PERIODONTAL HEALTH STATUS IN RELATION TO GLYCAEMIC PROFILE AMONG TYPE 2 DIABETIC PATIENTS AT KENYATTA NATIONAL HOSPITAL

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V60/72508/08

A thesis submitted in partial fulfilment for the degree of Master of Dental Surgery in Periodontology of the University of Nairobi.

2013
DECLARATION

I declare that this thesis is my original work and has not been submitted for the award of a degree in any other institution.

Kithela Silas Kinyua, BDS (Nbi).

Signature...........................................Date: .....................................................
This thesis has been submitted for examination with our approval as University supervisors.

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Lecturer, School of Dental Sciences, College of Health Sciences, University of Nairobi.

Signature…………………………………. Date ……………………………
DEDICATION

I dedicate this thesis to my wife Wangari and my children Kendi, Mbiyu and Muriithi.
ACKNOWLEDGEMENT

I thank almighty God for giving me the strength and sound mind to go through this thesis writing process. I most sincerely thank my wife, Josephine Wangari, for always being there for me. My sincere thanks go to my supervisors Dr. Nelson Matu and Dr. Bernard N. Mua for their constant guidance, advice and encouragement, from the time of conceptualization to finally writing of the thesis.

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<table>
<thead>
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<th>Full Form</th>
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<tr>
<td>BPS</td>
<td>Board of Post Graduate Studies</td>
</tr>
<tr>
<td>BOP</td>
<td>Bleeding on Probing</td>
</tr>
<tr>
<td>CAL</td>
<td>Clinical Attachment Loss</td>
</tr>
<tr>
<td>IDDM</td>
<td>Insulin Dependent Diabetes Mellitus</td>
</tr>
<tr>
<td>IL-1</td>
<td>Interleukin 1</td>
</tr>
<tr>
<td>IL-6</td>
<td>Interleukin 6</td>
</tr>
<tr>
<td>KNH</td>
<td>Kenyatta National Hospital</td>
</tr>
<tr>
<td>HbAlc</td>
<td>Glycaeted Haemoglobin</td>
</tr>
<tr>
<td>PPD</td>
<td>Periodontal Probing Depth</td>
</tr>
<tr>
<td>Mm</td>
<td>Millimetre</td>
</tr>
<tr>
<td>NIDDM</td>
<td>Non Insulin Dependent Diabetes Mellitus</td>
</tr>
<tr>
<td>SPSS</td>
<td>Scientific Package for Social Sciences</td>
</tr>
<tr>
<td>TNF-α</td>
<td>Tumour Necrosis Factor Alpha</td>
</tr>
<tr>
<td>UON</td>
<td>University of Nairobi</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>SD</td>
<td>Standard Deviation</td>
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ABSTRACT

Background
Severe periodontal disease acts to increase insulin resistance; thereby contributing to the induction of hyperglycaemia as well as hyperinsulinaemia. Persistent hyperglycaemia and hyperinsulinaemia are risk factors for diabetes and its numerous complications. Severe periodontal disease generally increases inflammatory markers in the tissues. Increased inflammatory markers are known to interact with insulin receptors making them resistant to insulin. This is of great significance in control of diabetes mellitus type 2.

Main Objective
To describe the periodontal health status in relation to glycaemic profiles among type 2 diabetic patients at Kenyatta National Hospital (KNH).

Study area
The study was conducted at the diabetic clinic at KNH.

Study population
All patients type 2 diabetes presenting for treatment of at the KNH diabetic clinic during the period of study were examined.

Sampling method
This was done through a judgemental sampling procedure, where only those patients examined and found to have had periodontal disease were included in the study.

Study design
This was a hospital based descriptive cross-sectional study.

Materials and Methods
Fifty patients met the inclusion criteria. Data on demographical variables were collected and recorded in a special chart. Plaque score, clinical attachment loss, probing depth and bleeding on probing were assessed and recorded using a Hu Freidy sterile periodontal probe and dental mirrors. Probing depth was determined at six points on each tooth (mesiobuccal, buccal, distobuccal, lingual, mesiolingual, distolingual) on all teeth except the third molars. These measurements were recorded in the clinical examination form. Patients’ blood samples were drawn under aseptic conditions and then taken to The Nairobi Hospital laboratory where under aseptic technique glycaeted haemoglobin was assessed.
Data analysis and presentation
Data were coded and processed with Statistical Package for Social Sciences (SPSS) 21.0. Comparison of means and proportions was done using Pearson's correlation test and Chi-Square test. Data is presented in the form of tables and chart diagrams.

Results
Of the 50 participants recruited, 21(42%) were male and 29(58%) were female. Their age range was between 33 and 78 years with a mean of 56.4 years (S.D ±11.27 years). 47(94%) of the participants had never smoked while 3(6%) were smokers. Most 40(80%) of the participants had poor oral hygiene with mean plaque scores ≥2. There were more females 23(46%) with plaque scores above 2, than males 17(34%). This was not statistically significant (x²=0.02, p>0.05). The overall mean plaque score was 2.5 (S.D±0.88). The overall mean gingival index was 1.6 (S.D±0.95). Majority 37(74%) of the participants had moderate to severe gingivitis. Most 33(66%) of the participants had moderate to severe periodontitis. The overall mean CAL was 3.9 (S.D±0.98). 33(66%) of the participants had poorly controlled diabetes with HbA1c levels above 8%. There was no correlation between HbA1c levels and the severity of periodontal disease (r=0.00, n=50, p>0.05).

Conclusions
Majority of the participants had moderate gingival inflammation. Majority of the participants had moderate periodontitis. Majority of the participants had HbA1c level of above 8% of the. There was no correlation between periodontal disease and HbA1c.

Recommendations
Dental education should be carried out regularly among this group to ensure there is change of altitude, so that they can be going for regular checkups. They should also be educated further on how to control their blood sugar levels.
CHAPTER ONE

1.0 INTRODUCTION AND LITERATURE REVIEW

1.1 Introduction

Periodontitis is a chronic infectious disease which leads to the destruction of the periodontal ligament fibres and alveolar bone until tooth loss. Periodontitis is one of the oldest and most common diseases of humans which was once generally believed to have been an inevitable consequence of aging. However, we have learnt over time that not all people nor all populations are at equal risk of developing periodontitis. There are several factors that are at interplay for one to manifest periodontitis. These are genetic factors, local factors like poor oral hygiene, the virulence of the attacking micro-organisms and underlying systemic factors. A study in Kenya indicates the prevalence of periodontitis in the general population to be 10%\(^1\). However, with the increase in diabetic cases this may be we expected to rise.

