሶችዎን ያጸዳሉ / ይቦርሹታል?	1.አዎ 2. አይ	
	መልስዎ አዎ ከሆነ: ምን ያህል ጊዜ ጥርስዎን ይቦርሹታል?	7. በወር አንዴ 8. በወር 2-3 ጊዜ 9. በሳምንት አንድ ግዜ 10. በሳምንት 2-6 ጊዜ 11. በቀን አንድ ጊዜ 12. በቀን ሁለት ጊዜ ወይም ከዚያ በላይ	
311	ጥርሶችዎን ፍሎስ ያደርጋሉ?	1.አዎ 2. አይ 3. ስለ ፍሎስ አላውቅም	
	መልስዎ አዎ ከሆነ: ምን ያህል ጊዜ ጥርሶችዎን ፍሎስ ያደርጋሉ?	7. በወር አንዴ 8. በወር 2-3 ጊዜ 9. በሳምንት አንድ ግዜ 10. በሳምንት 2-6 ጊዜ 11. በቀን አንድ ጊዜ 12. በቀን ሁለት ጊዜ ወይም ከዚያ በላይ	
312	ጥርስዎን ለማጽዳት ከሚከተሉት ውስጥ የቱን ይጠቀማሉ? 8. የጥርስ ብሩሽ 9. ባህላዊ መፋቂያ 10. ሁለቱንም (1 እና 2) 11. በውሃ መጉመጥመጥ 12. ስቴኪኒ 13. ከሰል 14. ሌላ (ይግለጹ) _____	3. አዎ	4. አይ
313	የጥርስ ብሩሽ የሚጠቀሙ ከሆነ; የጥርስ ብሩሽ በምን ያህል ጊዜ ይቀይራሉ?	4. በየ 3 እስከ 4 ወሩ 5. በየ6 ወሩ 6. በመደበኛነት አልቀይርም	
314	ጥርስዎን ለማጽዳት የጥርስ ሳሙና ይጠቀማሉ?	3. አዎ 4. አይ	

		9. መረጃው የለኝም		
315	ፍሎራይድ ያለበት የጥርስ ሳሙና ይጠቀማሉ?	3. አዎ 4. አይ 9. መረጃው የለኝም		
316	የጥርስ ሀኪም ለመጨረሻ ጊዜ ያዩት መቼ ነው?	7. ከ6 ወር በታች 8. 6-12 ወራት 9. ከ ነ አመት በላይ ግን ከ 2 አመት በታች 10. 2 ዓመት ወይም ከዚያ በላይ ግን ከ 5 ዓመት በታች 11. 5 ዓመት ወይም ከዚያ በላይ 12. የጥርስ ህክምና አገልግሎት አግኝቼ አላውቅም።		
317	የጥርስ ሀኪም ለመጨረሻ ጊዜ የነበኙበት ምክንያት ምን ነበር?	6. ምክክር/ምክር 7. በጥርሶች, ድድ ወይም አፍ ላይ ህመም ወይም ችግር 8. ሕክምና / ክትትል 9. መደበኛ ምርመራ/ህክምና 10. አላውቅም/አላስታውስም።		
318	ያጨሳሉ?	ነ.አዎ 2. አይ		
	መልስዎ አዎ ከሆነ: የትኛውንም የትምባሆ አይነት ምን ያህል ጊዜ ይጠቀማሉ? ሲጋራ ወይም ሌላ ከሆነ (ይግለጹ) _____	7. በጭራሽ 8. አልፎ አልፎ 9. በወር ውስጥ ብዙ ጊዜ 10. በሳምንት አንድ ግዜ 11. በሳምንት ውስጥ ብዙ ጊዜ 12. በየቀኑ በየቀኑ ከሆነ: በቀን ስንት ሲጋራዎች (ይግለጹ) ? _____		
	መልስዎ አዎ ከሆነ: ለምን ያህል ጊዜ አጨሱ?	_____		