Diabetes mellitus is a complex disease with both metabolic and vascular components, characterized by hyperglycaemia due to defects in insulin secretion, action or both\(^2\). Diabetes cases have been on the increase of late in Kenya, which has mainly been attributed to the lifestyle changes, dietary (high carbohydrate and fats), sedentary life, lack of adequate exercises and obesity\(^3\). Several studies have been done showing the link between diabetes and periodontal disease\(^4, 5, 6\). Periodontal disease and diabetes mellitus have been postulated to worsen each other, hence the concept of a two way traffic\(^4, 5\). Diabetic patients appear to respond to bacterial challenges in an exaggerated manner as compared to the non-diabetic through several possible mechanisms and develop more severe forms of inflammatory periodontal disease\(^7\). Type 2 diabetes mellitus is a common, chronic, complex disease with variable clinical presentations\(^2\). It is a metabolic condition
characterized by insulin resistance including impaired insulin effectiveness and the failure of pancreatic beta cells to produce sufficient insulin. The interrelationships between periodontitis and diabetes provide an example of systemic disease predisposing to oral infection, and once that infection is established, the oral infection exacerbates systemic disease.

From the Aforementioned there is need for more research on the association between periodontal disease and Diabetes mellitus. Therefore the aim of this study is to investigate the relationship between periodontal health status and glycaemic profile among type 2 diabetic patients at Kenyatta National Hospital. This information from this study could be used to develop policies aimed at improving the management of both periodontal disease and Diabetes mellitus.
LITERATURE REVIEW

1.2.1 Diabetes and its classification

Diabetes mellitus is defined as a metabolic disorder caused by different factors, characterized by a chronic high level of blood sugar with disturbances in carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, action or both. Scientists have divided diabetes into three different types. Type 1 diabetes mellitus or insulin dependent diabetes mellitus (IDDM) is also known as juvenile onset diabetes. Type 2 diabetes mellitus, non-insulin dependent diabetes mellitus (NIDDM) or adult onset diabetes. This is found in individuals who are insulin resistant and who usually have relative insulin deficiency. Gestational diabetes mellitus (GDM) is defined as hyperglycaemia that is first recognized during pregnancy. Plasma glucose estimation remains the basic diagnostic criterion for the establishment of disease in patients\(^2\).

1.2.2 Global burden of diabetes

At least 171 million people worldwide have diabetes; this figure is likely to be more than double by 2030\(^8\). Around 3.2 million deaths every year are attributable to complications of diabetes; six deaths every minute. The top 10 countries, in numbers of sufferers, include India, China, USA, Indonesia, Japan, Pakistan, Russia, Brazil, Italy, and Bangladesh. Overall, direct health care costs of diabetes range from 2.55% to 15% of annual health care budgets, depending on the local diabetes prevalence and the sophistication of the treatment available\(^8\). The costs of lost production may be as much as five times the direct health care cost, according to estimates derived from 25 Latin American countries. Recent studies in China, Canada, USA and several European countries have shown that feasible lifestyle interventions can prevent the onset of diabetes in people at high risk. Approximately, 7.1 million
Africans were said to have been suffering from diabetes at the end of 2000, a figure that was expected to rise to 18.6 million by 2030. A diabetes epidemic is underway. An estimated 30 million people worldwide had diabetes in 1985. A decade later, the global burden of diabetes was estimated to have been 135 million. The latest WHO estimate for the number of people with diabetes, worldwide, in 2000-is 171 million. This is likely to increase to at least 366 million by 2030. Two major concerns are that much of this increase in diabetes will occur in developing countries due to population growth, ageing, unhealthy diets, obesity and sedentary lifestyles and that there is a growing incidence of type 2 diabetes which accounts for about 90% of all cases of diabetes mellitus have been diagnosed. Screening for diabetes should begin at 45 years of age and should be repeated every 3 years in persons without risk factors. The number of deaths annually attributed to diabetes is around 3.2 million. Diabetes has become one of the major causes of premature illness and death in most countries, mainly through the increased risk of cardiovascular disease (CVD).

1.2.3 Complications associated with diabetes mellitus

Cardiovascular disease is responsible for between 50% and 80% of deaths in people with diabetes. Risk factors for heart disease in people with diabetes include high blood pressure, high serum cholesterol, obesity and smoking. Recognition and management of these conditions may delay or prevent heart disease in people with diabetes. Diabetic neuropathy is probably the most common complication. Studies suggest that up to 50% of people with diabetes are affected to some degree. Major
risk factors of this condition are the level and duration of elevated blood glucose. Neuropathy can lead to sensory loss and damage to the limbs. It is also a major cause of impotence in diabetic men. Diabetic retinopathy is a leading cause of blindness and visual disability\textsuperscript{10}. Research findings suggest that, after 15 years of diabetes, approximately 2\% of people become blind, while about 10\% develop severe visual handicap\textsuperscript{10}. Diabetes is among the leading causes of kidney failure, but its frequency varies among populations and is also related to the severity and duration of the disease. Diabetic foot disease, due to changes in blood vessels and nerves, often leads to ulceration and subsequent limb amputation. Diabetes is the most common cause of non-traumatic amputation of the lower limb\textsuperscript{11}.

1.2.4 Prevention of diabetes

Primary prevention includes, a healthy diet and regular physical activity, reduction of stress, protects susceptible individuals\textsuperscript{2}. It has an impact by reducing or delaying both the need for diabetes care and the need to treat diabetes complications. It should be emphasized particularly in the poorest regions of the world where resources are severely limited\textsuperscript{9}.

Secondary prevention includes early detection and good treatment. The treatment of high blood pressure and raised blood lipids, as well as the control of blood glucose levels, can substantially reduce the risk of developing complications and slow their progression\textsuperscript{3}. Risk factors include obesity, hypertriglyceridemia or previous evidence of impaired glucose homeostasis. Earlier detection of diabetes mellitus may lead to tighter control of blood glucose levels and a reduction in the severity of complications associated with the disease\textsuperscript{10}. Large, population based studies in China, Canada, USA and several European countries suggest that even moderate reduction in weight and half an hour of walking each day reduce the incidence of diabetes by
more than one half in overweight subjects with mild Impaired Glucose Tolerance (IGT)\textsuperscript{12}.

1.2.5 Economic costs of diabetes

Because of its chronic nature, the severity of its complications and the means required to control it, diabetes is a costly disease, not only for affected individuals and their families, but also for the health systems. Studies in India estimate that for a low income Indian family with an adult with diabetes, as much as 25\% of the family income may be devoted to diabetes care. For families in the USA with a child who has diabetes, the corresponding figures is 10\%\textsuperscript{12}.

In WHO's Western Pacific region a recent analysis of health care expenditure has shown that 16\% of hospital expenditure was for people with diabetes. In the Republic of the Marshall Islands, this figure was 25\%. In addition, 20\% of “offshore expenditure” on health by Fiji was for diabetic related complications- instances where facilities for care were not available in Fiji, so patients had to travel elsewhere. These represent considerable sums for countries that can ill afford such massive expenditure on preventable conditions\textsuperscript{12}.

1.2.6 HbA1c measurements

Measurement of glucose levels has been revolutionised by use of glycaated haemoglobin levels. This test is based on the observation that when there has been an extended period of elevated blood sugars there appears to have a non enzymatic linkage of the sugars to the proteins like haemoglobin and fructosamine\textsuperscript{13}. The rate of this linkage is directly proportional to the level of circulating sugars. The average lifespan of erythrocytes has been estimated to be 120 days\textsuperscript{13}. It is therefore reasoned that since there is a non enzymatic linkage of the circulating glucose with the erythrocytes haemoglobin, which is proportional to levels of glucose in the blood,
this can be used to estimate the glucose levels in the body. This is expressed as the percentage of erythrocytes that have been glycated (HbA1c %). According to the American diabetic association, patients are classified into three groups. Those with normal glucose levels, that is HbA1c between 3% and 6%. Those with well controlled glucose levels, that is HbA1c above 6% but below 8%. The third group includes those with poorly controlled diabetes, that is HbA1c level above 8%.2

1.2.7 Periodontal disease

The periodontium consists of the gingiva, periodontal ligament, root cement and the alveolar bone. These function as supporting structures around the teeth. The periodontium forms the defence barrier against mastication forces and participates in the defence reaction against oral microbes. The oral mucosa covers the lips and mucosa of the soft palate and the pharynx and can be divided into masticatory, specialized and lining mucosa. The gingiva itself is part of the masticatory mucosa, pink in colour and extends apically from the mucogingival line.

Periodontal disease is a common chronic complex lesion with variable clinical presentations6. The most prevalent form is chronic periodontitis, which can further be characterized by extent the (number of affected sites) and severity (degree of clinical attachment loss)14. There is no particular age at which the onset of the disease is more likely14 but it is clear that chronic periodontitis can mostly be considered a disease of middle age with a majority of patients in their 40s and 50s14. Periodontal disease can be classified according to a new periodontal disease classification system that was recommended by the 1999 International Workshop for the Classification of Periodontal Disease and Conditions and has been accepted by the American Academy of Periodontology15.
The new classification system has two main categories:

1. Gingival disease
2. Periodontal disease

Periodontal diseases have seven subcategories:

- a) Chronic periodontitis
- b) Aggressive periodontitis
- c) Periodontitis as a manifestation of systemic disease
- d) Necrotizing periodontal diseases
- e) Abscesses of the periodontium
- f) Periodontitis associated with endodontic lesions
- g) Developmental or acquired deformities.

Chronic periodontitis has further been classified as localized or generalized depending on whether <30% or >30% of sites are involved\textsuperscript{15}.

1.2.6: Prevalence of periodontal disease

The prevalence of periodontal disease in Kenya has been approximated to range from 10% to 80\%\textsuperscript{1,16}. Diabetics have a higher prevalence and severity of the disease as compared to the none diabetic\textsuperscript{16,17,18,19,20}. There seems to be a higher prevalence of gingivitis than periodontitis. This is similar to findings from other regions of the world. Periodontal disease has been shown to be worse in those patients who have uncontrolled diabetes\textsuperscript{18}.

1.2.7 Periodontitis: Case Definition

Periodontal disease assessment in epidemiological surveys has evolved over years starting with Russell's periodontal index to the current proposed case definition by CDC/AAP\textsuperscript{21} and later modified by Eke et al (2012)\textsuperscript{22}. The different indices that have been proposed over time have all had short-comings and each index has been proposed to overcome the short-comings of the previous one\textsuperscript{23}. The Ramfjords
Periodontal Disease Index, proposed the use of some index teeth that is, 16, 11, 24, 36, 41 and 44. This was later found to underestimate the disease prevalence and severity. O’Leary et al introduced the Periodontal Screening Examination which brought the concept of sextant examination of the mouth. The mouth is divided anatomically into sextants, first sextant is 17 to 14, 2nd sextant is 13 to 23. Third sextant is 24 to 27, fourth sextant is from 37 to 34, fifth sextant is from 33 to 43 and finally the sixth sextant is from 44 to 47. The tooth notations used are those by Federation Dentaire Internationale (FDI). Ramfjord introduced the idea of measurement from the gingival margin to the base of the sulcus. From these earlier years many authors have proposed different systems but CDC/AAP has been most accepted.

1.2.7 Periodontitis and diabetes

Periodontal destruction probably results from the action of various toxic products released from specific pathogenic sub-gingival plaque bacteria as well as from the host responses elicited against plaque bacteria and their products. The inflammatory response may result in gingival ulceration around the tooth, which can allow intact bacterial cells or their products into the systemic circulation. Many investigators have reported that diabetic subjects, particularly those less well controlled, have increased levels of inflammatory periodontal disease. In terms of periodontitis influencing diabetes, subjects with type 1 and type 2 diabetes with severe periodontitis have more diabetic complications than diabetic subjects with no periodontitis. It is inconclusive whether periodontal treatment results in the improvement in metabolic control and reduction of markers of inflammation such as TNF alpha and cytokines. Cytokine production as a consequence of an infectious challenge could potentially contribute to insulin resistance in a number of ways, including modification of insulin
receptor substrate 1 by serine phosphorylation\textsuperscript{26}. Alteration of adipocyte functions with increased production of free fatty acids\textsuperscript{27, 28}. Diminution of endothelial nitric acid production. A number of case reports, cross-sectional studies and a few longitudinal studies have reported an increased prevalence of periodontal diseases in patients with type 2 diabetes mellitus.

Clinicians should be aware of bi-directional relationship between diabetes mellitus and periodontitis and its clinical ramifications for diagnosis and treatment\textsuperscript{4, 25}. Tumour necrosis factor alpha has been reported to play a key role in the pathogenesis of type 2 diabetes\textsuperscript{29}. Diabetes mellitus influences periodontal disease through mechanisms such as microangiopathy, alteration in collagen metabolism, altered crevicular fluid composition, altered host response, altered microflora and hereditary predisposition\textsuperscript{30}. 
CHAPTER TWO

2.0 STATEMENT OF THE RESEARCH PROBLEM, JUSTIFICATION, OBJECTIVES, HYPOTHESIS, VARIABLES

2.1 STATEMENT OF THE PROBLEM

Chronic periodontitis is a treatable condition that negatively impacts on diabetes. When well managed, there is a significant difference in outcome and morbidity of diabetes. Diabetes is a chronic debilitating disease affecting major systems and resulting in both mortality and morbidity. Due to its chronic nature, the severity of its complications and the means required to control them, diabetes is a costly disease, not only for affected individuals and their families, but also for the health systems. The number of deaths attributed annually to diabetes is around 3.2 million. Diabetes has become one of the major causes of premature illness and death in most countries, mainly through the increased risk of cardiovascular disease (CVD).

The latest WHO estimate for the number of people with diabetes, worldwide, in 2000 is 171 million. This is likely to increase to at least 366 million by 2030. Two major concerns are that much of this increase in diabetes will occur in developing countries, due to population growth, ageing, unhealthy diets, obesity and sedentary lifestyles. There is a growing incidence of type 2 diabetes, which accounts for about 90% of all cases. Diabetes is known to cause several complications like peripheral nerve paraesthesia which eventually results into undetected wounds and these wounds are difficult to treat successfully. Diabetes also affects the blood vessels leading to complications like glaucoma in the eye and male impotence. Other complications are stroke and kidney failure. Due to poverty levels in sub-Saharan Africa and low literacy levels these impacts of the disease are more observed in these parts of the world.
2.2 JUSTIFICATION OF THE STUDY

Studies done in Kenya on association of diabetes and periodontitis found that people with diabetes tend to have a higher prevalence of periodontitis than the normal population. These studies did not correlate the level of glycated haemoglobin as a measure of the level of glucose control over long periods with periodontitis. According to WHO estimates in sub-Saharan Africa will carry the burden of global non-communicable disease burden in this century, and more so regarding diabetes mellitus, therefore, all efforts to find all links that can be used to control diabetes are commendable. The results of this study should sensitize physicians of the need to refer all diabetic patients for periodontal disease management.