318	በአለፉት 30 ቀናት ውስጥ፣ አልኮል በጠጡባቸው ቀናት፣ ብዙ ጊዜ በቀን ስንት መጠጦች ይጠጡ ነበር ?	7. ከ ነ ያነሰ መጠጥ 8. ነ መጠጥ 9. 2 መጠጦች 10. 3 መጠጦች 11. 4 መጠጦች 12. 5 ወይም ከዚያ በላይ መጠጦች 9.ባለፉት 30 ቀናት አልኮል አልጠጣሁም።	

319	በጥርስዎ ወይም በአፍዎ ሁኔታ ምክንያት፣ ባለፉት 12 ወራት ውስጥ ከሚከተሉት ችግሮች ውስጥ ምን ያህል ጊዜ አጋጥሞዎታል?						
		በተደጋጋሚ (4)	በትክክል ብዙ ጊዜ (3)	አንዳንድ ጊዜ (2)	አጋጥሞኝ አያውቅም (1)	አላውቅም (0)	
	(ሀ) ምግቦችን የመንከስ ችግር						
	(ለ) ምግቦችን የማኘክ ችግር						
	(ሐ) ንግግር መቸገር / ቃላትን መጥራት ችግር						
	(መ)አፍ መድረቅ						
	(ሠ) በጥርስዎ ገጽታ ምክንያት፡ሀፍረት መሰማት						
	(ረ)በጥርስዎ ወይም አፍ ላይ ባለ ችግር ውጥረት ስሜት መሰማት						
	(ሰ) በጥርሶ ምክንያት ፈገግታ/ሳቅ መተው						
	(ሸ)ብዙ ጊዜ እንቅልፍ መቆራረጥ						
	(i) ከሥራ መቅረት						
	(j) የተለመዱ ተግባራትን ለመስራት መቸገር						
	(k) ከትዳር ጓደኛ ወይም ከቅርብ፡ሰዎችዎ፡ጋር ትእግስት ማጣት						
	(ል)በማህበራዊ እንቅስቃሴዎች፡ውስጥ ተሳትፎ መቀነስ						

320	የሚከተሉትን ምግቦች በትንሽ መጠንም ቢሆን ምን ያህል ጊዜ ይበላሉ ወይም ይጠጣሉ?						
		በቀን ውስጥ ብዙ ጊዜ (6)	በየቀኑ (5)	በሳምንት ብዙ ጊዜ (4)	በሳምንት አንድ ጊዜ	በወር ውስጥ ብዙ ጊዜ (2)	አልፎ አልፎ/ በጭራሽ

					(3)		(1)	
	ፍራ ፍሬ							
	ብስኩት, ኬክ፣ ጣፋጭ ዳቦ							
	ማር ወይም ማርማላት							
	ስኳር፡ያለው ማስቲካ							
	ጣፋጮች / ከረሜላ							
	ሎሚ ፣ ኮካ ኮላ ወይም ሌሎች ለስላሳ መጠጦች							
	ሻይ በስኳር							
	ቡና በስኳር							

ስለ ትብብርዎ በጣም እናመሰግናለን ! የእርስዎ ተሳትፎ በጣም የተመሰገነ ነው።

	ክፍል 4: የአካል ምርመራ	
401	የደም ግፊት	_____ሚሜ.ሜርኩሪ
402	ክብደት	_____ ኪግ
403	ቁመት	_____ ሴ.ሜ
404	BMI	_____ኪ.ግ/ሜ²
405	የወገብ ዙሪያ	_____ ሴ.ሜ
	ክፍል 5፡ የላብራቶሪ ሙከራዎች	
501	የ 3 ወር ስኳር ክምችት(HbA1c)	የቅርብ ጊዜ _____% ያለፉት 3 ወራት_____%
502	ጠዋት በባዶ ሆድ የስኳር መጠን	_____ሚግ/ዴሊ

መረጃውን የሰበሰበው ሰው ስም _____

ቀን_____

ፊርማ_____

Table 11. Prevalence of periodontal disease and pocket depth among different Characteristics