2.3 OBJECTIVES

2.3.1 Main objective

The main objective of this study was to describe the periodontal health status in relation to glycaemic profile in diabetic type 2 patients at Kenyatta National Hospital.

2.3.2 Specific objectives

The following were the specific objectives of this study.

1. To determine the severity of gingival inflammation among diabetics type 2 patients at KNH.
2. To determine the severity of periodontitis among diabetics type 2 patients at KNH.
3. To determine glycated haemoglobin levels among diabetics type 2 patients at KNH.
4. To relate the severity of periodontal diseases with the glycated haemoglobin levels of these patients.
2.4 HYPOTHESIS

2.4.1 Null Hypothesis

There is no relationship between glycaeted haemoglobin levels and periodontal health status in diabetics type 2 patients.

2.4.2 Alternative hypothesis

There is a relationship between glycaeted haemoglobin levels and periodontal health status in diabetics type 2 patients.

2.5 VARIABLES

<table>
<thead>
<tr>
<th>Social –demographic</th>
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</thead>
<tbody>
<tr>
<td>1. Age</td>
<td>Number of years</td>
</tr>
<tr>
<td>2. Gender</td>
<td>Female/Male</td>
</tr>
<tr>
<td>3. Education Level</td>
<td>Primary/Secondary/tertiary</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
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<tr>
<td>4. Periodontal disease status</td>
<td>I. Periodontal Probing Depth</td>
</tr>
<tr>
<td></td>
<td>II. Bleeding on Probing</td>
</tr>
<tr>
<td></td>
<td>III. Plaque score</td>
</tr>
<tr>
<td></td>
<td>IV. Gingival index</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Glycaeted haemoglobin levels</td>
<td>Level of HbA1c in blood</td>
</tr>
</tbody>
</table>
CHAPTER THREE

3.0 STUDY METHODOLOGY AND MATERIALS

3.1 STUDY AREA

This study was undertaken at Kenyatta National Hospital (KNH). KNH is a national referral hospital located off Ngong road in Nairobi, Kenya. It has a well established diabetic clinic for the follow-up of diabetic patients. KNH is the largest referral hospital with a patient pool that is nation-wide. Glycaeted haemoglobin values were assessed at The Nairobi Hospital laboratory.

3.2 STUDY DESIGN

Study designs are generally classified as analytic and descriptive.

This was a descriptive hospital-based cross-sectional study where patients were recruited and data collected at one point in time.

3.3 STUDY POPULATION

The study population comprised all patients attending the diabetic clinic at the KNH during the period of this study.

3.4 SAMPLING DETREMINATION

3.4.1 SAMPLE SIZE

The sample size (n) required to detect a non zero correlation of at least 0.4 or greater between variation in HbA1c levels in diabetic type 2 patients and variation in measures of periodontal health status at α=0.05 significance level using a two sided test (H0: p=0 verses H1:p≠0) with 90% power (1-β=0.90) was calculated as follows
Given $Z_{1-\alpha/2}=Z_{.975}=1.96$ and $Z_{1-\beta}=Z_{.90}=1.28$

where $Z' = \frac{1}{2} \ln \left( \frac{1-p_{\text{smallest}}}{1-p_{\text{smallest}}} \right)$ then $Z' = \frac{1}{2} \ln (1+0.4/1-0.4)=0.4236$

$n = Z_{1-\alpha/2} + Z'_{1-\beta}/ (Z')^2 + 3$

$n = (1.96 + 1.28)^2/(0.4236)^2 + 3$  

$n = 61.49$ or $62$

### 3.4.2 SAMPLING METHOD

A judgemental sampling method was used to select the study participants. Participants were screened and all those who met the inclusion criteria were picked to participate in the study.

### 3.5 DATA COLLECTION

Data were collected using an administered questionnaire (appendix I). Oral examination was done by the principal investigator. For glycaeted haemoglobin assessment, 5mls of venous blood was drawn by the principal investigator using a sterile hypodermic syringe and transported in a sterile EDTA bottle to a laboratory at The Nairobi Hospital within 24 hours. Care was exercised to ensure the sample was not haemolysed during transport by avoiding unnecessary shaking of the transporting bottle. HbA1c test was performed at The Nairobi Hospital using the Abbot Architectc8000 instrument. This utilized a turbid metric method to assess HbA1c. HbA1c percentage was then calculated using a formula traceable to the IFCC (International Federation for Clinical Chemistry) also called reference method. Analysis was then performed by a trained technologist qualified at the level of Bachelor of Science in medical laboratory technology and with at least five years of experience in clinical chemistry. Quality control was performed daily with commercial quality control material availed from the manufacturer of the equipment. External quality assurance was also performed by the Kenya Bureau of Standards and one of the samples was submitted to another laboratory to ensure consistency.
Other variables that were assessed were gingival index, clinical attachment loss (CAL) and periodontal probing depth (PPD) and plaque scores. Periodontal clinical examination of all teeth except the 3rd molars at six points (mesiobuccal, buccal, distobuccal, lingual, mesiolingual, distolingual) was done under illumination from a head torch using disposable gloves, masks, gauze, a Hu-Freidy sterile periodontal probe and oral dental mirrors.

Records of the gingival score for bleeding on probing were evaluated based on the Loe and Silness 1963 gingival index. This was assessed immediately after sweeping the gingival sulcus with the periodontal probe under slight pressure on the Ramfjord teeth.

**Plaque score**—presence of plaque on buccal and lingual surfaces of Ramfjord index teeth (16, 11, 24, 36, 31, 44 (FDI nomenclature) using The modified Quigley and Hein index (Turesky et al. 1970). As proposed in the index, those who were missing the index teeth, the adjacent tooth was used.

**Pocket depth** was measured from the free gingival margin to the base of the sulcus and recorded in millimetres.

Gingival recession was recorded as the distance from the cemental enamel junction to the free gingival margin. This was, therefore, used to calculate the **Clinical attachment loss** as the sum of recession in millimetre and probing depth in millimetre.

**Periodontal disease assessment** was done using the CDC/AAP description by Page et al. later modified by Eke et al. Infection control was achieved by the use of disposable face masks, examination gloves and autoclaved periodontal probes. Oral health instructions and health education was given verbally with the aid of a dental model and a toothbrush.
3.5.1 Data Validation

Pre-testing of the questionnaire was done by the principal investigator utilizing patients in the Periodontology clinic at the University of Nairobi Dental Hospital to make sure that the study objectives were met. The questionnaire was analyzed and any corrections or adjustments were made. The pre-testing was mainly to find out how well the investigator was able to capture accurately the periodontal parameters that define the periodontal status of the diabetic patient. Those who participated in the pre-testing were not eligible for the actual research.

3.5.2 Data storage and analysis

Data were stored in print and electronic form. Analysis was done with the use of computer package SPSS version 20 (SPSS Inc, Chicago, Illinois, USA). Statistical test, Spearman correlation test was used to assess whether there was a correlation between the periodontal status of the patient and their glycaeted haemoglobin levels, or link between the other variables and glycaeted haemoglobin levels thus test the hypothesis. The Chi square test was used to determine the link between the different groups of HbA1c levels and other variables (periodontitis and plaque score groups). Data were presented in tables and figures.
3.6 EXCLUSION AND INCLUSION CRITERIA

3.6.1 Inclusion criteria

The following qualified for inclusion into the study

1. Patients diagnosed with diabetes type 2 and on follow-up at the diabetes clinic.
2. Patients who consented.

3.6.2 Exclusion Criteria

The following category of persons did not qualify to be included.

1. Patients undergoing treatment for rheumatoid arthritis. These patients are put on regular doses of anti-inflammatory drugs which have been known to have a host modulation effect on periodontitis.
2. Pregnant patients. Pregnancy hormones have been known to influence the state of periodontal tissues and hence exacerbate gingivitis.
3. Patients on non steroidal anti-inflammatory drugs. These drugs have a host modulation effect and therefore modifying the state of periodontitis.

3.8 MINIMIZING BIAS AND ERRORS

1. The study included only those patients who met the inclusion criteria.
2. The HbA1c equipment at The Nairobi hospital that was used is assessed monthly by external quality assurance officers from the Kenya Bureau of Standards.

3.9 ETHICAL CONSIDERATIONS

Ethical approval was sought and obtained from the KNH and University of Nairobi Ethics, Research and Standards Committee, ethical clearance number-P358/09/2011 (Appendix III). Informed consent was sought from the study subjects.
Those who decline to participate had their wish respected and this did not affect their services in the clinic. Study subjects confidentiality was maintained by not including their names on the questionnaire. Patients found to have had uncontrolled diabetes were immediately referred to the physicians for immediate attention.

3.10 EXPECTED APPLICATION OF RESULTS

The results and recommendations of the study could be applied in the care of diabetic patients. It could be used to sensitize the physicians for the need to refer diabetic patients to a dentist even those without obvious periodontal disease or other oral diseases. It shall also serve as a partial fulfilment of a Master of Dental Surgery degree in Periodontology of the University of Nairobi.
CHAPTER FOUR
RESULTS

4.1 Introduction

Sixty two participants were found to meet the inclusion criteria. Ten did not consent to withdrawal of blood. Two blood samples haemolysed during transport leaving total of 50 valid samples. The results are now presented in various forms for various variables.

4.2 Socio-demographic characteristics

4.2.1 Age and gender distribution

Of the fifty participants who were included in this study, 21 (48%) were males while 29(52%) were females. The age of the participants ranged between 33 and 78 years with a mean age of 56.4 (±SD11.27) years. Males were older (Mean; 57.00±8.80 SD years ) than females(Mean;53.93±12.92 SD years). There were more females than males below the age of 50 years and above 60 years, while there were more males in the age group 51-60 years. Figure below 1 shows the age and gender distribution of the participants.

![Age and Gender distribution of the participants](image)

**Fig.1: Age and Gender distribution of the participants**
4.2.2 Level of education of the participants by age and gender

Most 23(46%) of the participants had secondary level of education and only 7(14%) had not been to school while 14 (28%) had primary school level and 6(12%) had been up to college level. Table 1 shows the distribution of level education by other demographic variables.

Table 1: Level of education of the participants by age and gender

<table>
<thead>
<tr>
<th>Level of education</th>
<th>Primary and Lower Education n(%)</th>
<th>Secondary and Higher Education n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-49 years</td>
<td>7(33.3)</td>
<td>7(24.1)</td>
</tr>
<tr>
<td>50-59 years</td>
<td>3(14.3)</td>
<td>11(37.9)</td>
</tr>
<tr>
<td>60-79 years</td>
<td>11(52.4)</td>
<td>11(37.9)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9(42.9)</td>
<td>12(41.4)</td>
</tr>
<tr>
<td>Female</td>
<td>12(57.1)</td>
<td>17(15.6)</td>
</tr>
</tbody>
</table>
4.2.3 Occupation of respondents

Figure 2 below shows that majority 24(48%) of the participants were self employed. Among the participants, 6(12%) were unemployed, 11(22%) were employed and 9(18%) were peasant farmers.

![Occupation of the respondents](image URL)

Fig.2: Occupation of the respondents
4.2.4 Smoking habit

Most 47(94%) of the participants reported to have never smoked while 3(6%) reported to be smokers at the time of data collection all smokers were male and were aged above 50 years. This is shown in the figure 3 below.

![Smoking habits of the participants](image)

**Fig.3: Smoking habits of the participants**
4.2.5 Alcohol use

When asked about alcohol consumption, majority 43(86%) of the participants reported to have never consumed any type of alcoholic beverages while 7(14%) reported to be consuming alcohol at the time of data collection. All the persons consuming alcohol were males. This is shown in figure 4 below.

![Alcohol consumption among participants](image)

**Fig. 4: Alcohol consumption among the participants.**
4.2.6 Miraa/Khat chewing

Majority 48(96%) of the participants reported to have never chewed miraa while only 2(4%) of the participants reported to have been chewing “miraa” at the time of data collection. This is shown in figure 5 below.

![Bar chart showing Miraa/Khat chewing habit among participants]

**Fig. 5: Miraa/Khat chewing habit among the participants.**
4.2.7 Visit to a dentist

Majority 44(88%) of the participants had been to a dentist before and only 6(12%) had never visited a dentist.

![Visit to a dentist](image)

**Fig.6: Visit to a dentist**
4.2.8 Reasons for visiting a dentist

Majority 26(52%) of the participants reported they only considered it important to visit the dentist when they were in pain and only 6(12%) went for regular checkups, that is every six months (see figure 7 below).

Fig.7: Main reason for visiting the dentist
4.2.9 Services received at the dentist

Among the participants 7(14%) had had a dental check up, 23(46%) had had a dental extraction 6(12%), 3(6%) visited for cleaning, while 11(22%) went for other forms of services (see figure 8 below).

![Bar Chart: Services received at the dentist](image_url)

**Fig.8: Services received at the dentist**
4.3.1: Distribution of the participants as per the mean plaque scores

Over all more participants 40(80%) had mean plaque scores above 2. More females 23(46%) than males 17(34%) had higher mean plaque scores. This was not statistically significant ($x^2$=0.02, p>0.05). Participants with moderate gingival inflammation also had plaque score above 2. This was statistically significant ($x^2$=16, p<0.05). Majority 25(50%) of the participants with plaque scores above 2 were 50 years and above, this was statistically significant ($x^2$=7.28, p<0.05). The overall mean plaque score was 2.5(±0.88SD).