Variables		Periodontitis		Periodontal pocket depth	
		No (%)	Yes (%)	Shallow (%)	Deep (%)
Sex	Male	4.3	95.7	55.9	39.8
	Female	11	89	60	29
Age (Years)	20-34	30.8	69.2	69.2	0
	35-49	13.2	86.8	58.5	28.3
	50-64	3	97	61.4	35.6
	65+	8	92	49	43
Educational status	No formal education	0	100	38.5	61.5
	Primary school	7.5	92.5	57.5	35
	Secondary & Preparatory school	10.9	89.1	55.4	33.7
	College diploma or 1st Degree	7.9	92.1	66.7	25.4
	Post graduate (2nd degree & above)	0	100	62.5	37.5
Religion	Orthodox Christian	7	93	62.4	30.6
	Muslim	0	100	47.8	52.2
	Protestant Christian	12	88	49	40
	Catholic Christian	0	100	100	0
	Other	44.4	55.6	33.33	22.22
Residency	Urban/semi urban	8.3	91.7	58.7	33
	Rural	10	90	50	40
House hold monthly income (ETB)	<=2000	9.8	90.2	54.1	36.1
	2001-4000	6.7	93.3	56.67	36.67
	4001-6000	9.1	90.9	96.6	27.3
	>6000	7.8	92.2	60.8	31.4
Occupation	House wife	7	93	60	33
	Private business/ self employed	11.5	88.5	59	29.5
	Government employee	7	93	56	37
	Retired	5.3	94.7	52.6	42.1
	Student & unemployed	11.1	88.9	66.7	22.2
Current alcohol use (2 or more drinks/day)	Yes	4.55	95.45	68.18	27.27
	No	8.8	91.2	57.2	34
BMI	Normal	10.3	89.7	54.4	35.3
	Overweight/obese	7.4	92.6	50.14	32.43
Waist circumference	Normal	9.1	90.9	54.5	36.4
	Abnormal (raised)	8	92	60	32

Characteristics		Periodontitis		Periodontal pocket depth	
		No (%)	Yes (%)	Shallow (%)	Deep (%)
Plasma FBS (mg/dl)	≤130	7.1	92.9	54.3	38.6
	131-180	10.5	89.5	54	35.5
	> 180	7	93	67	26
HgA1C	<7	11.4	88.6	52.27	36.36
	7-8.5	6.1	93.9	59.0	34.9
	>8.5	9.8	90.2	50.8	39.4
Type of diabetes	Type 1	16.7	83.3	53.3	30
	Type 2	7	93	59	34
Duration of diabetes	<=5 years	9.1	90.9	61.8	29.1
	6-10 years	4	96	63	33
	10+ years	9.8	90.2	54.5	35.7
Diabetes medications	Monotherapy (either oral agent or insulin)	16	84	59.3	24.7
	Combination (any type)	3.8	96.2	58.65	37.59
	None	0	100	0	100
Concomitant comorbidities	Yes	6.9	93.1	56.9	36.2
	No	17.9	82.1	67.86	14.29
Habit of regular tooth brushing	Yes	9.4	90.6	55.2	35.4
	No	7.5	92.5	60.8	31.7
Oral hygiene practice	Poor	6.7	93.3	59.6	33.7
	Fair	8.9	91.1	57.4	33.7
	Good	18.2	81.8	54.55	27.27
Frequency of replacing tooth brush	Not replacing regularly (>6 months)	5.1	94.9	59.3	35.6
	Every 4 to 6 month	8	92	64	28
	Every 3 month	10.9	89.1	52.7	36.4
Use of tooth paste	Yes	8.3	91.7	59.6	32.1
	No	8.3	91.7	55	36.7
Bleeding on brushing	Yes	1.7	98.3	61.2	37.1
	No	15.2	84.8	58.7	26.1
Missed/loose tooth (non traumatic)	Yes	8	92	55	37
	No	9.2	90.8	66.2	24.6
Dentures	Yes	18	82	39	43
	No	6.9	93.1	61.2	31.9
Habit of simple sugar intake & carbonated drinks	Frequent	7.3	92.7	61	31.7
	None/infrequent	8.6	91.4	57.7	33.7