Table 2: Distribution of the participants as per the mean plaque scores

<table>
<thead>
<tr>
<th>Variables</th>
<th>≤2</th>
<th>&gt; 2</th>
<th>$x^2$</th>
<th>d.f</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>n(%)</td>
<td>n(%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4(8)</td>
<td>17(34)</td>
<td></td>
<td></td>
<td>0.02</td>
</tr>
<tr>
<td>Female</td>
<td>6(12)</td>
<td>23(46)</td>
<td>0.02</td>
<td>1</td>
<td>0.870</td>
</tr>
<tr>
<td>Age (Years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-49</td>
<td>6(12)</td>
<td>8(16)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-79</td>
<td>11(22)</td>
<td>25(50)</td>
<td>7.28</td>
<td>1</td>
<td>0.007</td>
</tr>
<tr>
<td>GI</td>
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<td></td>
<td></td>
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<tr>
<td>Mild</td>
<td>7(14)</td>
<td>6(12)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ Moderate</td>
<td>3(6)</td>
<td>34(68)</td>
<td>16</td>
<td>2</td>
<td>0.001</td>
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<tr>
<td>HbA1c</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal and</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Well controlled</td>
<td>4(8)</td>
<td>13(26)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poorly controlled</td>
<td>6(12)</td>
<td>27(54)</td>
<td>0.85</td>
<td>2</td>
<td>0.65</td>
</tr>
</tbody>
</table>
4.3.2: Distribution of the participants as per gingival inflammation severity

Majority 37(74%) of the participants had moderate to severe gingivitis. While in terms of gender distribution, there were more 23(46%) females with moderate to severe gingivitis than males 14(28%). This was not statistically significant ($x^2=1.02$, $p>0.05$). There were more 22(44%) participants aged above 55 years with moderate to severe GI than those below 54 years. This was not statistically significant ($x^2=1.71$, $p>0.05$). The mean gingival score was 1.6(±0.95SD).

Table 3: Distribution of the participants as per gingival inflammation severity

<table>
<thead>
<tr>
<th></th>
<th>GI Severity</th>
<th>Mild N (%)</th>
<th>Moderate &amp; Severe n (%)</th>
<th>$X^2$</th>
<th>d.f</th>
<th>P - Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td>7(14.0)</td>
<td>14(28.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td>6(12.0)</td>
<td>23(46.0)</td>
<td>1.012</td>
<td>1</td>
<td>0.314</td>
</tr>
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<td>Age years</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 54</td>
<td></td>
<td>8(16.0)</td>
<td>15(30.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55 and above</td>
<td></td>
<td>5(10.0)</td>
<td>22(44.0)</td>
<td>1.708</td>
<td>1</td>
<td>0.191</td>
</tr>
<tr>
<td>Mean PS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good Oral Hygiene (PS≤2)</td>
<td></td>
<td>8(16.0)</td>
<td>3(6.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor Oral Hygiene (PS≥2)</td>
<td></td>
<td>5(10.0)</td>
<td>34(64.0)</td>
<td>16.004</td>
<td>2</td>
<td>0.001</td>
</tr>
</tbody>
</table>
4.3.4: Severity of the periodontitis among the participants

Most 32(64%) of the participants had moderate form of periodontitis and only 1(2%) had severe periodontitis.

Fig.9: Frequency and percentage distribution of the participants as per periodontitis severity

4.2.5: Distribution of the participants as per the severity of periodontitis.

As shown in table 4 below, there were more females 18(36%) with moderate to severe periodontitis than males 15(30%). This was not statistically significant ($\chi^2=1.74$, $p>0.05$). More participants with moderately controlled diabetes had moderate form of periodontitis though statistically not significant ($\chi^2=1.72$, $p>0.05$). Most 15(30%) of those who had moderate periodontitis fall in the age group 60-79 years.
### Table 4: Distribution of the participants as per the severity of periodontitis

<table>
<thead>
<tr>
<th></th>
<th>Mild</th>
<th>≥ Moderate</th>
<th>( x^2 )</th>
<th>d.f</th>
<th>( p \geq 0.05 )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>6(12)</td>
<td>15(30)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>11(22)</td>
<td>18(36)</td>
<td>1.74</td>
<td>2</td>
<td>0.42</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-59</td>
<td>11(22)</td>
<td>18(36)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60-79</td>
<td>6(12)</td>
<td>15(30)</td>
<td>6.5</td>
<td>2</td>
<td>0.59</td>
</tr>
<tr>
<td><strong>Plaque Scores</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;2</td>
<td>6(12)</td>
<td>4(8)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;2</td>
<td>11(22)</td>
<td>29(58)</td>
<td>3.86</td>
<td>2</td>
<td>0.145</td>
</tr>
<tr>
<td><strong>HbA1c</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal to Well controlled</td>
<td>5(10)</td>
<td>12(24)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poorly controlled</td>
<td>12(24)</td>
<td>21(40)</td>
<td>0.86</td>
<td>2</td>
<td>0.94</td>
</tr>
</tbody>
</table>
4.3.6: Distribution of the participants as per HbA1c levels

The HbA1c levels ranged from 5.4% to 15.4%, the mean was 9.28(SD±2.55). Participants were categorized into 3 groups, those with normal HbA1c (3% to 5.99%), well controlled HbA1c (6% to 7.99%) and those with uncontrolled diabetes (above 8%). About two thirds of the participants had uncontrolled diabetes 33(66%) and only about one third had controlled to normal diabetic levels 17(34%).

Fig.10. Frequency distribution of HbA1c among the participants
4.3.7 Correlation between the means of PI and that of GI, PD and CAL.

There was a significant positive correlation between the mean plaque score and probing depth ($r = 0.48$, $n=50$, $p<0.05$, 2tails). There was a significant positive correlation between mean of plaque score and that of mean gingival index ($r=0.68$, $n=50$, $p<0.05$, 2tails) There was also a statistically positive correlation between plaque score and CAL ($r=0.47$, $n=50$, $p<0.05$, 2tails) as shown in table 6 below.

**Table 5: Correlation between the means of PI and GI, PD and CAL**

<table>
<thead>
<tr>
<th></th>
<th>Pearson's</th>
<th>P value ($p \leq 0.05$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean of plaque score with probing depth</td>
<td>0.48</td>
<td>0.001</td>
</tr>
<tr>
<td>Mean of plaque score with gingival index</td>
<td>0.68</td>
<td>0.001</td>
</tr>
<tr>
<td>CAL</td>
<td>0.47</td>
<td>0.001</td>
</tr>
</tbody>
</table>
4.3.8: Correlation of the HbA1c levels with the means of PD, GI, PS and CAL

There was a very weak negative correlation between the various disease indicators and the levels of HbA1c and this was not statistically significant as shown in table 6 below.

**Table 6: Correlation of the HbA1c levels with the means of PD, GI, PS and CAL**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Correlation Value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probing depth</td>
<td>-0.03</td>
<td>0.86</td>
</tr>
<tr>
<td>Gingival index</td>
<td>-0.06</td>
<td>0.68</td>
</tr>
<tr>
<td>Plaque index</td>
<td>-0.03</td>
<td>0.85</td>
</tr>
<tr>
<td>CAL</td>
<td>0.00</td>
<td>0.98</td>
</tr>
</tbody>
</table>
STUDY LIMITATIONS

1. Accuracy of glycaeted haemoglobin levels is dependent on the laboratory parameters set by the specific laboratory.

2. Determination of the periodontal status of a patient is dependent on the clinician’s experience. The accuracy of determining the floor of the periodontal pocket is dependent on the clinician’s ability.
CHAPTER FIVE

5.0 DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Discussion

The main aim of this study was to describe the periodontal health status and relate this to the glycaemic profile among type 2 diabetics and also to determine HbA1C level among these patients.

5.1.1 Social demographic characteristics of the population

There were more females than males in this study, 29 (58%) females against 21 (42%) males. This compares well to a study done on a similar group by Otieno et al, who found out of a group of 211 participants, 39.5% were males and 60.5% were females. This could be explained by the health seeking behaviour of the females where females sought treatment for symptoms early. The age range of the participants was 33 years to 78 years which compares previous studies. The peak age for diabetes has been noted to be 40-49 but they also noted that this is likely to change as the population in Sub-Saharan Africa changes. In this study it was noted that, more participants 24 (48%) were self-employed than those who were in formal employment 11 (22%). This reflects the countries social economic set up were most of the people are either unemployed or are in the informal sector.

There were more none smokers 47 (94%) than smokers 3 (6%) in this group. This was a low rate of smoking as compared to the general population. This may be explained by the increased awareness in this group because of the education that is carried out among the group when they come for review in the clinic. Smoking has been established as one of the modifiable risk factors of periodontal diseases. Very few participants chewed “miraa” as were those who consumed alcohol. This could
again be explained by the increased awareness about the effects these habits have on diabetes.

Most 44(88%) of the participants had visited a dentist, and only 6(12%) had never been to a dentist before. This was way above the reported utilisation of dental services in Kenya. This may be explained by the increased awareness about effects of oral diseases on diabetes, among the participants. Most 26(52%) of the participants visited the dentist only when they were in pain. This compares well with study done in Nigeria among pregnant women attending an antenatal clinic (53.9%) 

5.1.2 Oral hygiene status

Overall most participants 40(80%) had poor oral hygiene with plaque scores above 2. This reflects on their poor dental services seeking habits, were most of the participants reported they only went to a dentist when in pain. More females 23(46%) than males 17(34%) had poor oral hygiene this finding is contrary to studies done in Kenya and Finland where it was found that males had poorer oral hygiene.

5.1.3 Periodontal disease

5.1.3.1 Gingivitis

The overall mean Gingival index score in this group was 1.56 (±0.67SD), this compares well with a study done by Matu et al who found the mean GI to be 1.46. Over all more participants had moderate gingivitis 21(42%) while more males 5(23.8%) had severe disease compared to females 2(6.9%) but this was not statistically significant. This does not compare well with the findings that more females had poor oral hygiene than males. Participants who had poor oral hygiene should have had more severe type of the disease.
5.1.3.2 Periodontitis

The findings from this study indicate that there were more participants with moderate to severe periodontitis disease. The disease seemed to be worse in those participants who had uncontrolled blood sugars, HbA1c above 8% with majority falling into the category of severe to moderate periodontitis. Participants with high mean plaque scores also had a more severe form of periodontal disease with the majority (58%) falling in the moderate periodontitis category although this was not statistically significant ($x^2=3.86, p>0.05$). These findings compare with other studies done on relationship between diabetes and periodontal disease\textsuperscript{4,17,20,38,39}.

5.1.4 HbA1c Levels

Majority 33(66%) of the participants in this study had uncontrolled diabetes. This compares well to a study done in a similar group\textsuperscript{36} who found 60.5% of the patients to have uncontrolled diabetes, that is HbA1c above 8% though the sample sizes were different. There were more participants with mean plaque scores above 2 who also had poorly controlled diabetes. Participants with uncontrolled diabetes also had severe form of periodontal disease. Studies done in Asia have shown similar levels of control. There was no linear correlation between the HbA1c with the severity of periodontal disease, this is contrary to other studies by\textsuperscript{1,6}. This could be explained by the variation in sample size in the different studies. Despite the participants having low use substances detrimental to their health they still had high level of HbA1c with a mean of 9.28±2.54SD. Since the type of medications taken for the control of diabetes was not assessed. It was not possible to comment on the cause of there being many participants with uncontrolled diabetes 33(66%). Contrary to the many studies that have found patients with uncontrolled diabetes to have severe form of
periodontitis, this group the majority had moderate form of the disease. This could also be attributed to the different methodologies used to assess the diseases.
5.2 CONCLUSIONS

Based on the findings of this study, the following were the conclusions.

1. Majority (60%) of the participants had moderate gingival inflammation.

2. Majority (64%) of the participants had moderate periodontitis.

3. The level of blood sugar control was way above the recommended levels for most of these participants with majority of the participants 33(66%) having their Hba1c level above 8%.

4. More females 23(46%) than males 14(28%) had moderate to Severe form of gingival inflammation.

5. There was no correlation between periodontal disease and Hba1c levels.

5.3 RECOMMENDATIONS

Based on the findings of this study, the following was recommended.

1. Dental education should be carried out regularly among this group to ensure there is change of altitude, so that they can be going for regular checkups.

2. Patients should further be educated on how to control their blood sugars.

3. Another study with a larger sample size and factoring in most of the confounding variables should be carried out to ascertain the level of blood sugar control among diabetics type 2 at KNH.
REFERENCES


APPENDIX 1: questionnaire

Date. ..............................  Serial Number........
File No. ..............................

Part A

Patient details

1. Gender
   Male  Female

2. Age (Years) ......................

3. Occupation
   Self employed
   Employed
   Unemployed
   Farmer

4. Level of education
   Primary
   Secondary
   College
   University

7. Do you practice the following habits?
   Smoking  Yes  No
   Alcohol consumption  Yes  No
   Khat/miraa chewing  Yes  No
8. Have you ever visited a dentist?
If yes, what treatment did you receive?
Check up
Medication
Extraction
Filling
Cleaning teeth
Surgery
Others (Specify)…………………………..

9. In your condition i.e. having diabetes and on medication, do you think it is beneficial to visit the dentist?  Yes  No  

10. When do you consider it important to visit the dentist?
? Every six month
When in pain
When I notice Bleeding gums
Due to Shaking teeth
Swelling
APPENDIX II Clinical Examination form

1. Plaque index-Quigley Hein Index-(Modified by Turesky et al, 1970)

<table>
<thead>
<tr>
<th>score</th>
<th>criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No plaque.</td>
</tr>
<tr>
<td>1</td>
<td>Separate flecks of plaque at the cervical margin of the tooth.</td>
</tr>
<tr>
<td>2</td>
<td>A thin continuous band of plaque (up to one mm) at the cervical margin of the tooth.</td>
</tr>
<tr>
<td>3</td>
<td>A band of plaque wider than one mm but covering less than one third of the crown of the tooth.</td>
</tr>
<tr>
<td>4</td>
<td>Plaque covering at least one third but less than two thirds of the</td>
</tr>
</tbody>
</table>
crown of the tooth.

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</table>
| 5 | Plaque covering two thirds or more of the crown of the tooth

## 2. RAMFJORD’S TEETH

<table>
<thead>
<tr>
<th>Tooth</th>
<th>16</th>
<th>12</th>
<th>24</th>
<th>36</th>
<th>32</th>
<th>44</th>
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<tbody>
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<td>L</td>
<td>F</td>
<td>L</td>
<td>F</td>
<td>L</td>
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<td>Score</td>
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## 3. Gingival index—Loe and Silness 1963

<table>
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<tr>
<th>Scores</th>
<th>criteria</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>Absence of inflammation</td>
</tr>
<tr>
<td>1</td>
<td>Mild inflammation; slight change in colour</td>
</tr>
<tr>
<td>2</td>
<td>Moderate inflammation; bleeding on probing</td>
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<tr>
<td>3</td>
<td>Severe inflammation; tendency towards spontaneous bleeding</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Tooth</th>
<th>16</th>
<th>12</th>
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### 4. Periodontal Probing Depth-Mandible-Six point chart

<table>
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<th>45</th>
<th>44</th>
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### 5. Periodontal Probing Depth –Maxillary arch

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5. Glycaeted haemoglobin levels

<table>
<thead>
<tr>
<th>Serial number</th>
<th>Glycaeted haemoglobin level</th>
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</table>
This is to certify that I, _________________________________________________
Hereby agree to participate in this educational and research study on “periodontal
health status in relation to glycaemic profiles among type 2 diabetic patients at
Kenyatta National Hospital”. This will be carried out by Dr. Silas Kinyua Kithela, a
postgraduate student pursuing a Master’s degree in Periodontology at University of
Nairobi, school of Dental Sciences, P.O. Box 336-00202 Nairobi. The consent to
carry out this study has been given by the University of Nairobi and Kenyatta
National Hospital Ethics board (KHN/UON-ERC).

Contact information- Email: uonknh_erc@unobi.ac.ke. Website: www.unobi.ac.ke

I understand that this study will involve a mouth examination using a dental mirror
and periodontal probe where all the teeth will be examined for plaque, gum bleeding,
pocket depth and mobility. I also understand that i will be sent to Nairobi Hospital
Laboratory where my sugar levels will be assessed. I understand that no dental
treatment will be rendered but i will be informed on how to care for my teeth and if
my sugars are found to be uncontrolled i will immediately be referred to a physician.

Perceived benefits

I understand this will benefit me personally as I will be informed of any abnormal
findings in my mouth so that I may voluntarily seek any other treatment. I understand
the results obtained from this study will provide baseline information for the
development of a protocol to identify and reduce dental disease in diabetics. Those
patients found to have uncontrolled diabetes will be immediately referred to a
physician for management.
**Risks**

There are no anticipated risks for participating in the study. I understand that I will be given a free dental check up and advice on oral hygiene measures and also that I will receive treatment for my gums. However, there is a chance of slight discomfort in my gums and bleeding during examination. I also understand that some blood will be drawn at the Nairobi hospital laboratory which will be used to assess the levels of the blood glucose in my body for the last 3 months.

**Costs and payments**

I understand that this study is strictly voluntary and no monetary compensation will be given.

**Confidentiality:**

I understand that all personal information learned about me in this research will be kept strictly confidential.

**Withdrawal privilege:**

I understand that I may refuse to participate or withdraw from the study at any time without penalty or prejudice. If I do this I will continue to receive health care at KNH as I would normally receive.

**Voluntary consent:**

I certify that I have read all of this consent form or it has been read to me and that I understand it. Any questions pertaining to the research have been answered to my satisfaction. My signature below means I freely agree to participate in this study.

**Signature of participant**……………………………………………… Date…………………………
Investigators statement:

I certify that I have explained to the above individual the nature and purpose of this study, potential benefits and possible risks associated with participation in this study.

I have answered any questions that have been raised. I have explained the above to the participant on the date on this consent form.

Investigator................................................................. Date.................................
Maelezo ya Kutafuta Idhini Kutoka kwa Wagonjwa Wa Kisukari Wanaoshiriki Katika Utafiti.

Kiini cha Utafiti

Hii ni kuonyesha ya kwamba mimi ______________________________ nimepatiana ruhusa ya kushiriki katika utafiti unaochunguza “hali ya kiafya ya ufizi katika wagonjwa wa kisukari wanaoudumiwa katika hospitali kuu ya kenyatta”.


Manufaa na madhara ya utafiti

Nitajulishwa matokeo ya utafiti baada ya kuangalia na nitapewa mawaidha yanayohitajika. Pia nikiwa na mahitaji ya dharura ya kimatibabu nitatumwa kwa mtaalamu katika hospitali kuu. Matokeo ya utafiti huu yatawasidia wanasaayansi wa hapa nchini na wa kimataifa kushugulikia ugonjuwa wa kisukari kikamilifu. Nimeelewa kwamba hakuna gharama yeyote kwa kushiriki katika utafiti huu.

Hifadhi ya Nakala ya Habari Utakayotaoa

Tunasistiza usiri huu katika kusimamia habari tutakazopewa ili kuzuia kujulikana kwa watakaoshiriki katika utafiti huu. Hakuna majina yatakayotumika katika vikao vya sayansi kwa umma na ripoti zitakazochapishwa katika mijarida za sayansi.

**Dhini na Sahihi**

Nimesoma maelezo yaliyoko hapa juu na nimekubali kwa hiari kushiriki katika utafiti huu.

.................................................. ..................................................

Jina la Mshiriki                             Sahihi ya Mshiriki na Tarehe

Mimi niliyepewa jukumu la kupeana maelezo kuhusu utafiti huu kwa mshiriki aliyetajwa hapa juu, nimepeana maelezo kamili kulingana na masomo na ujuzi wangu katika kazi hii. Kwa hivyo ninhitimu kufanya jukumu hili.

.................................................. ..................................................

Jina la Shahidi                             Sahihi ya Shahidi na Tarehe

**Idhini na Sahihi**

Nimesoma maelezo yaliyoko hapa juu na nimekubali kwa hiari kushiriki katika utafiti huu.

.................................................. ..................................................

Jina la Mshiriki                             Sahihi ya Mshiriki na Tarehe

Mimi niliyepewa jukumu la kupeana maelezo kuhusu utafiti huu kwa mshiriki aliyetajwa hapa juu, nimepeana maelezo kamili kulingana na masomo na ujuzi wangu katika kazi hii. Kwa hivyo ninhitimu kufanya jukumu hili.

.................................................. ..................................................

Jina la Shahidi                             Sahihi ya Shahidi na Tarehe
APPENDIX IV: ETHICS APPROVAL